TowerPinkster

Architecture · Engineering · Interiors

Teamsters Local 2727 - Office Addition and Renovation

PROJECT MANUAL

1/9/2026

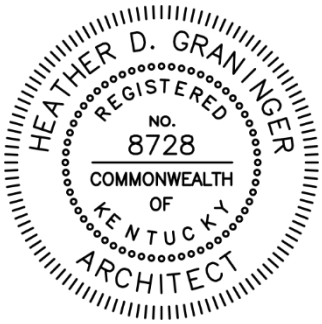
OWNER

Teamsters Local 2727

4810 N Preston Hwy
Shepherdsville, KY 40165

PROJECT NUMBER

Architect's Project No. 25376.000





Heather D. Graninger, AIA
State Registration Number 8728

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SECTION 00 1114 - NOTICE TO BIDDERS

Notice is hereby given that sealed proposals will be received:

BY: TowerPinkster
320 Pearl St. Suite 100
New Albany, IN 47150

FOR: Teamsters Local 2727
4810 N Preston Hwy
Shepherdsville, KY 40165

VIA: Jim.Keller@TowerPinkster.com

UNTIL: 4:00 pm (project local time)

DATE: February 10, 2026

The Owner will open all bids privately.

Proposals received after the hour and date set for receiving of proposals, will be returned unopened.

All work will be awarded under a single General Contract.

Proposals shall be executed on the Proposal Form included in the bid documents. The signed and sealed hard copy bid documents are on file with the Owner and Architect and may be examined by Bidders at the following locations:

Teamsters Local 2727
4810 N. Preston Highway
Shepherdsville, KY 40165

TowerPinkster
320 Pearl Street Suite 100
New Albany, IN 47150
812-282-9554 p

PRE-BID CONFERENCE
DATE: **Thursday, January 29, 2026**
TIME: **2:00 PM,** Project Local Time
LOCATION: 4810 N. Preston Highway, Shepherdsville, KY 40165

Bidding is BY INVITATION ONLY.

All bidders will have free access to a complete electronic set of Drawings and Specifications.

All bid documents may be downloaded free of charge in electronic PDF format for viewing, printing and distribution to bidders, sub-bidders, suppliers, and reprographics services at the discretion and responsibility of the General Contractors. Bidders shall complete the Plan Holder List form via www.koverthawkins.com/bid-information.

Upon completion of the form, bidders will be re-directed to the Project Page where all bid information may be downloaded. Bidders should bookmark this link and www.koverthawkins.com/bid-information for future access.

A list of updated Plan Holders and Addenda will periodically be posted and made available for download.

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The Architect retains all copyright to the bid documents, as instruments of their professional service.

Bidders, or any other persons, may not use the PDF files for any other purpose than preparing a bid for this project. Bidders may not distribute bid documents or files to Plan Rooms (either electronic or hard copy format) without the express written permission of the Architect.

For convenience of the bidders, complete electronic files will also be sent to the following reprographic services.

Bidders are responsible for costs of any desired printing of drawings and/or specifications directly from these reprographics services at cost of printing plus any shipping and handling charges.

Zen Reprographics
648 South 8th Street
Louisville, KY 40203
502-587.1951p

www.zenreproplanroom.com

All questions and requests for substitutions shall be directed to:

Jim Keller
TowerPinkster
Jim.Keller@towerpinkster.com

Bid Security in the amount of five percent (5%) of the Proposal, including all add alternates must accompany each Proposal in accordance with the Instructions to Bidders.

The Owner reserves the right to accept or reject any bid and to waive any irregularities in bidding. The Base Bid may be held for a period not to exceed Forty-Five (45) days before awarding Contracts. All additive Alternate Bids may be held for a period not to exceed Thirty (30) days after signing of Contract.

Should a successful Bidder withdraw his bid, or fail to execute a satisfactory contract within ten (10) days after notice of acceptance of his bid, the Owner may declare the Bid Security forfeited as liquidated damages, not as penalty.

The successful Bidder shall furnish a Performance Bond and Labor and Materials Payment Bond in an amount equal to one hundred percent (100%) of the Contract Sum with an approved surety company and said bond shall remain in full force and effect for a period of one (1) year after date of final acceptance of the work. The cost of all bonds shall be included in the bid price.

TEAMSTERS LOCAL 2727
JANUARY 19, 2026

END OF SECTION 00 1114

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AIA® Document A701™ – 2018

Instructions to Bidders

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

Teamsters Local 2727 - Office Addition & Renovation

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

Teamsters Local 2727
7711 Beulah Church 2727
Louisville, Ky 40228

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

Tower Pinkster Titus Associates, Inc
320 Pearl Street, Suite 100
New Albany, IN 47150
Telephone Number: 812.282.9554

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ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

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

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

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

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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, as indicated below, from the issuing office designated in the advertisement or invitation to bid, for the deposit sum, if any, stated therein.

(Indicate how, such as by email, website, host site/platform, paper copy, or other method Bidders shall obtain Bidding Documents.)

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

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

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

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

§ 3.2 Modification or Interpretation of Bidding Documents

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

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

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

§ 3.3 Substitutions

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

§ 3.3.2 Substitution Process

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

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

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

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

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

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

§ 3.4 Addenda

§ 3.4.1 Addenda will be transmitted to Bidders known by the issuing office to have received complete Bidding Documents.

(Indicate how, such as by email, website, host site/platform, paper copy, or other method Addenda will be transmitted.)

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

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

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

ARTICLE 4 BIDDING PROCEDURES

§ 4.1 Preparation of Bids

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

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

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

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

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

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

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

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

§ 4.2 Bid Security

§ 4.2.1 Each Bid shall be accompanied by the following bid security:

(Insert the form and amount of bid security.)

§ 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

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of the bid security shall be forfeited to the Owner as liquidated damages, not as a penalty. In the event the Owner fails to comply with Section 6.2, the amount of the bid security shall not be forfeited to the Owner.

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

§ 4.2.4 The Owner will have the right to retain the bid security of Bidders to whom an award is being considered until (a) the Contract has been executed and bonds, if required, have been furnished; (b) the specified time has elapsed so that Bids may be withdrawn; or (c) all Bids have been rejected. However, if no Contract has been awarded or a Bidder has not been notified of the acceptance of its Bid, a Bidder may, beginning days after the opening of Bids, withdraw its Bid and request the return of its bid security.

§ 4.3 Submission of Bids

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

§ 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.)

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ARTICLE 5 CONSIDERATION OF BIDS

§ 5.1 Opening of Bids

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

§ 5.2 Rejection of Bids

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

§ 5.3 Acceptance of Bid (Award)

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

§ 5.3.2 Unless otherwise prohibited by law, the Owner shall have the right to accept Alternates in any order or combination, unless otherwise specifically provided in the Bidding Documents, and to determine the lowest responsive and responsible Bidder on the basis of the sum of the Base Bid and Alternates accepted.

ARTICLE 6 POST-BID INFORMATION

§ 6.1 Contractor's Qualification Statement

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

§ 6.2 Owner's Financial Capability

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

§ 6.3 Submittals

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

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

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

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

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

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

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

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ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND

§ 7.1 Bond Requirements

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

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

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

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

§ 7.2 Time of Delivery and Form of Bonds

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

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

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

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

ARTICLE 8 ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS

§ 8.1 Copies of the proposed Contract Documents have been made available to the Bidder and consist of the following documents:

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

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

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

.4 AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:
(Insert the date of the E203-2013.)

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.5 Drawings

Number	Title	Date

.6 Specifications

Section	Title	Date	Pages

.7 Addenda:

Number	Date	Pages

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

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

[ ] The Sustainability Plan:

Title	Date	Pages

[ ] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

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

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SECTION 00 2214 - SUPPLEMENTARY INSTRUCTIONS TO BIDDERS (Non-Public Works)

The following supplements modify the Instructions to Bidders, AIA Document A701 - 2018, entitled "Instructions to Bidders". Where a portion of the Instruction to Bidders is modified or deleted by these Supplementary Instructions, the unaltered portions of the Instructions To Bidders shall remain in effect.

ARTICLE 9 - SUPPLEMENTARY INSTRUCTIONS

Article 3 - BIDDING DOCUMENTS, delete the current Paragraph and replace with the following:

3.1.1 Article 3 – BIDDING DOCUMENTS, delete the current Paragraph and replace with the following: All bid documents may be downloaded free of charge in PDF format for viewing, printing and distribution to bidders, sub-bidders and suppliers at the discretion and responsibility of the general contractors. All information is posted on a website identified in the Notice To Bidders or available by contacting the Architect. The Architect retains all copyright to all Bid Documents. Bidders may not use the Bid Documents for any purpose except preparing a bid for this project. Bidders may not distribute Bid Documents to Plan Room services, either electronic or hard copy, without the express written permission of the Architect. Printing of bid documents, including all costs associated therewith, is to be borne by the bidders.

Article 3 - BIDDING DOCUMENTS, delete the current Paragraph and replace with the following:

3.1.2 Article 3 – BIDDING DOCUMENTS, delete the current Paragraph and replace with the following: Bid documents are available to sub-bidders in accordance with Paragraph 3.1.1.

Article 3 - BIDDING DOCUMENTS, add the following Paragraph:

3.1.5 Article 3 – BIDDING DOCUMENTS, add the following Paragraph: In the event of any discrepancy between electronic versions and any hard copy, printed versions of the files, the hard copy version on file at the Architect's office will govern.

Article 3 - BIDDING DOCUMENTS, add the following Paragraph:

3.3.5 Article 3 – BIDDING DOCUMENTS, add the following Paragraph: When specifications include a list of acceptable manufacturers, it is done for the express purpose of establishing a basis of durability, efficiency, configuration, maintain Owner's maintenance stock, and not for the purpose of limiting competition. These said names establish the products on which the bidder's proposal shall be based for that particular specification item. Proposed substitutions must be submitted in accordance with Specification Section 01630-Product Options and Substitutions.

Article 3 - BIDDING DOCUMENTS, delete the current Paragraph and replace with the following:

3.4.1 Article 3 – BIDDING DOCUMENTS, delete the current Paragraph and replace with the following: Addenda will be added to the bid documents and made available to all bidders via the website.

Article 3 - BIDDING DOCUMENTS, delete Paragraph 3.4.3.Article 4 - BIDDING PROCEDURES, delete Paragraph 4.2 in its entirety, including 4.2.1, 4.2.2 and 4.2.3.

Article 5 – CONSIDERATION OF BIDS, delete the current Paragraph and replace with the following:

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5.1 Bids received may be privately opened or publicly read aloud at the sole discretion of the Owner.

Article 5 – CONSIDERATION OF BIDS, delete the current Paragraph and replace with the following:

5.3.1 The Owner shall have the right to accept or reject any and/or all Bids, determined upon any basis.

The Owner shall have the right to waive informalities and irregularities in a Bid received and to accept or reject a Bid which, in the Owner's judgment, is in the Owner's best interest. All are at the sole discretion of the Owner.

Article 7 – PERFORMANCE BOND AND PAYMENT BOND.

7.1.1 Under Section 7.1.1, delete the words "If stipulated in the Bidding Documents, the" and substitute the word "The".

7.1.1 Under Section 7.1.1, add the following sentence: "The costs for all Bonds must be included in the bid price."

7.1.2 Delete Section 7.1.2 in its entirety.

Article 7 – PERFORMANCE BOND AND PAYMENT BOND, delete Article 7 in its entirety.

Electronic submissions of bids are acceptable. Email bids to jim.keller@towerpinkster.com

END OF SECTION 00 2214

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CONTRACTOR'S BID FORM FOR NON-PUBLIC WORKS:

CONTRACTORS BID FOR: *Teamsters Local 2727*
Building Addition
4810 N Preston Hwy
Shepherdsville, KY 40165

Owner: *TEAMSTERS LOCAL 2727*
Date: _____
Bidder (Firm): _____
Address: _____
City, State, Zip: _____
Telephone No.: _____
Fax No.: _____

E-Mail Address: _____

Pursuant to notices given, the undersigned proposes to furnish all material and labor necessary to complete general construction according to plans and specifications prepared by KOVERT HAWKINS ARCHITECTS, 630 Walnut Street, Jeffersonville, Indiana, for the sum of:

BASE BID
Lump Sum _____ $_____

Calendar days to complete work_____

ADDENDA
Acknowledges receipt of:

Addendum No. _____	Dated _____	No. of Pages _____
Addendum No. _____	Dated _____	No. of Pages _____
Addendum No. _____	Dated _____	No. of Pages _____
Addendum No. _____	Dated _____	No. of Pages _____

ALTERNATES
The undersigned also proposes to furnish or to omit all labor and materials necessary to complete work as required by the Alternate Bids, as provided in the specifications as follows:

Alternate No. 1:	*Existing Roof Replacement*	$ _____
Alternate No. 2:	*Site Lighting*	$ _____
Alternate No. 3a:	*Tile on Restroom Wet Wall*	$ _____
Alternate No. 3b:	*Tile on all Restroom Walls*	$ _____
Alternate No. 5:	*Floor replace in Swag Room 105*	$ _____

ALLOWANCES
By filling in the amounts below, the bidder acknowledges the following allowance amounts are included in the forgoing bid prices (indicate amount(s) of allowance(s) in the space(s) below):

Cash Allowances within the Base Bid per Section 01210 $ _____
Brick Allowance within the Base Bid per Section 01210 $ _____per 1000 _____thousands
Contingency Allowance within the Base Bid per Section 01220 $ _50,000.00_____

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COMPLETION OF WORK

Undersigned guarantees, if awarded contract, to complete the work within _____( ) calendar days.

GENERAL CONTRACTOR CERTIFICATION

I hereby certify that we have obtained a complete set of construction documents, including all Drawings, Specifications and Addenda, and have reviewed the jobsite to sufficiently familiarize ourselves with the existing conditions.
Dated at _____ this _____ day of _____, 20___.

_____
(Name of Organization)

BY _____
_____
(Title of Person Signing)

OATH AND AFFIRMATION

I hereby affirm under the penalties for perjury that the facts and information contained in the foregoing bid is true and correct.
Dated at _____ this _____ day of _____, 20___.

_____
(Name of Organization)

BY _____
_____
(Title of Person Signing)

ACKNOWLEDGEMENT

STATE OF _____
COUNTY OF _____
Before me, a Notary Public, personally appeared the above-named _____ and
(Name of Person Signing)
swore that the statements contained in the foregoing document are true and correct.
Subscribed and sworn to before me this _____ day of _____, 20 ___.

_____
Notary Public

My Commission Expires:_____
County of Residence: _____

END OF SECTION 00 4203

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SECTION 00 4313 - BID SECURITY FORM

1.01 PROJECT MANUAL

All requirements of the Project Manual shall apply to this Section.1.02 SCOPE

A. Contractors Bid Security shall be either:

1. Bid Bond.
2. Certified Check.
3. Cashier's Check

B. The Bid Bond, if used, shall be AIA Document A310 - 2010, entitled "Bid Bond".

1. Bond shall be by an acceptable Surety Company licensed to do business in the State of **Indiana**.
2. A copy of this form is bound herewith

C. Bid Security shall be:

1. In an amount equal to five (5) percent of the total lump sum base bid plus (5) percent of all add alternates.
2. Security shall be executed in favor of the Owner.

3. Should the successful Bidder fail to enter into a contract or furnish the required Bonds within ten (10) days from date of notice of award, the Owner may declare the Bidder's Bid Security forfeited and the Security amount retained by the Owner as liquidated damages.

D. Refer to Section 00 4393 - Contractor's Bid Submittal Checklist for requirements as to time of submission.

END OF SECTION 00 4313

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AIA® Document A310™ – 2010

Bid Bond

CONTRACTOR:
(Name, legal status and address)

SURETY:
(Name, legal status and principal place of business)

OWNER:
(Name, legal status and address)

Teamsters Local 2727
7711 Beulah Church 2727
Louisville, KY 40228

BOND AMOUNT: $

PROJECT:
(Name, location or address, and Project number, if any)

Teamsters Local 2727 - Office Addition and Renovation

The Contractor and Surety are bound to the Owner in the amount set forth above, for the payment of which the Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, as provided herein. The conditions of this Bond are such that if the Owner accepts the bid of the Contractor within the time specified in the bid documents, or within such time period as may be agreed to by the Owner and Contractor, and the Contractor either (1) enters into a contract with the Owner in accordance with the terms of such bid, and gives such bond or bonds as may be specified in the bidding or Contract Documents, with a surety admitted in the jurisdiction of the Project and otherwise acceptable to the Owner, for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof; or (2) pays to the Owner the difference, not to exceed the amount of this Bond, between the amount specified in said bid and such larger amount for which the Owner may in good faith contract with another party to perform the work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect. The Surety hereby waives any notice of an agreement between the Owner and Contractor to extend the time in which the Owner may accept the bid. Waiver of notice by the Surety shall not apply to any extension exceeding sixty (60) days in the aggregate beyond the time for acceptance of bids specified in the bid documents, and the Owner and Contractor shall obtain the Surety's consent for an extension beyond sixty (60) days.

If this Bond is issued in connection with a subcontractor's bid to a Contractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

When this Bond has been furnished to comply with a statutory or other legal requirement in the location of the Project, any provision in this Bond conflicting with said statutory or

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

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

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

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legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

Signed and sealed this day of ,

	(Contractor as Principal) *(Seal)*
(Witness)	*(Title)*
	(Surety) *(Seal)*
(Witness)	*(Title)*

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SECTION 00 4336 - SUBCONTRACTOR LIST

1.01 PROJECT MANUAL

A. All requirements of the Project Manual shall apply to this Section.

1.02 SCOPE

A. Successful Bidder for each Contract shall submit his complete Subcontractors List for all trades and divisions of work.

B. After submission of this List and after approval by the Architect/Engineer and Owner, it shall not be changed without written approval by the Owner and Architect/Engineer.

C. Refer to Section 00 4393 – Contractor's Bid Submittal Checklist for requirements as to time of submission.

1.03 FORM

Provide in Contractor's own format to include the following information:

A. Description of work or trade.

B. Company Name.

C. Company Address.

D. Company Phone and Fax.

E. Contact Person.

F. E-mail Address.

G. MBE/WBE Status.

END OF SECTION 00 4336

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SECTION 00 4393 – CONTRACTOR'S BID SUBMITTAL CHECKLIST

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

A. Section Includes:

1. Submittals required at time of bid.
2. Submittals required following bid.

1.02 BID SUBMITTALS

A. The following items are to be submitted by all bidders for all contracts at the time of bidding:

1. Proposal Form Parts I and II
2. Bid Security
3. Financial Statement (as required by Proposal Form)

B. Submit **two** copies (one signed original and one copy) of above information.

1.03 POST-BID SUBMITTALS

A. The following items are to be submitted by each successful bidder for all contracts within twenty-four (24) hours following the time of bidding:

1. Schedule of Values
2. Unit Prices (except where required as part of Proposal Form Part I)
3. Subcontractor List

B. The following items are to be submitted prior to execution of the Owner-Contractor Agreement:

1. Performance Bond
2. Labor & Material Payment Bond
3. Certificate of Insurance
4. Indiana Certificate of Qualification for Public Works Projects
5. Signed Escrow Agreement
6. Employee Background Check
   (per Section 00 7301-Supplementary General Conditions, Article 13)
7. Employee Drug and Alcohol Testing
   (per Section 00 7301-Supplementary General Conditions, Article 13)
8. Employment Eligibility Verification
   (per Section 00 7301-Supplementary General Conditions, Article 13)

C. Submit all above items to Architect for review and approval.

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END OF SECTION 00 4393

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SECTION 00 5200 - AGREEMENT FORM

1.01 PROJECT MANUAL

A. All requirements of the Project Manual shall apply to this Section.

1.02 SCOPE

A. The agreement shall be AIA Document A101 - 2017, entitled “Standard Form of Agreement Between Owner and Contractor”.

1. Where the basis of payment is a stipulated sum.
2. Copy of this form is bound herewith.

B. This form, when fully executed, becomes a part of the successful Bidder’s Contract Documents.

END OF SECTION 00 5200

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AIA® Document A101™ – 2017

Standard Form of Agreement Between Owner and Contractor *where the basis of payment is a Stipulated Sum*

AGREEMENT made as of the day of in the year
(In words, indicate day, month and year.)

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

Teamsters Local 2727
7711 Beulah Church 2727
Louisville, Ky 40228

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

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

Teamsters Local 2727 - Office Addition and Renovation

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

Tower Pinkster Titus Associates, Inc
320 Pearl Street, Suite 100
New Albany, IN 47150

The Owner and Contractor agree as follows.

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

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

The parties should complete A101™–2017, Exhibit A, Insurance and Bonds, contemporaneously with this Agreement. AIA Document A201™–2017, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

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TABLE OF ARTICLES

1 THE CONTRACT DOCUMENTS

2 THE WORK OF THIS CONTRACT

3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

4 CONTRACT SUM

5 PAYMENTS

6 DISPUTE RESOLUTION

7 TERMINATION OR SUSPENSION

8 MISCELLANEOUS PROVISIONS

9 ENUMERATION OF CONTRACT DOCUMENTS

EXHIBIT A INSURANCE AND BONDS

ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement, and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. An enumeration of the Contract Documents, other than a Modification, appears in Article 9.

ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others.

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

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

[ ] The date of this Agreement.

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

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

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

§ 3.2 The Contract Time shall be measured from the date of commencement of the Work.

§ 3.3 Substantial Completion

§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve Substantial Completion of the entire Work:

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(Check one of the following boxes and complete the necessary information.)

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

[ ] By the following date:

§ 3.3.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work are to be completed prior to Substantial Completion of the entire Work, the Contractor shall achieve Substantial Completion of such portions by the following dates:

Portion of Work	Substantial Completion Date

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

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be ($), subject to additions and deductions as provided in the Contract Documents.

§ 4.2 Alternates

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

Item	Price

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

Item	Price	Conditions for Acceptance

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

Item	Price

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

Item	Units and Limitations	Price per Unit ($0.00)

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

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

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ARTICLE 5 PAYMENTS

§ 5.1 Progress Payments

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

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

§ 5.1.3 Provided that an Application for Payment is received by the Architect not later than the day of a month, the Owner shall make payment of the amount certified to the Contractor not later than the day of the month. If an Application for Payment is received by the Architect after the application date fixed above, payment of the amount certified shall be made by the Owner not later than ( ) days after the Architect receives the Application for Payment.
(Federal, state or local laws may require payment within a certain period of time.)

§ 5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form, and supported by such data to substantiate its accuracy, as the Architect may require. This schedule of values shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 5.1.5 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

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

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

- **.1** That portion of the Contract Sum properly allocable to completed Work;
- **.2** That portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction, or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing; and
- **.3** That portion of Construction Change Directives that the Architect determines, in the Architect's professional judgment, to be reasonably justified.

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

- **.1** The aggregate of any amounts previously paid by the Owner;
- **.2** The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A201–2017;
- **.3** Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Contractor intends to pay;
- **.4** For Work performed or defects discovered since the last payment application, any amount for which the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A201–2017; and
- **.5** Retainage withheld pursuant to Section 5.1.7.

§ 5.1.7 Retainage

§ 5.1.7.1 For each progress payment made prior to Substantial Completion of the Work, the Owner may withhold the following amount, as retainage, from the payment otherwise due:
(Insert a percentage or amount to be withheld as retainage from each Application for Payment. The amount of retainage may be limited by governing law.)

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

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

§ 5.1.7.3 Except as set forth in this Section 5.1.7.3, upon Substantial Completion of the Work, the Contractor may submit an Application for Payment that includes the retainage withheld from prior Applications for Payment pursuant to this Section 5.1.7. The Application for Payment submitted at Substantial Completion shall not include retainage as follows:
(Insert any other conditions for release of retainage upon Substantial Completion.)

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

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

§ 5.2 Final Payment

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

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

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

§ 5.2.2 The Owner's final payment to the Contractor shall be made no later than 30 days after the issuance of the Architect's final Certificate for Payment, or as follows:

§ 5.3 Interest

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

%

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 Initial Decision Maker

The Architect will serve as the Initial Decision Maker pursuant to Article 15 of AIA Document A201–2017, unless the parties appoint below another individual, not a party to this Agreement, to serve as the Initial Decision Maker.
(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)

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

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

[ ] Litigation in a court of competent jurisdiction

[ ] Other *(Specify)*

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

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

§ 7.1.1 If the Contract is terminated for the Owner's convenience in accordance with Article 14 of AIA Document A201–2017, then the Owner shall pay the Contractor a termination fee as follows:
(Insert the amount of, or method for determining, the fee, if any, payable to the Contractor following a termination for the Owner's convenience.)

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

ARTICLE 8 MISCELLANEOUS PROVISIONS
§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2017 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

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

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

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

§ 8.5 Insurance and Bonds

§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance as set forth in AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum, Exhibit A, Insurance and Bonds, and elsewhere in the Contract Documents.

§ 8.5.2 The Contractor shall provide bonds as set forth in AIA Document A101™–2017 Exhibit A, and elsewhere in the Contract Documents.

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

§ 8.7 Other provisions:

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents:

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

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

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

.4 AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:
(Insert the date of the E203-2013 incorporated into this Agreement.)

.5 Drawings

Number	Title	Date

.6 Specifications

Section	Title	Date	Pages

.7 Addenda, if any:

Number	Date	Pages

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

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

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

[ ] The Sustainability Plan:

Title	Date	Pages

[ ] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

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

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

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

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SECTION 00 6113 – CONTRACTOR'S BOND FOR CONSTRUCTION

1.01 PROJECT MANUAL

All requirements of the Project Manual shall apply to this Section.

1.02 SCOPE

A. The Performance Bond and Labor and Material Payment Bond shall be AIA Document A312 - 2010, comprised of two sections entitled "Performance Bond" and "Payment Bond".

1. Bonds shall be executed by an acceptable Surety Company licensed to do business in the State of Indiana.
2. A copy of this form is bound herewith.

B. Bonds shall be executed in an amount equal to one hundred percent (100%) of the contract amount in favor of the Owner conditioned on the full and faithful performance of the contract and full payment of all obligations arising there under.

C. This form when fully executed becomes a part of the successful bidder's Contract Documents.

END OF SECTION 00 6113

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Performance Bond

CONTRACTOR:
(Name, legal status and address)

SURETY:
(Name, legal status and principal place of business)

OWNER:
Teamsters Local 2727
7711 Beulah Church 2727
Louisville, Ky 40228

CONSTRUCTION CONTRACT
Date:
Amount: $
Description:
(Name and location)

Teamsters Local 2727 - Office Addition and Renovation

BOND
Date:
(Not earlier than Construction Contract Date)

Amount: $
Modifications to this Bond:

CONTRACTOR AS PRINCIPAL
Company: *(Corporate Seal)*
Signature: _____
Name and Title:

SURETY
Company: *(Corporate Seal)*
Signature: _____
Name and Title:

(Any additional signatures appear on the last page of this Performance Bond.)

(FOR INFORMATION ONLY — Name, address and telephone)
AGENT or **BROKER:**

OWNER'S REPRESENTATIVE:
(Architect, Engineer or other party:)

Email Address:

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

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

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

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§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

§ 2 If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Section 3.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond shall arise after

.1 the Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice shall indicate whether the Owner is requesting a conference among the Owner, Contractor and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Section 3.1 shall be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Owner's right, if any, subsequently to declare a Contractor Default;

.2 the Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and

.3 the Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

§ 4 Failure on the part of the Owner to comply with the notice requirement in Section 3.1 shall not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

§ 5 When the Owner has satisfied the conditions of Section 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

§ 5.1 Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

§ 5.2 Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

§ 5.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owner's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Section 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

§ 5.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor and with reasonable promptness under the circumstances:

.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or

.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

§ 6 If the Surety does not proceed as provided in Section 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Section 5.4, and the Owner refuses the payment or the Surety has denied liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.

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§ 7 If the Surety elects to act under Section 5.1, 5.2 or 5.3, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety shall not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication, for

.1 the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

.2 additional legal, design professional and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Section 5; and

.3 liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

§ 8 If the Surety elects to act under Section 5.1, 5.3 or 5.4, the Surety's liability is limited to the amount of this Bond.

§ 9 The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors and assigns.

§ 10 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 11 Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 12 Notice to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears.

§ 13 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 14 Definitions

§ 14.1 Balance of the Contract Price. The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made, including allowance to the Contractor of any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

§ 14.2 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

§ 14.3 Contractor Default. Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

§ 14.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 14.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

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§ 15 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 16 Modifications to this bond are as follows:

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL		**SURETY**	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature:		Signature:	
Name and Title:		Name and Title:	
Address:		Address:	

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User Notes: (3B9ADA2A)

AIA® Document A312™ – 2010

Payment Bond

CONTRACTOR:
(Name, legal status and address)

SURETY:
(Name, legal status and principal place of business)

OWNER:
Teamsters Local 2727
7711 Beulah Church 2727
Louisville, Ky 40228

CONSTRUCTION CONTRACT
Date:
Amount: $
Description:
(Name and location)

Teamsters Local 2727 - Office Addition and Renovation

BOND
Date:
(Not earlier than Construction Contract Date)

Amount: $
Modifications to this Bond:

CONTRACTOR AS PRINCIPAL
Company: *(Corporate Seal)*
Signature:

Name and Title:

SURETY
Company: *(Corporate Seal)*
Signature:

Name and Title:

(Any additional signatures appear on the last page of this Payment Bond.)

(FOR INFORMATION ONLY — Name, address and telephone)
AGENT or **BROKER:**

OWNER'S REPRESENTATIVE:
(Architect, Engineer or other party:)

Email Address:

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

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

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

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§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner to pay for labor, materials and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.

§ 2 If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies and holds harmless the Owner from claims, demands, liens or suits by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond shall arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Section 13) of claims, demands, liens or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract and tendered defense of such claims, demands, liens or suits to the Contractor and the Surety.

§ 4 When the Owner has satisfied the conditions in Section 3, the Surety shall promptly and at the Surety's expense defend, indemnify and hold harmless the Owner against a duly tendered claim, demand, lien or suit.

§ 5 The Surety's obligations to a Claimant under this Bond shall arise after the following:

§ 5.1 Claimants, who do not have a direct contract with the Contractor,

.1 have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and

.2 have sent a Claim to the Surety (at the address described in Section 13).

§ 5.2 Claimants, who are employed by or have a direct contract with the Contractor, have sent a Claim to the Surety (at the address described in Section 13).

§ 6 If a notice of non-payment required by Section 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Section 5.1.1.

§ 7 When a Claimant has satisfied the conditions of Sections 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:

§ 7.1 Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

§ 7.2 Pay or arrange for payment of any undisputed amounts.

§ 7.3 The Surety's failure to discharge its obligations under Section 7.1 or Section 7.2 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Section 7.1 or Section 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

§ 8 The Surety's total obligation shall not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Section 7.3, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.

§ 9 Amounts owed by the Owner to the Contractor under the Construction Contract shall be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfy obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

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§ 10 The Surety shall not be liable to the Owner, Claimants or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to, or give notice on behalf of, Claimants or otherwise have any obligations to Claimants under this Bond.

§ 11 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 12 No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Section 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 13 Notice and Claims to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, shall be sufficient compliance as of the date received.

§ 14 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 15 Upon request by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

§ 16 Definitions

§ 16.1 Claim. A written statement by the Claimant including at a minimum:

- **.1** the name of the Claimant;
- **.2** the name of the person for whom the labor was done, or materials or equipment furnished;
- **.3** a copy of the agreement or purchase order pursuant to which labor, materials or equipment was furnished for use in the performance of the Construction Contract;
- **.4** a brief description of the labor, materials or equipment furnished;
- **.5** the date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
- **.6** the total amount earned by the Claimant for labor, materials or equipment furnished as of the date of the Claim;
- **.7** the total amount of previous payments received by the Claimant; and
- **.8** the total amount due and unpaid to the Claimant for labor, materials or equipment furnished as of the date of the Claim.

§ 16.2 Claimant. An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials or equipment were furnished.

§ 16.3 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

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§ 16.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 16.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

§ 17 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 18 Modifications to this bond are as follows:

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL		**SURETY**	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature:		Signature:	
Name and Title:		Name and Title:	
Address:		Address:	

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SECTION 00 7200 - GENERAL CONDITIONS

1.1 PROJECT MANUAL

All requirements of the Project Manual shall apply to this Section.

1.2 SCOPE

A. The General Conditions shall be AIA Document A201 - 2017, entitled “General Conditions of the Contract for Construction”.

1. A copy of which is bound herewith.

END OF SECTION 00 7200

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AIA® Document A201™ – 2017

General Conditions of the Contract for Construction

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

Teamsters Local 2727 - Office Addition and Renovation

THE OWNER:
(Name, legal status and address)

Teamsters Local 2727
7711 Beulah Church 2727
Louisville, Ky 40228

THE ARCHITECT:
(Name, legal status and address)

Tower Pinkster Titus Associates, Inc
320 Pearl Street, Suite 100
New Albany, IN 47150

TABLE OF ARTICLES

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2 OWNER

3 CONTRACTOR

4 ARCHITECT

5 SUBCONTRACTORS

6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

7 CHANGES IN THE WORK

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9 PAYMENTS AND COMPLETION

10 PROTECTION OF PERSONS AND PROPERTY

11 INSURANCE AND BONDS

12 UNCOVERING AND CORRECTION OF WORK

13 MISCELLANEOUS PROVISIONS

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

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

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

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14 TERMINATION OR SUSPENSION OF THE CONTRACT

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

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consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

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

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

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

§ 1.3 Capitalization

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

§ 1.4 Interpretation

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

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

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

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

§ 1.6 Notice

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

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

§ 1.7 Digital Data Use and Transmission

The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties will use AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

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§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document G202™–2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

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,

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assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

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

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

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

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

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

§ 2.4 Owner's Right to Stop the Work

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

§ 2.5 Owner's Right to Carry Out the Work

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

ARTICLE 3 CONTRACTOR

§ 3.1 General

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

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

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

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§ 3.2 Review of Contract Documents and Field Conditions by Contractor

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

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

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

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

§ 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.

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

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

§ 3.5 Warranty

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

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

§ 3.6 Taxes

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

§ 3.7 Permits, Fees, Notices and Compliance with Laws

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

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

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

§ 3.7.4 Concealed or Unknown Conditions

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

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

§ 3.8 Allowances

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 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

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Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

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

§ 3.11 Documents and Samples at the Site

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

§ 3.12 Shop Drawings, Product Data and Samples

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

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

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

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

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

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

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

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

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

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

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

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

§ 3.13 Use of Site

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

§ 3.14 Cutting and Patching

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

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

§ 3.15 Cleaning Up

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

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

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§ 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 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

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Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 Communications

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

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

§ 4.2.6 The Architect 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

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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.

§ 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,

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prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 Contingent Assignment of Subcontracts

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

.1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and

.2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

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

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

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

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

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

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

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

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

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

§ 6.2 Mutual Responsibility

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

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work,

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

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

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

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

§ 6.3 Owner's Right to Clean Up

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

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

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

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

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

§ 7.2 Change Orders

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

.1 The change in the Work;
.2 The amount of the adjustment, if any, in the Contract Sum; and
.3 The extent of the adjustment, if any, in the Contract Time.

§ 7.3 Construction Change Directives

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

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

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

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.1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
.2 Unit prices stated in the Contract Documents or subsequently agreed upon;
.3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
.4 As provided in Section 7.3.4.

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

.1 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;
.2 Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;
.3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
.4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and
.5 Costs of supervision and field office personnel directly attributable to the change.

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

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

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

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

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

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

§ 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will

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affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

ARTICLE 8 TIME

§ 8.1 Definitions

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

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

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

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

§ 8.2 Progress and Completion

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

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

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

§ 8.3 Delays and Extensions of Time

§ 8.3.1 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

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unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment.

§ 9.3 Applications for Payment

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

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

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

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

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

§ 9.4 Certificates for Payment

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

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

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§ 9.5 Decisions to Withhold Certification

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

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

§ 9.5.2 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.

§ 9.5.3 When the reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.4 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Contractor shall reflect such payment on its next Application for Payment.

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

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§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

§ 9.7 Failure of Payment

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents, the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

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§ 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

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

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

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of 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.

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§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- **.1** liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
- **.2** failure of the Work to comply with the requirements of the Contract Documents;
- **.3** terms of special warranties required by the Contract Documents; or
- **.4** audits performed by the Owner, if permitted by the Contract Documents, after final payment.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a supplier, shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to

- **.1** employees on the Work and other persons who may be affected thereby;
- **.2** the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and
- **.3** other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.

§ 10.2.3 The Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites and utilities of the safeguards.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

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§ 10.2.8 Injury or Damage to Person or Property

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 Hazardous Materials and Substances

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner and Architect of the condition.

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for hazardous materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for hazardous materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense thereby incurred.

§ 10.4 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

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ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.

§ 11.1.2 The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 11.1.3 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 11.2 Owner's Insurance

§ 11.2.1 The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.

§ 11.2.2 Failure to Purchase Required Property Insurance. If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.

§ 11.2.3 Notice of Cancellation or Expiration of Owner's Required Property Insurance. Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

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§ 11.3 Waivers of Subrogation

§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§ 11.3.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance

The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused.

§11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to

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the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner or Separate Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

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§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

§ 13.3 Rights and Remedies

§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

§ 13.3.2 No action or failure to act by the Owner, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.

§ 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

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

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

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

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

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

§ 13.5 Interest

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

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ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

.1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;

.2 An act of government, such as a declaration of national emergency, that requires all Work to be stopped;

.3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or

.4 The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

.1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;

.2 fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;

.3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or

.4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

.1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;

.2 Accept assignment of subcontracts pursuant to Section 5.4; and

.3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance,

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the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

.1 that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or

.2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall

.1 cease operations as directed by the Owner in the notice;

.2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and

.3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

§ 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

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§ 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

.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

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Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of the request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished, or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 15.3 Mediation

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.

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§ 15.3.4 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

§ 15.4 Arbitration

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

§ 15.4.4 Consolidation or Joinder

§ 15.4.4.1 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as those of the Owner and Contractor under this Agreement.

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SECTION 00 7302 - SUPPLEMENTARY GENERAL CONDITIONS (Non-Public Works)

A. Unless otherwise provided in these Supplemental Conditions, all work shall be governed by the terms of AIA Document A201 - 2007, entitled "General Conditions of the Contract for Construction". The following Supplemental Conditions, modify, delete from and add to AIA A201. Where an Article Paragraph, Subparagraph or Clause of AIA A201 is modified, deleted from or added to by these Supplemental Conditions, the unaltered provisions of that Article, Paragraph, Subparagraph or Clause shall remain in full force and effect. To the extent that there is any conflict or ambiguity between AIA A201 and these Supplemental Conditions, then these Supplemental Conditions shall control.

ARTICLE 1 - GENERAL PROVISIONS

1.1.1 THE CONTRACT DOCUMENTS

Add the following:

1. Proposal Form.

1.1.5 THE DRAWINGS

Add the following Paragraphs:

1.1.5.1 The Drawings are a graphic representation intended to convey the design intent of the Project. They are a 2-dimensional representation of a 3-dimensional Project, and they do not provide a detail for every construction condition of the project. The Drawings are a small scale representation of complex construction assemblies and components, and not every element of the Project can be indicated in these small scale representations. The Drawings are not an instruction manual, nor are they assembly instructions. They are meant for use by experienced, competent construction professionals with the ability to read, interpret, co-ordinate, interpolate and infer information from them. The Drawings do not indicate every component and assembly necessary to construct the Project. It is the Contractor's responsibility to provide all components and assemblies necessary to provide a safe, complete and finished Project, which is reasonably fit for its intended purpose, whether or not such components and assemblies are detailed on the Drawings.

1.1.5.2 In general, all drawings are diagrammatic and schematic, and cannot indicate every offset, fitting, and accessory, nor can they indicate the field coordination work required to avoid all conflict with other trades. Contractor shall check drawings, shop drawings, and actual equipment of other trades to verify spaces available and make reasonable modifications, as directed, without extra cost to Owner; maintain headroom and other requirements in all areas; and where such requirements appear inadequate, notify Architect/Engineer before proceeding.

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1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

Add the following sentence to Paragraph 1.2.1:

It is the Contractor's responsibility to provide all work necessary for a complete and finished Project of first class quality. The Contractor will work skillfully, carefully and will perform in all respects in a workmanlike manner.

Add the following Paragraphs 1.2.2.1 and 1.2.3.1:

1.2.2.1 The Drawings are not intended to define the scope of work among various trades, sub-contractors, material suppliers and vendors. The sheet numbering system is for the convenience of the Architect and the Architect's consultants only and is not intended to define a sub-contractor's or material supplier's scope of work. Information is detailed, described and located at various locations throughout the Drawings. No consideration will be given to requests for change orders which relate to a failure of the Contractor, or the Contractor's sub-contractors and suppliers to obtain and review a complete set of Contract Documents during bidding, nor to maintain a complete set of Contract Documents during construction. Where bidding is separated into a number of different prime contracts, this paragraph applies to each of the separate prime contracts.

1.2.3.1 In the event of conflicts or discrepancies among the Contract Documents, interpretations will be based on the following priorities.

1. The Agreement
2. Addenda, with those of later date having precedence over those of earlier date.
3. The Supplementary Conditions.
4. The General Conditions of the Contract for Construction.
5. Drawings and Specifications.

In the case of an inconsistency between Drawings and Specifications or within either Document not clarified by addendum, the better quality or greater quantity of Work shall be provided in accordance with the Architect's interpretation. The Contractor has a duty to inquire about possible ambiguities and inconsistencies which are patent or obvious during the bidding process, and will not receive additional compensation or be excused from resulting difficulties in performance for failure to point out any inconsistencies after that point. In the case of disregard by the Contractor of such inconsistencies and ambiguities, the Architect may require the Contractor to remove and correct work which has been installed at no additional cost to the Owner.

ARTICLE 2 - OWNER

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2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

2.2.2 DELETE Subparagraph 2.2.2 in its entirety.

2.2.3 DELETE Subparagraph 2.2.3 in its entirety and replace with the following:

Neither the Owner nor the Architect shall be liable for inaccuracies or omissions contained in any surveys for the site of the Project, nor shall any inaccuracies or omissions in such items relieve the Contractor of its responsibility to perform the Work in accordance with the Contract Documents.

2.2.5 Replace Subparagraph 2.2.5 with the following:

The Contractor will be provided free of charge all bid documents in PDF format. Printing of all bid documents, including all costs associated therewith, is to be borne by the Contractor for use by and distribution to all their bidders, sub-bidders and suppliers at the discretion and responsibility of the Contractor. All bid documents will be made available as identified in the Notice To Bidders.

ARTICLE 3 - CONTRACTOR

3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

3.3.4 ADD the following new Subparagraph:

The Contractor shall maintain total control of and shall be fully responsible for the Contractor's employees, agents, representatives, workers, Subcontractors, sub-subcontractors and other such persons or entities, and shall remove from the Site any such persons or entities not in compliance with the Contract Documents as interpreted by the Architect or the Owner. The Contractor shall assure harmonious labor relations at and adjacent to the Site so as to prevent any delays, disruption or interference to the Work. The Contractor shall prevent strikes, sympathy strikes, slowdowns, work interruption, jurisdictional disputes or other labor disputes resulting for any reason whatsoever, from the acts or failure to act, of the employees of the Contractor or any of its Subcontractors material suppliers, or other such persons or entities. The Contractor agrees that it will bind and require all of its Subcontractors, material suppliers and other such persons or entities to agree to all of the provisions of this subparagraph. If the Contractor or any of its Subcontractors, material suppliers or other such persons or entities fail to fulfill any of the covenants set forth in the Subparagraph, the Contractor will be deemed to be in default and substantial violation of the Contract Documents.

3.5 WARRANTY

Add the following new Subparagraphs 3.5.2, 3.5.3, 3.5.4, 3.5.5, 3.5.6, 3.5.7, 3.5.8 and 3.5.9.

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3.5.2 For a period of one (1) year from the date of Substantial Completion, the Contractor warrants as provided in Subparagraph 3.5.1 and further warrants to the Owner, and the Architect that (a) all movable or adjustable work shall remain in working order, including hardware, doors, windows, apparatus, machinery, mechanical and electrical equipment and (b) the Contractor's portion of the Work shall be waterproof and weatherproof in every respect.

3.5.3 In addition to all the Contractor warranties and obligations to correct defective Work provided by law or as set forth in any of the Contract Documents, the Contractor agrees, upon notice from the Owner or the Architect, to pay for, and if requested, correct, repair, restore and cure any damage or injury, whenever the same shall occur or appear, resulting from any defects, omissions or failure in workmanship or materials, and indemnify, hold harmless, and defend the Owner against any and all claims, losses, costs, damages and expenses, including attorneys' fees, suffered by the Owner as a result of such damage or injury, whenever such damage or injury shall occur or appear.

3.5.4 The commencement and terms of the guarantees and warranties required by the Contract Documents shall not in any manner be affected by any delay in the commencement, progress or completion of the Work, regardless of the cause therefore.

3.5.5 The foregoing guarantees and warranties shall not shorten any longer warranty or liability period provided for by law or in the Contract Documents or otherwise received from the Contractor or any Subcontractor, material supplier or manufacturer, nor supersede the terms of any special warranty given by the Contractor, nor shorten any period of the Contractor's legal liability for defective Work, but shall be in addition thereto.

3.5.6 Notwithstanding anything to the contrary contained herein with respect to warranties, it is understood and agreed that the foregoing warranties and guarantees shall not affect, limit or impair the Owner's right against the Contractor with regard to latent defects in the Work which do not appear within the applicable warranty period and which could not, by the exercise of reasonable care and due diligence, be ascertained or discovered by the Owner within such warranty period. The Contractor shall be correct and cure any such latent defects which are reported to the Contractor by the Owner in writing within ninety (90) days after such latent defect first appears or could, by the exercise of reasonable care and due diligence, be ascertained or discovered by the Owner.

3.5.7 Neither the acceptance of any of the Work by the Owner, in whole or in part, nor any payment, either partial or final, by the Owner to the Contractor, shall constitute a waiver by the Owner of any claims against the Contractor for defects in the Work, whether latent or apparent, and no such payment or acceptance of the Work by the Owner shall release or discharge the Contractor of the Contractor's surety, if any, from any such claims for breach of such warranties.

3.5.8 Upon completion of the Work, the Contractor shall furnish the Owner with all written warranties, guarantees, operating manuals, all shop drawings and submittals used in the project relative to

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equipment installed, and if requested by the Architect, a complete set of reproducible drawings with all field changes noted on them relating to the improvements constructed.

3.5.9 If required by the Owner or the Architect, the Contractor shall deliver to the Owner a signed affidavit stating that the Work has been constructed in accordance with the Contract Documents. If such affidavit is required, final payment or a final certificate for payment shall not be tendered until such affidavit has been delivered to the Owner.

3.12 SHOP DRAWINGS, PROJECT DATA AND SAMPLES

A. Refer to Section 01330 - Submittal Procedures for further provisions on this subject.

3.13 USE OF SITE

ADD the following new Subparagraphs 3.13.1 and 3.13.2:

3.13.1 If the Owner requires the contractor to relocate materials or equipment which have been stored on the Site or within the Project, the Contractor shall relocate such materials or equipment at no additional cost to the Owner.

3.13.2 The Contractor is solely responsible for its Site access. The Contractor shall keep all roads, walks, ramps and other areas on and adjacent to the Site in good working order and condition and free from obstructions which might present a hazard to or interference with traffic or the public. When construction operations necessitate the closing of traffic lanes, the Contractor shall be responsible for arranging such closings in advance with the authorities having jurisdiction, the Owner, and adjacent property Owners. The Contractor shall provide adequate barricades, signs and other devices for traffic guides and public safety. Contractor shall maintain all adjacent streets to that Project in a clean condition and shall clean all dirt and mud from the Project and from such adjacent street on a daily basis.

3.14 CUTTING AND PATCHING

A. Refer to Section 01732 - Cutting and Patching for further provisions on this subject.

3.15 CLEANING UP

A. Refer to Section 01740 - Cleaning for further provisions on this subject.

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ARTICLE 6 - CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

6.2 MUTUAL RESPONSIBILITY

ADD the following new Subparagraphs 6.2.6 and 6.2.7:

6.2.6 No Contractor, other Contractor, or Subcontractor, shall be entitled or permitted to sue or make a claim against the Owner or the Architect on account of any delay, disruption or acceleration or damage related thereto. If, however, the Owner or the Architect is sued or receives a claim from a Contractor or other Contractor on account of any alleged delay, disruption, interference or acceleration or damage related thereto caused, or alleged to be caused, in whole or in part, by the Contractor, the Contractor shall defend and indemnify the Owner and the Architect therefore, and reimburse them for their attorney's fees, costs and expenses.

6.2.7 Inasmuch as the completion of the Project within the Contract Time is dependent upon the close and active cooperation of all those engaged therein, it shall be expressly understood and agreed that the Contractor shall lay out and install its Work at such time or times and in such manner as not to delay, interfere, or disrupt the Work of others.

ARTICLE 7 - CHANGES IN THE WORK

7.1 GENERAL

Add the following new Subparagraphs 7.1.4 and 7.1.5:

7.1.4 Consultants to Architect or Owner:

1. Consultants to Architect or Owner shall have NO authority to modify Contract requirements in the Scope of Work or Contract Time.
2. Consultants to Architect or Owner shall have no direct communication with Contractor or subcontractors, suppliers and vendors to Contractor without the express consent of the Architect.
3. Any direct communication authorized by the Architect shall be for clarifications of the Work only and shall not act to authorize any changes in the Scope of Work, Contract Sum or Contract Time.

7.1.5 The overhead, profit and commission percentages included in a Change Order or Construction Change Directive must not exceed the maximums given at the end of this paragraph, and will be considered to include, but not be limited to, insurance (other than Workman's Compensation Insurance, FICA, Medicare and FUTA), bonds, small tools, incidental job burdens, supervisory expense, project management expense, clerical expense, preparatory expense and general office expense. Workmen's Compensation Insurance, and employment taxes under FICA, Medicare and FUTA are to be itemized

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separately and no percentage for overhead, profit and commission will be allowed on them. The percentages for overhead, profit and commission will be negotiated and may vary according to the nature, extent and complexity of the work involved, but not to exceed the maximum percentages shown. Not more than three percentages will be allowed regardless of the number of tiers of sub-contractors; that is, the markup on work subcontracted by a subcontractor will be limited to one overhead percentage and one profit percentage in addition to the prime contractor's commission percentage. On proposals covering both increases and decreases in the amount of the contract, the overhead, profit, and where applicable, commission, will be computed on the net change only. On proposals for decreases in the amount of the contract, the overhead and profit shall be added to the decrease in direct cost:

Description	*Overhead*	*Profit*	*Commission*
To Contractor on work performed by other than his/her own forces	0%	0%	10%
To Contractor for that portion of work performed with by his/her own forces	10%	10%	0%
To Sub-contractor for that portion of work performed by his/her own forces	10%	10%	0%

7.3 CONSTRUCTION CHANGE DIRECTIVES

Add the following new Subparagraph to 7.3.7.6:

7.3.7.6 Amount for overhead and profit as set forth in this Agreement shall be in accordance with the schedule set forth in Article 7.1.5.

ARTICLE 8 - TIME

8.2 PROGRESS AND COMPLETION

ADD the following Subparagraphs 8.2.4, 8.2.5 and 8.2.6:

8.2.4 Whenever it may be useful or necessary for the Owner to do so, the Owner may take possession of the Project or parts thereof at any time that it is determined by the Architect that the Work has been completed to a point where the Owner may occupy or use said Project, or parts thereof, without interference, delay or disruption to the continued execution of the work. The Owner may at such time install furnishings and equipment as it sees fit or may at its discretion hire other Contractors for this purpose. Such use or occupation shall not relieve the Contractor or these warranty obligations as provided in the Contract Documents nor shorten their commencement dates.

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8.2.5 Except as otherwise provided herein, substantial completion of work shall be within the number of calendar days stated by the Contractor on the Proposal Form and shall become a contract obligation. The time for completion of the work shall be extended for the period of any excusable delay, which term shall include only those delays directly caused by any of the reasons enumerated in the following subparagraph 8.3.2 and 8.3.3.

8.2.6 Completion shall be understood to be substantially complete for the Owner's beneficial occupancy, with only minor Punch List" items yet to be completed and items such as balancing of heating system, etc., which cannot be completed due to climatic conditions.

8.3 DELAYS AND EXTENSIONS OF TIME

DELETE Subparagraph 8.3.1 in its entirety and substitute the following:

8.3.1 If the Work is delayed, disrupted, interfered with our constructively accelerated (hereinafter and collectively referred to as "Hinderance" or "Hindrances") at any time by any act or neglect of the Owner, the Architect, other Contractors or Subcontractors, or any of their employees, or by changes ordered in the Work, fire, unusual delay in transportation, unavoidable casualties, or other cause beyond the Contractor's control as elsewhere provided in the Contract Documents, then the Contract Time shall be increased by Change Order for such reasonable time as the Architect may determine.

DELETE Subparagraph 8.3.3 in its entirety and substitute the following:

8.3.3 Whether or not any Hinderance shall be the basis for an increase in the Contract Time, the Contractor shall have no claim against the Owner or the Architect for an increase in the Contract Sum, nor a claim against the Owner or the Architect for a payment or allowance of any kind for damage, loss or expense resulting from any Hinderance. As between the Contractor and the Owner, except for acts constituting intentional or grossly unreasonable interference by the Owner or the Architect with the Contractor's performance of the Work when such acts continue after the Contractor's written notice to the Owner of such interference or disruption, the Contractor shall assume the risk of all Hindrances arising from any and all causes whatsoever, including without limitation, those due to any act or omission of the Owner or the Architect, except only to the extent that an increase to the Contract Time may be due to the Contractor as expressly provided for in this Subparagraph. The Contractor shall bear all costs, expenses and liabilities in connection with Hindrances and all costs, expenses and liabilities of any nature whatsoever, whether or not provided for in the Contract Documents, shall conclusively be deemed to have been within the contemplation of the parties. The only remedy available to the Contractor shall be an increase in the Contract Time.

ADD the following new Subparagraphs 8.3.4, 8.3.5 and 8.3.6:

8.3.4 The Owner's exercise of any of its rights under the Contract Documents, including but not limited to its rights regarding changes in the Work, regardless of extent or number of such changes, performance of separate Work or carrying of the Work by the Owner or the Architect, directing overtime or changes in the sequence of the Work, withholding payment or otherwise exercising its rights hereunder, or exercising any of its

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remedies of suspension of the Work or requirements of correction or re-execution of any defective Work shall not, under any circumstances, be construed as intentional interference or disruption with the Work.

8.3.5 No increase in the Contract Time shall be granted for any Hindrance resulting from unsuitable ground conditions, inadequate forces, the failure of the Contractor to place orders for equipment or materials sufficiently in advance to insure their delivery when needed, or any Hindrance resulting from interruptions to or suspensions of the Work so as to enable others to perform their Work, other than as specifically provided elsewhere in the Contract Documents.

8.3.6 If the Contractor causes a Hindrance to the Work so as to cause any damage to the Owner or any damages for which the Owner may become liable, the Contractor shall be liable therefore and the Owner may withhold from any amount yet due the Contractor the amount reasonably required to compensate the Owner for such damages, if the amount of compensation exceeds the amount yet paid to the Contractor, the Contractor shall pay the difference to the Owner immediately upon demand.

ARTICLE 9 - PAYMENTS AND COMPLETION

9.2 SCHEDULE OF VALUES

Add the following new Subparagraph 9.2.2:

9.2.2 Contractor shall obtain written concurrence in such schedule of values from the Surety furnishing any Performance Bond and Labor and Materials Payment Bond. Copy of written concurrence by the Surety shall be submitted by the time of written submission.

9.3 APPLICATIONS FOR PAYMENT

ADD the following new Subparagraphs: 9.3.1.3, 9.3.1.4, 9.3.1.5, and 9.3.1.6:

9.3.1.3 The Owner will pay ninety-five percent (95%) of the amount due the Contractor on Account of progress payments for the entire period of the Contract.

9.3.1.4 A subcontractor shall be paid ninety-five percent (95%) of the earned sum by the Contractor for the entire period of the Contract.

9.3.1.5 The Owner, Contractor and the Architect/Engineer shall cooperate to the end that retentions shall be paid promptly when all conditions of the Contract have been met.

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9.3.1.6 Applications for payment, subsequent to the first application, shall be accompanied by Waivers of Lien from the Contractor and all major subcontractors, suppliers, and vendors.

ADD the following at the end of Subparagraph 9.3.3:

9.3.3 This provision shall not be construed as relieving the Contractor from the sole responsibility and expense for the care and protection of materials and Work upon which payments have been made or the restoration of any stolen, destroyed or damaged Work, or as a waiver of the right of the Owner to require the fulfillment of all of the terms of the Contract Documents.

9.5 DECISIONS TO WITHHOLD CERTIFICATION

ADD the following new Subparagraph 9.5.4:

9.5.4 If any claim or lien is made or filed with or against the Owner, the Architect, the Project, or the Contract Sum by any persons or entity claiming that the Contractor or and Subcontractor or other person for whom the Contractor is responsible has failed to make payment for labor, services, materials, equipment, taxes or other items or obligations furnished or incurred for or in connection with the Work, or if at any time there shall be any evidence of such non-payment or of any claim or lien which is chargeable to the Contractor, or if the Contractor or any Subcontractor or other person or entity for whom the Contractor is responsible caused damage to the Work or to any other Work on the project, or if the Contractor fails to perform or is otherwise in default under any of the terms or provisions of the Contract Documents, the Owner shall have the right to retain from any payment then due or thereafter to become due an amount which it deems sufficient to (1) satisfy, discharge and/or defend against such claim or lien or any action which may be brought or judgment which may be recovered thereon, (2) make good any such non-payment, damage, failure or default, and (3) compensate the Owner and the Architect for any and all losses, liabilities, damages, cost and expenses, including legal fees and costs, which may be sustained or incurred by either or both of them in connection therewith. The Owner shall have the right to apply and charge against the Contractor so much of the amount retained as may be required for the foregoing purposes. If the amount retained is insufficient therefore, the Contractor shall be liable for the difference and shall pay the difference to the Owner.

9.6 PROGRESS PAYMENTS

DELETE Subparagraph 9.6.6 in its entirety and replace with the following:

9.6.6 No recommendation or certification of a progress payment, any progress payment, final payment, or any partial or entire use or occupancy of the Project by the Owner, shall constitute acceptance of any Work not in accordance with the Contract Documents.

9.9 PARTIAL OCCUPANCY OR USE

9.9.1 DELETE the phrase "when such portion is designated by separate agreement with the Contractor" in line 2; DELETE the last two sentences in Subparagraph 9.9.1.

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9.10 FINAL COMPLETION AND FINAL PAYMENT

9.10.1 ADD the following sentence at the end of the Subparagraph:

"Provided, however, that final payment shall not be due and payable until sixty-one (61) days after the Work has been completed and the Contract fully performed".

9.10.4 ADD the following at the end of Subparagraph 9.10.4:

"Final payment constituting the unpaid balance of the Contract Sum shall be paid to the Contractor in full, no less than sixty-one (61 days) following the date of substantial completion. If at any of that time there are any remaining uncompleted items, an amount equal to two hundred percent (200%) of the value of each item as determined by the Architect shall be withheld until said items are completed and a Final Certificate of Payment is issued by the Architect".

DELETE Subparagraph 9.10.5 in its entirety and replace with the following:

9.10.5 The Contractor's obligation to perform the Work and complete the Project in accordance with the Contract Documents shall be absolute. Neither approval of any progress or final payment, nor the issuance of a Certificate of Substantial Completion, nor any payment by the Owner to the Contractor under the Contract Documents, nor any use or occupancy of the Project or any part thereof by the Owner, nor any act of acceptance by the Owner shall constitute an acceptance of Work not in accordance with the Contract Documents, nor does it constitute a waiver of any claims that arise from: (1) liens, claims, security interests or encumbrances arising out of the contract or settled; or (2) terms of any warranties in favor of the Owner that are provided pursuant to the Contract Documents or otherwise.

ARTICLE 10 - PROTECTION OF PERSONS AND PROPERTY

DELETE Subparagraph 10.1.1 in its entirety and replace with the following:

10.1.1 The Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work and in connection with the Contractor's performance of any work other than the Work.

10.2 SAFETY OF PERSONS AND PROPERTY

10.2.1 REPLACE the words "reasonable" with the phrase "all necessary" in both instances in line 1.

ADD the following to Subparagraph 10.2.1:

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.4 Protect excavation, trenches, buildings and grounds from all water damage. Furnish necessary equipment to provide this protection during the term of the Contract. Construct and maintain necessary temporary drainage to keep excavations free of water.

.5 Provide protection of the Work against wind, storms, cold and heat. At the end of each day, cover new Work which may be damaged;

.6 Provide adequately-engineered shoring and bracing required for safety and for the proper execution of the Work and have same removed when the Work is completed; and

.7 Protect, maintain and restore benchmarks, monuments and other reference points affected by the Work. If benchmarks, monuments or other reference points are displaced or destroyed, points shall be re-established and markers reset under the supervision of a licensed surveyor, who shall furnish certificates of its work.

10.2.5 INSERT the work "solely" after the word "loss" in the clause which reads "except damage or loss attributable to acts or omissions of the Owner or Architect...".
ADD the following new Subparagraphs 10.2.9, 10.2.10 and 10.2.11:

10.2.9 "The Project is designed to be self-supporting and stable after the Work is fully completed. Except as otherwise provided, it is solely the Contractor's responsibility to determine erection procedures and sequences, and to insure the safety of the Project and its component parts during erection. This includes, but is not limited to, the addition or modification of whatever temporary bracing, guys or tie downs may be necessary. Such material shall be removed after completion of the Work".

10.2.10 The Contractor shall conform with the United States Department of Labor and the State Division of Labor Occupational Safety and Health Administration regulations.

10.2.11 The Contractor shall have the Hazard Communication Program in effect with all their personnel working on the project. All Material Data sheets should be current as required by law.

ARTICLE 11 - INSURANCE AND BONDS

11.1 CONTRACTOR'S LIABILITY INSURANCE

11.1.2 Add the following limits of liability:

.1 Workmen's Compensation - statutory.

Employer's Liability - $100,000.

.2 Comprehensive General Liability (including Premises - Operations, Independent Contractor's Protective, Products and Completed Operations, Broad Form Property Damage):

a. Bodily Injury:
$1,000,000 - one person aggregate per project endorsement. CG2503 to be included

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$1,000,000 - annual aggregate.

b. Property Damage:
$500,000 - each occurrence.
$1,000,000 - annual aggregate.

c. Property Damage Liability Insurance shall include coverage for the following hazards:
X (Explosion, C (Collapse), U (Underground).

d. Wavier of subrogation to be included

e. Additional insured form CG2010 to be included

.3 Contractual Liability (Hold Harmless Coverage).

a. Bodily Injury:
$1,000,000 each occurrence

b. Property Damage:
$500,000 each occurrence
$500,000 aggregate

.4 Personal Injury, with employment exclusion deleted:

$1,000,000.

.5 Comprehensive Automobile Liability (Owned, Non-Owned, Hired):

a. Bodily Injury:
$1,000,000 each person.
$1,000,000 each accident

b. Property Damage:
$500,000 each occurrence.

c. Owner to be named as additional insured and provided a Waiver of Subrogation.

.6 Catastrophic Umbrella Coverage, including products - complete operations:

$2,000,000

.7 Prime Contractors and all subcontractor's insurance shall be primary and non-contributory on all insurance.

Add the following new Subparagraph 11.1.5:

11.1.5 The Contractor shall furnish one copy of Certificate of Insurance, Indiana State Industrial Board Form 18A, required of each copy of the agreement, which shall specifically set forth evidence of all coverages required. Furnish Owner copies of any endorsements subsequently issued amending coverage limits.

11.3 PROPERTY INSURANCE

11.3.1 Change the last sentence to ADD: "Architects and Engineers of Record after "Subcontractors". ADD the following new Subparagraph 11.3.7.1:

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11.3.7.1 Any errors and omissions insurance maintained by the Architect or the Architect's Consultants shall not serve to exclude the Architect or Architect's Consultant from the mutual waiver of rights outlined in paragraph 11.3.7. The waiver of rights is given in exchange for property insurance covering the work.

11.3.9 DELETE Subparagraph 11.3.9 in its entirety.
11.3.10 DELETE all words following "insurers" in the first line and put a "." after "insurers".

ARTICLE 13 – MISCELLANEOUS PROVISIONS

13.2 SUCCESSORS AND ASSIGNS

13.2.1 DELETE the last two sentences of this Subparagraph.
ADD the following as the last two sentences of the Subparagraph:

"Contractor shall not assign the Contract or any portion thereof without the written consent of Owner. Owner is entitled to assign the Contract or any portion thereof".

13.2.2 DELETE this Subparagraph in its entirety.

13.5 TESTS AND INSPECTIONS

ADD the following new Subparagraph 13.5.7:

13.5.7 Neither the observations of the Architect, its administration of the Contract Documents, nor inspections tests or approvals by persons other than the Contractor shall relieve the Contractor from its obligation to perform the Work in accordance with the Contract Documents.

ADD the following new Paragraph 13.8:

13.8 There shall be no firearms allowed on the project site or anywhere within the project property. Exceptions would be made for law enforcement officials, security forces required elsewhere by these Specifications, or per other requirements or allowances specifically made by the Owner.

ADD the following new Paragraph 13.9:

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13.9 There shall be no smoking or tobacco use allowed within the buildings, on the project site or anywhere within the project property. Violators shall be removed from the project immediately.

Any construction materials in contact with or exposure to such tobacco products shall be removed and replaced with new, at the Contractor's expense.

ARTICLE 14 - TERMINATION OR SUSPENSION OF THE CONTRACT

14.1 TERMINATION BY THE CONTRACTOR

DELETE Subparagraph 14.1.1 in its entirety and replace with the following:

14.1.1 If the Work is stopped for a period of sixty (60) days under an order of any court or other public authority having jurisdiction, or as a result of any act of government such as a declaration of a national emergency making material unavailable, through no act or failure to act of the Contractor or a Subcontractor or their agents or employees or any other persons performing any of the Work under a contract with the Contractor, and the Owner has not otherwise suspended, delayed, disrupted or interrupted the Work in accordance with the Subparagraph, then the Contractor may, upon fourteen (14) days' written notice to the Owner, terminate the Contract, and recover from the Owner payment for all Work executed to date. Recovery by the Contractor of lost anticipated profit and overhead and other consequential and incidental damages is hereby specifically excluded.

14.1.3 DELETE all words following the words "payment for" and ADD the following after "payment for":

"all work executed to date. Recovery by the Contractor of last anticipated profit and overhead and other consequential and incidental damages is hereby excluded."

ADD the following new Subparagraph 14.1.5:

14.1.5 "The Owner shall not be liable to the Contractor for the Owner's failure to perform its obligations set forth herein if such performance is prevented or interrupted by war (including the consequences thereof), fire, tornado, hurricane, windstorms, labor problems, fuel or transportation shortages, civil unrest, governmental action, or any other natural or economic disaster or cause which is reasonably beyond the control of the Owner ("Force Majeure"). If the estimated duration of the Force Majeure is one year or more, the Contractor shall have the option to terminate this Contract upon thirty (30) days' written notice. In the event that the estimated duration of the Force Majeure is less than one year, the Contract Time shall be increased by the same length of time as the Force Majeure persisted.".

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14.3 SUSPENSION BY THE OWNER FOR CONVENIENCE

14.3.1 DELETE this Subparagraph in its entirety.
14.3.2 DELETE this Subparagraph in its entirety.

14.4 TERMINATION BY THE OWNER FOR CONVENIENCE

14.4.3 DELETE the words ", and cost incurred by reason of such termination" and REPLACE with "reimbursable costs actually incurred."

DELETE the words "reasonable overhead and profit on" in the second line and REPLACE with "and an amount representing six percent (6%) of the amount of the work not executed".

END OF SECTION 00 7302

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SECTION 00 7316 – INSURANCE REQUIREMENTS

1.01 PROJECT MANUAL

All requirements of the Project Manual shall apply to this Section.

1.02 MINIMUM INSURANCE COVERAGES

A. Workmen's Compensation - statutory.

1. Employer's Liability - $100,000.

B. Comprehensive General Liability (including Premises - Operations, Independent Contractor's Protective, Products and Completed Operations, Broad Form Property Damage):

a. Bodily Injury:
$1,000,000 - one person aggregate per project endorsement. CG2503 to be included
$2,000,000 - annual aggregate.
b. Property Damage:
$1,000,000 - each occurrence.
$2,000,000 - annual aggregate.
c. Property Damage Liability Insurance shall include coverage for the following hazards: X (Explosion, C (Collapse), U (Underground).
d. Wavier of subrogation to be included
e. Additional insured form CG2010 to be included

C. Contractual Liability (Hold Harmless Coverage).

a. Bodily Injury:
$2,000,000 each occurrence
b. Property Damage:
$1,000,000 each occurrence
$2,000,000 aggregate
c. Personal Injury, with employment exclusion deleted:
$1,000,000.

D. Comprehensive Automobile Liability (Owned, Non-Owned, Hired):

a. Bodily Injury:
$1,000,000 each person.
$1,000,000 each accident
b. Property Damage:
$500,000 each occurrence.
c. Owner to be named as additional insured and provided a Waiver of Subrogation.

E. Catastrophic Umbrella Coverage, including products - complete operations:

$2,000,000

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F. Prime Contractors and all subcontractor's insurance shall be primary and non-contributory on all insurance.

END OF SECTION 00 7316

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SECTION 01 1100 - SUMMARY OF WORK – SINGLE CONTRACT

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. Section Includes:

1. Work covered by the Contract Documents.
2. Contractor's use of premises.
3. Coordination of work and trades.
4. Owner occupancy during construction.
5. Partial occupancy of completed work.
6. Temporary exiting.
7. Construction scheduling and phasing.

B. Project is being bid with construction work under one General Contract for all trades.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. Provide and pay for all materials, labor, services, equipment, licenses, permits, fees, taxes, and other items necessary for the execution, installation and completion of Work indicated in Contract Documents.

B. The Work includes coordination with Architect, Owner's Representative, Owner's separate contractors, material suppliers and vendors.

1.3 CONTRACTOR'S USE OF PREMISES

A. Contractor shall limit his use of premises for work and storage, to allow for Owner's occupancy as identified in this Section.

B. Assume full responsibility for protection and safekeeping of products stored on premises.

1. Move any stored products that interfere with operations of Owner or other Contractor.
2. Obtain and pay for use of additional storage or work areas needed for operations.
3. Available space for construction field offices and storage sheds is limited to the project site. Contractor must arrange for off site storage as required.

C. Contractor shall allow for any other work outside of this contract, whether by Owner's personnel or Contractors under Owner's separate contracts, to proceed without delay or impediment.

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1.4 COORDINATION

A. Schedule, manage and expedite all work under his Contract, coordinating his work with his sub-contractors, material suppliers, vendors, and trades so that no conflicts of timing or location occur.

1. Work shall progress according to approved progress schedule. Schedule dates for incorporation of work, and identify all critical path events and dates.
2. Coordinate and provide all floor, ceiling, roof, and wall sleeves.
3. Provide all cutting, fitting or patching required.

B. Keep Architect informed on the progress of the work.

1. Close or cover no work until duly inspected and approved.
2. Uncover un-inspected work and after approval, repair and/or replace all work at no cost to Owner.
3. Notify Architect at least 7 days in advance of utility connections, utility shut-offs, mechanical equipment and oil line cutovers, street or alley closings to allow ample time to receive Owner's written approval of procedure to be followed.
4. Coordinate all operations with the Architect and Owner. Complete in the minimum amount of time.

C. Protection:

1. Do not close or obstruct streets, entrance drives, sidewalks or other facilities without permission of the Owner and local authorities.
2. Conduct operations with minimum interference.
3. Furnish, erect and maintain barricades, warning lights, signs and guards as may be required.

1.5 CONSTRUCTION SCHEDULING AND PHASING

A. Owner intends to award the Contract and issue a Notice to Proceed within 60 days after bid opening.

B. Contractor shall mobilize on site and begin work immediately thereafter.

C. Contractor must achieve Final Completion within 30 calendar days of Substantial Completion.

END OF SECTION 01 1100

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SECTION 01 1400 - GENERAL CONSTRUCTION REQUIREMENTS

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. Section Includes:

1. Special Provisions.
2. Commencement Activity.
3. Quality Control.
4. Pre-final and Final/Occupancy Inspections
5. Project Closeout.

1.2 SPECIAL PROVISIONS

A. Project:

1. The Project is the total construction for which the Contractor is responsible, including all labor, materials and equipment used or incorporated in such construction.

B. Work:

1. The Work comprises the completed construction designed under the Project and includes labor necessary to produce such construction, and materials and equipment to be incorporated in such construction.

C. Contract Documents includes the following (See General Conditions 1.1.1 for definition):

1. Project Manual. (See General Conditions 1.1.7 for definition) The Project Manual is composed of the following:
   a. The Bidding Requirements.
   b. The Contract Forms.
   c. The Conditions of the Contract.
   d. The Specifications. (See General Conditions 1.1.6 for definition)
2. Drawings (See General Conditions 1.1.5 for definition)
3. Addenda (See Instructions to Bidders 1.3 for definition)
4. Other Documents as identified in the Contract for Construction, the General Conditions of the Contract for Construction, and Supplementary General Conditions

D. Permits and Fees:

1. The Contractor is responsible for verifying any and all fees required from all utilities, agencies and authorities having jurisdiction. The Contractor shall obtain and pay for the Building Permit and all other permits and governmental fees, licenses and inspections required, whether specifically referenced or not.

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2. The Contractor is to include in the bid the cost of all charges payable to State, local or special community development agencies and any additional fees as required for the completion of the project.

E. Historical and Archeological Finds: All items having any apparent historical or archeological interest discovered in the course of construction must be carefully preserved. The Contractor must leave the archeological find undisturbed and immediately report it to the Architect. Work on the project may be stopped until such find is analyzed, inspected and removed by the Governing Authority.

1.3 COMMENCEMENT ACTIVITY

A. Evidence that the Contractor has started procurement of materials, preparation and submission of shop drawings, preparation of subcontracts and other preparatory work must satisfy the requirement that work began upon receipt of Notice to Proceed.

1.4 QUALITY CONTROL

A. Testing:

1. Employ the services of an independent testing laboratory to take samples, perform tests and make inspections. The costs for such laboratory and tests shall be borne by the Contractor.
2. Submit testing reports as per Architect.
3. Refer to Section 01 4500-Quality Control for additional requirements.

1.5 PRE-FINAL AND FINAL/OCCUPANCY INSPECTIONS

A. The Contractor is to notify in writing, the Architect, that the work is complete for a Pre-Final Inspection (also referred to as “Final Punchlist Inspection”. The Contractor must provide the Architect at least 10 calendar days advance notice.

B. The Contractor is to diligently complete all punchlist items before a Final/Occupancy Inspection is scheduled.

1.6 PROJECT CLOSEOUT

A. Cleaning during construction:

1. The premises and the job site shall be maintained in a reasonable neat and orderly condition and kept free from accumulations of waste materials and rubbish during the entire construction period. Remove crates, cartons, and other flammable waste materials or trash from the work areas at the end of each working day. Do not allow debris to blow onto adjoining properties. Respond immediately to request from adjoining property owners to remove any debris that does manage to show up on adjoining properties.
2. Maintain the project in clean condition until the Owner accepts the building.
3. Refer to Section 01 7423 - Cleaning for additional requirements.

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B. Closeout Procedures:

1. Refer to Section 01 7700 - Closeout Procedures for additional requirements.

C. Closeout Submittals:

1. Before the project can be closed out, the Contractor shall have provided all submittals required by the Contract Documents. All submittals required by the Contract Drawings or Specifications shall be sent to the Architect for review and coordination, in accordance with the requirements of the respective Drawing or Specification section. Any items that the Architect determines are incomplete or incorrect shall be corrected and resubmitted.
2. Refer to Section 01 7800 - Closeout Submittals for additional requirements.
3. Refer to Section 01 7846 - Closeout Maintenance Materials for additional requirements.

D. Retainage:

1. The Architect will assign a monetary value to all punchlist items not completed, and to all required submittals not received, as of the date of "Final Acceptance" and an amount equal to 200 percent of the total value of those items shall be retained and/or deducted from the Contractor's final payment until the Contractor demonstrates to the Architect's satisfaction that such items have been completed or corrected. Refer to the General Conditions and Supplementary General Conditions for additional information regarding retainage.

END OF SECTION 01 1400

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SECTION 01 2116 - CONTINGENCY ALLOWANCE

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. Section Includes:

1. Contingency Allowance in Contract Sum.

1.2 CONTINGENCY ALLOWANCE

A. Allow a lump sum fee of *$ 50,000.00.*

B. To be included in the Base Bid of Contract.

C. Itemize Contingency Allowance on Application and Certificate for Payment and Schedule of Values.

D. Contingency Allowance to be used for unforeseen conditions encountered during the work.

E. Do not include any contractor's additional costs in bid.

F. Adjustments to contingency allowance will include labor, material, transportation, overhead and profit. All costs for these items to be included in all proposals to Architect for adjustments to contract.

G. Use Funds in Contingency Allowance only on written agreement between Owner, Architect and Contractor.

H. All Proposals shall be authorized by the Architect prior to execution and recorded in Contractor's as-builts and Architect's project Record Documents.

I. Adjustment to Allowances will be made by Change Order. Any unused amounts to be credited back to the Owner.

END OF SECTION 01 2116

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SECTION 01 2300 - ALTERNATES

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. Section Includes:

1. Procedures for exercising alternates.
2. Identification and description of alternates.

B. All items, either indicated on the Drawings or specified in the Project Manual, not specifically indicated to be included in a specific alternate is to be included within the base bid scope of work.

1.2 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Bidding Requirements: Quotation of cost for each alternate as listed on Proposal Form.

B. Owner-Contractor Agreement: Alternates accepted by Owner for incorporation into the work.

C. Sections of Specifications identified by work of each alternate.

1.3 PROCEDURES

A. Alternates will be exercised at the option of Owner.

B. Coordinate related work and modify surrounding work as required to complete the Work, including changes under each Alternate, when acceptance as designated in Owner-Contractor Agreement.

C. All Alternates shall be bid. Base Bid to be all work as shown on the Drawings and Specifications, except Alternates.

D. Owner reserves the right to accept or reject any and all Alternates as determined solely at the discretion of the Owner. Alternates may be accepted or rejected independently from one another, and in any order of priority or hierarchy as determined by the Owner.

1.4 SCHEDULE OF ALTERNATES

A. ALTERNATE NO. 1:

1. Give the amount to be ADDED to the Base Bid for the following:
   a. Remove roof of the existing building and reroof to match roofing of the new addition.

2. Base Bid to include:
   a. Tie into the existing roof with the roof of the new addition.

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B. ALTERNATE NO. 2

1. Give the amount to be ADDED to the Base Bid for the following:
   a. Extend wiring and relocate North light poles to North of the new parking area.
   b. Base bid to include demo of exterior North parking pole lights and add exterior wall packs on the North side of the addition to cover the drive and parking on the North side.

C. ALTERNATE NO. 3a

1. Give the amount to be ADDED to the Base Bid for the following:
   a. Add tile on wet wall of new restrooms Men 102 and Women 103 up to 7'-0" as indicated on sheet I101.
   b. Base bid to include epoxy finish as scheduled.

D. ALTERNATE NO. 3b

1. Give the amount to be ADDED to the Base Bid for the following:
   a. Add tile on all walls of new restrooms Men 102 and Women 103 up to 7'-0" as indicated on sheet I101.
   b. Base bid to include epoxy finish as scheduled.

E. ALTERNATE NO. 4

1. Give the amount to be ADDED to the Base Bid for the following:
   a. Removal of existing VCT floor and wall base in Swag Room 105 and replace with decorative epoxy flake floor and new base.
   b. Base bid to include existing VCT and base to remain.

END OF SECTION 01 2300

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SECTION 01 2973 - SCHEDULE OF VALUES

1.1 REQUIREMENTS INCLUDES

A. Section Includes:

1. General Requirements.
2. Format and Content.

1.2 GENERAL REQUIREMENTS

A. Submit to the Architect/Engineer a Schedule of Values allocated to the various portions of the Work.

B. Upon request of the Architect/Engineer, support the values with data which will substantiate their correctness.

C. The Schedule of Values, unless objected to by the Architect/Engineer, shall be used as the basis for the Contractor's Application and Certificate for Payment.

1.3 FORMAT AND CONTENT

A. Type schedule on AIA Document G703, Continuation Sheet for Application and Certificate for Payment. Identify schedule with:

1. Title of Project as listed on cover of Project Manual
2. Architect project number.
3. Name and Address of Contractor.
4. Contract Designation.
5. Date of submission.

B. Schedule shall list the installed value of the component parts of the Work in sufficient detail, as determined by the Architect, to serve as a basis for computing values for progress payments during construction.

1. Follow the table of contents of this Project manual as the format for listing component items.
2. Identify each line item with the number and title of the respective major section of the specifications.
3. Identify separate line items for all items for materials and labor.
4. Identify further breakdown for any and all items as determined by the Architect.

C. For Mechanical and Electrical Scope of Work, major products or operations are to be listed.

D. For the various portions of the work:

1. Each item shall include a directly proportional amount of the contractor overhead and profit.
2. For items on which progress payments will be requested for stored materials, break down the value into:
   a. The cost of the materials, delivered and unloaded, with taxes paid.
   b. The total installed value.

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E. The sum of all values listed in the schedule shall equal the total Contract Sum.

END OF SECTION 01 2973

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SECTION 01 3100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. Section Includes:

1. Administrative and supervisory personnel.
2. Submittals.
3. Contractor quality control.
4. Coordination Drawings.
5. Project coordination.

B. Procedures for preparation, updating and submittal of Construction Progress Documentation.

1.2 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

A. Project Coordination Administrator: Contractor Representative experienced in administration, supervision, and quality control of building expansion and alteration construction, similar to Work of this Project, including mechanical and electrical work.

B. Project Field Superintendent:

1. Contractor Representative experienced in general field supervision of building construction, similar to Work of this Project, including mechanical and electrical work, to supervise, direct, inspect and coordinate Work of Contractor, subcontractors, suppliers and installers, and expedite Work to assure compliance with Construction Schedules.
2. Superintendent must read, write, and speak English fluently.
3. Superintendent must be present at the Project site whenever work is being performed. Superintendent must remain on the Project from Notice to Proceed to Substantial Completion. Do not change personnel without written permission from the Owner.

1.3 SUBMITTALS

A. Submit list of Contractor's principal staff assignments, including Project Coordination Administrator, Project Field Superintendent, Quality Control Representative, and other personnel in attendance at site; identify their duties and responsibilities.

B. Submit all items for execution of Contract as listed in Section 00 4393 – Contractor’s Bid Submittal checklist.

C. Submit shop drawings, product data, and other required submittals, in accordance with Section 01 3300 - Submittal Procedures, for review and compliance with Contract Documents, for field dimensions and clearances, for relation to available space, and for relation to Work by Owner or separate Contracts.

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D. Submit Requests for Information and interpretation of Contract Documents in a timely manner and obtain replies from Architect in accordance with the Contract.

1.4 CONTRACTOR QUALITY CONTROL

A. Perform project quality control in accordance with requirements in the Contract.

B. Coordinate scheduling of inspection and testing required by individual specification Sections and in accordance with Section 01 4500 - Quality Control.

1.5 COORDINATION DRAWINGS

A. Prepare and distribute coordination drawings where close coordination is required for installation of Products and materials fabricated off-site by separate entities, and where limited space availability requires maximum utilization of space for efficient installation of different components. Show interrelationship of components shown on separate shop drawings. Indicate required installation sequences.

1.6 PROJECT COORDINATION

A. Coordinate construction activities and work of all trades under various Sections of these Specifications and Work of Contract to facilitate orderly installation of each part of Work. Coordinate construction operations included under different Sections of Specifications and Contract that are dependent upon each other for proper installation, connection, and operation.

B. Where installation of one part of Work is dependent on installation of other components, either before or after that part of Work, schedule construction activities in sequence required to obtain uninterrupted installation.

C. Obtain drawings, manufacturer's product data, instructions, and other data to provide a complete and proper installation.

1. Check field dimensions prior to installing products. Verify necessary clearances and means of access from equipment storage to final position.
2. Make data and information available to trades involved.

D. Ensure that utility requirements of operating equipment are compatible with building utilities. Coordinate Work of various specification Sections for installation and final connection of equipment.

1. Assure that mechanical, plumbing, and electrical rough-ins have been properly located.

E. Coordinate space requirements and installation of mechanical, plumbing, and electrical Work which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, conduits, and wiring, as closely as possible; make runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

F. Where availability of space is limited, coordinate installation of different components to ensure maximum accessibility for required maintenance, service, and repair.

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G. Provide for installation of items scheduled for future installation.

H. Where necessary, prepare memoranda for distribution to each party involved outlining special procedures required for coordination. Prepare memoranda for Architect and separate contractors where coordination of their work is required.

I. In finished areas, conceal pipes, ducts, conduits, and wiring in the construction. Coordinate locations of fixtures and outlets with finish elements.

J. Coordinate completion and clean up of Work of separate Sections in preparation for completion of work per the Contract.

K. After Owner occupancy of Project, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize to Owner.

END OF SECTION 01 3100

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SECTION 01 31 19 - PROJECT MEETINGS

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. Section Includes:

1. Contractor participation in pre-bid conference, pre-construction conferences, progress meetings, and pre-installation meetings.
2. Architect shall schedule and chair Project Meetings and prepare summary minutes for distribution by Contractor to all in attendance.

1.2 PRE-CONSTRUCTION CONFERENCES

A. Architect will administer pre-construction conference.

B. Attendance:

1. Architect.
2. Owner's Representative.
3. Contractor's Project Manager.
4. Contractor's Job Superintendent.

C. Agenda:

1. Execution of Owner-Contractor Agreement.
2. Exchange of preliminary submittals.
3. Submission of executed bonds and insurance certificates.
4. Distribution of Contract Documents.
5. Submission of Schedule of Values. (If not required before hand).
6. Designation of personnel representing the parties in Contract.
7. Procedures and processing of Requests for Information, field decisions, submittals, substitutions, Applications for Payment, proposal requests, Change Orders, and contract closeout procedures.
8. Scheduling.
9. Construction facilities and temporary controls.
10. Notice to Proceed.

D. Architect will record minutes and distribute copies to Contractor and Owner and those affected by decisions made. Contractor is responsible for distribution of copies to Subcontractors, Suppliers and Vendors.

E. Architect will administer mobilization conference at Project site for clarification of Contractor responsibilities in use of site and for review of administrative procedures.

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1.3 PROGRESS MEETINGS

A. Architect shall schedule and administer Project Meetings throughout progress of the Work not less frequently than every month. Additional Project Meetings shall be scheduled as appropriate to construction activity.

B. Attendance:

1. Architect.
2. Owner's Representative.
3. Contractor's Project Manager.
4. Contractor's Job Superintendent.
5. Major Subcontractors and Suppliers.
6. Contractor's Quality Control Representative.
7. Others as appropriate to agenda topics.

C. Agenda:

1. Review of and corrections to minutes of previous meetings.
2. Review of Work progress and/or payment progress.
3. Field observations, problems, and decisions.
4. Identification of problems which impede planned progress.
5. Review of submittals schedule and status of submittals.
6. Review of off-site fabrication and delivery schedules.
7. Maintenance of progress schedule.
8. Corrective measures to regain projected schedules.
9. Planned progress during succeeding work period.
10. Coordination of projected progress.
11. Maintenance of quality and work standards.
12. Effect of proposed changes on progress schedule and coordination.
13. Status of pending changes and substitutions.
14. Other business relating to Work.
15. Review of Construction Progress Documentation.

D. Architect will record minutes and distribute copies to Owner and Contractor. Contractor shall distribute copies to all others.

E. Contractor shall hold separate meetings with workers, sub-contractors and suppliers to coordinate means and methods of construction, and jobsite safety. Do not use Owner/Architect Progress Meetings for such purpose.

1.4 PRE-INSTALLATION MEETINGS

A. When required in individual specification sections or as determined necessary by Architect, convene a pre-installation meeting at work site prior to commencing work of the section.

B. Require attendance of parties directly affecting, or affected by, work of the specific section.

C. Notify Architect seven days in advance of meeting date.

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D. Prepare agenda and preside at meeting:

1. Review conditions of installation, preparation and installation procedures.
2. Review coordination with related work.
3. Agenda items listed in individual specification Sections.
4. Installation schedule.

E. Architect will record minutes and distribute copies to participants, and those affected by decisions made.

END OF SECTION 01 31 19

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SECTION 01 3200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. Section Includes:

1. Construction Progress Schedule.
2. Contractor as-built drawings.
3. Provisions for format, content, revisions, submittals and distribution.

1.2 CONSTRUCTION PROGRESS SCHEDULE

A. Format:

1. Prepare Schedules as horizontal bar chart with separate bar for each major portion of Work or operation, identifying first work day of each week.
2. Sequence of Listings: The Table of Contents of this Project Manual.
3. Form: Contractor's option.

B. Content:

1. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.
2. Identify each item by major Specification section number.
3. Provide sub-schedules to define critical portions of entire Schedule.
4. Show accumulated percentage of completion of each item, and total percentage of Work completed, to correspond with Application for Payment. Percentage of completion shall not include stored materials.
5. Provide separate schedule of submittal dates for shop drawings, product data, and samples and dates reviewed submittals will be required from Architect. Show dates for selection of finishes.
6. Show delivery dates for Owner furnished items, if any.
7. Coordinate content with Section 01 2973 - Schedule of Values.

C. Revisions:

1. Indicate progress of each activity to date of submittal, and projected completion date of each activity.
2. Identify activities modified since previous submittal, major changes in scope and other identifiable changes.
3. Provide narrative report to define problem areas, anticipated delays and impact on Schedule. Report corrective action taken or proposed and its effect.

D. Submittals:

1. Submit initial Schedules immediately following Award of Contract. After review, revise data and immediately submit for re-review.

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2. Submit up-dated Progress Schedules with each Application and Certificate for Payment.
3. An updated Progress Schedule is required for review/consideration for Application and Certificate for Payment.
4. Submit under transmittal letter.

E. Distribution:

1. Distribute copies of reviewed schedules to Architect job site file, subcontractors, suppliers and other concerned entities including separate contractors.
2. Instruct recipients to promptly report, in writing, problems anticipated by projections shown in Schedules.

1.3 CONTRACTOR AS-BUILT DRAWINGS

A. Format:

1. Contractor's job superintendent to record as-built conditions onto a single set of project drawings for all trades included in scope of work.
2. As-built set to be kept on site at all times.
3. Documentation may be hand written in ink or pasted directly onto drawings. All information must be considered to be permanently affixed.

B. Content:

1. Include work of all trades included in scope of work.
2. Include all changes, errors, deviations, omissions, additions, clarifications and corrections.
3. Include any item installed in a location other than that shown on contract drawings.
4. Correct any inaccurate or altered dimension.

C. Revisions:

1. As-built drawings shall be updated daily with all work completed.
2. Contractor job superintendent to be responsible for subcontractor information on as-built drawings.

D. Submittals:

1. As-built drawings may be reviewed at progress meetings or periodically as requested by Architect to review entries to date.

E. Distribution:

1. As built drawings shall be given to Architect prior to release of final payment.
2. Refer to Section 01 7800 - Closeout Submittals.

END OF SECTION 01 3200

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SECTION 01 3300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. Section Includes:

1. Submittal Schedule.
2. Submittal Requirements.
3. Shop Drawings.
4. Electronic files provided by the Architect.
5. Product Data.
6. Samples.
7. Manufacturer's Information.
8. Review by Contractor and Architect.
9. Re-submittals.
10. Distribution.

1.2 SUBMITTAL SCHEDULE

A. Submit to the Architect a schedule listing all submittals required for review as required in the individual specifications sections.

B. List submittals by specification section as listed in the index.

1.3 SUBMITTAL REQUIREMENTS

A. Formats:

1. Submit all drawings and technical data electronically in PDF format.
   a. Furnish all submittals specified in all sections of the specifications.
   b. Submit each section under a separate transmittal for clarity and ease of review.
   c. Make a complete submittal for each section; do not issue multiple submittals per section.
   d. Compile all sheets, drawings, and product data into a single electronic file for review. Do not submit multiple PDF files per sheet or item.
   e. Identify manufacturer and subcontractor/supplier.
   f. Submit Material and Safety Data Sheets for all products and materials.
   g. Name each PDF file to match specifications title and number, matching that as listed in the project manual.
2. Submit to Architect via Architect's project management website specific to this project.
3. Contractor will provide Architect/Consultant licenses and/or access to software used by contractor for construction management and submittals.
4. Submit actual samples for finishes, colors, and textures for approval via mail or hand delivery.

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B. Transmit submittals in accordance with approved Progress Schedule and in such sequence to avoid delay in the Work or work of other contracts.

C. Apply Contractor's stamp, signed or initialed, certifying to review, verification of products, field dimensions and field construction criteria and coordination of information with requirements of Work and Contract Documents.

D. Coordinate submittals into logical groupings to facilitate interrelation of the several items:

1. Finishes which involve Architect selections of colors, textures, or patterns.
2. Associated items which require correlation for efficient function or for installation.

1.4 SHOP DRAWINGS

A. Present in a clear thorough manner, drawn by professional draftsman.

B. Identify project with title as shown on cover of Project Manual; identify each element of drawings by reference to sheet number and detail, schedule, or room number on Contract Documents.

C. Identify field dimensions; show relation to adjacent or critical features of Work or products.

D. Sheet Size:

1. Minimum: 8-1/2 x 11 inches.
2. Maximum: 30 x 42 inches.

1.5 ELECTRONIC FILES PROVIDED BY THE ARCHITECT

A. Architect may make available, at no cost, base xref drawings in AutoCAD format for contractor's use in preparing shop drawings.

B. AutoCAD version of electronic files will be the latest version being utilized in the Architect's office. The Architect has no obligation to provide electronic files in a format that may be an old, outdated, reduced or simplified version of that being utilized in the Architect's office.

C. Electronic files are an instrument of the Architect's service, and are the property of the Architect.

D. The use of the information contained in the electronic files is at the sole risk of the user.

E. The use of the electronic files does not relinquish the contractor from responsibilities for site and field verification of spaces, construction, conditions, requirements, dimensions, etc.

1.6 PRODUCT DATA

A. Submit only pages which are pertinent; mark each copy of standard printed data to identify pertinent products, referenced to Specification Section and Article number. Show reference standards, performance

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characteristics, and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions; and required clearances.

B. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the Work. Delete information not applicable.

C. Provide manufacturer's published catalog pages and industry cutsheets, with all items and options marked as appropriate to the project.

1.7 SAMPLES

A. When finishes are specified on the Drawings, submit samples of the specified finish for approval.

B. When finishes are not specified on the Drawings, submit full range of manufacturer's standard finishes, except when more restrictive requirements or price groups are specified, indicating colors, textures, and patterns, for Architect's selection.

C. Submit samples to illustrate functional characteristics of products, including parts and attachments.

D. Label each sample with identification required for transmittal letter.

E. Submit number of samples specified in individual specifications sections but not less than three (3).

F. Special circumstances may require additional samples for determination of acceptance, such as textures, patterns, colorways, etc. Provide sample in the quantity and/or size as required for this determination. Requirements to be determined solely by the Architect. All such samples will be returned to the Contractor, less those retained for Owner and Architect files.

G. Samples for selection of finishes need to be submitted as actual samples of the actual colors, materials and textures for proper selection and review of available choices. Samples for finishes already selected as indicated in the Drawings may be color charts in lieu of actual samples, if acceptable to the Architect.

H. All samples may be retained for Owner and Architect files.

I. See individual Specification sections for additional information and requirements.

1.8 MANUFACTURER'S INFORMATION

A. Manufacturer's instructions for storage, protection, preparation, assembly, installation, adjusting, balancing and finishing.

B. Installation details, anchoring requirements or other information specifically required by manufacturer.

C. Specific information or details required by Manufacturer to uphold warranty of product specified.

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1.9 CONTRACTOR'S REVIEW

A. Review submittals prior to transmittal; verify subcontractor's field measurements, field construction criteria, manufacturer's catalog numbers, and conformance of submittal with requirements of Contract Documents.

B. Coordinate submittals with requirements of Work and of Contract Documents.

C. Affix a stamp and sign each drawing, manufacturer's data, sample, etc. as follows:

This submittal has been reviewed by (*Name of Contractor*) and approved with respect to the means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incidental thereto. (*Name of Contractor*) also warrants that this submittal complies with contract documents and comprises no variations or increase in contract price thereto.

By:-

_____

Date:_____

D. Notify Architect in writing at time of submittal, of any deviations from requirements of Contract Documents. Architect will neither accept incomplete submittals, nor those which in the Architect's opinion, have not been properly reviewed by the Contractor.

E. Do not fabricate products or begin work which requires submittals until return of submittal with Architect acceptance.

F. Submittals which have not been thoroughly reviewed by Contractor prior to being forwarded to Architect will be rejected and returned for review.

1.10 ARCHITECT'S REVIEW

A. Architect will review shop drawings, product data, and samples and return submittals within a reasonable time frame for complete review and approval.

B. Architect's review is for conformance with information given and design concept expressed in the Contract Documents. The 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.

C. Review of shop drawings does not authorize changes to the contract sum unless stated in a separate letter or change order.

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1.11 RE-SUBMITTALS

A. Make re-submittals under procedures specified for initial submittals; identify changes made since previous submittals.

1.12 DISTRIBUTION

A. Duplicate and distribute reproductions of shop drawings, copies of product data, and samples, which bear Architect's stamp of approval, to job site file, Contractor's Record Documents file, sub-contractors, suppliers and other entities requiring information.

END OF SECTION 01 3300

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SECTION 01 4500 - QUALITY CONTROL

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. Section Includes:

1. General Requirements.
2. Qualifications.
3. Laboratory Requirements.
4. Building Survey.
5. Quality Control Procedures.
6. Testing and Inspection Laboratory Services.
7. Contractor Field Inspection and Testing.
8. Contractor’s Daily Report.
9. Contractor’s Test and Inspection Reports.
10. Non-Compliance Check-Off List.
11. Completion and Inspection of Work.

1.2 GENERAL REQUIREMENTS

A. Survey:

1. Engage licensed surveyor, without extra cost to the Owner.
2. Assure correct position of building on site, establish correct levels, lines and grades, verify column centers, walls, trenches, establish grades and bench marks at all grading and drainage improvements, and otherwise fully and completely layout work required by this Contract.

B. Inspection, Sampling, and Testing is required for:

1. Soils Compaction Control
2. Cast-In-Place Concrete
3. Anchor Bolt Torque
4. Mechanical testing
5. Electrical testing

C. Employment of Testing Laboratory or Inspector shall in no way relieve Contractor of his obligation to perform Work in accordance with Contract and Contract Documents.

1.3 QUALIFICATIONS

A. Testing laboratory's qualifications:

1. Testing laboratory should be pre-qualified prior to bidding.
2. Testing laboratory must have a registered professional engineer as full time staff.

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3. Testing laboratories wishing to be included on the pre-qualified list herein shall submit qualifications in writing to the Architect no later than ten (10) days prior to the bid.

B. Pre-qualified testing laboratories:

1. ECS Southeast, LLP
   1762 Watterson Trail; Louisville, KY 40299
   502-493-7100; 502-493-8190 fax

2. Hagerty Engineering, Inc.
   335 Spring Street B; Jeffersonville, IN 47130
   502-553-3211

3. Asher Engineering, Inc.
   1021 South Floyd Street; Louisville, KY 40203
   502-589-0073; 502-589-0076 fax

4. ATC Group Services / Cardno ATC
   11001 Bluegrass Parkway, Suite 250; Louisville, KY 40299
   502-710-0264; 502-267-4072 fax

1.4 LABORATORY REQUIREMENTS

A. Meet basic requirements of ASTM E 329 for inspection and testing agencies for concrete and steel as used in construction.

B. Perform specified inspections, sampling and testing of materials and methods of construction:

1. Comply with specified standards; ASTM, other recognized authorities, and as specified.
2. Ascertain compliance with requirements of Contract Documents.

C. Promptly notify Architect/Engineer and Contractor of irregularities or deficiencies of Work which are observed during performance of services.

D. Promptly submit two (2) copies of all reports, inspections and tests to Architect, to include the following:

1. Date, project title and number.
2. Testing Laboratory name and address.
3. Name and signature of inspector.
4. Dates of inspection, sampling, and test.
5. Record of temperature and weather.
6. Identification of product and specification section.
7. Location in project.
8. Type of inspection or test.
9. Observations regarding compliance with Contract Documents.

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1.5 BUILDING SURVEY

A. Horizontal Control Survey:

1. After earthwork is completed and before any foundation excavation commences, Contractor shall run and maintain a closed, offset traverse outside the building perimeter a suitable distance with 2" x 2" hub stakes driven flush and bearing a Surveyor's tack at all intervening building grids.
   a. Each hub shall be flagged, protected, and identified by a clearly visible guard stake.
   b. Appropriate temperature, and sag corrections must be applied if traverse is measured by Surveyor's chain.

2. If transit visibility between opposing hubs straddling the building is impossible, additional lines of hubs tacked, flagged, protected, and identified as above) shall be installed along lines through the building and tied into the perimeter traverse.
3. The completed traverse (if not run by) shall be checked, drawn up and certified by a Licensed Surveyor employed by the Contractor and approved by the Architect.
   a. An experience record and professional references shall be submitted along with a request for the approval of any Surveyor.
   b. One copy of the certified drawing shall be posted in the Contractor's field office for reference.
   c. Additional copies of the drawing shall be posted in the Contractor's field office for reference.
   d. Until such time as all foundation; reinforced concrete piers and columns; and steel column anchor bolts are in place, all stakes will be maintained.
   e. The services of the approved Surveyor shall be secured by the Contractor to re-establish all hubs damaged or lost for any reason.

4. All foundations; concrete column dowels and forms; and steel column anchor bolts shall be located by transits set up only over traverse hub stakes.
   a. Anchor bolts shall be secured in final position by fixing into wood templates, or other approved methods before any concrete is cast.
   b. The Architect reserves the right to reject the equipment or the personnel.

B. Vertical Control:

1. After earthwork is completed, the Contractor shall establish building bench marks of 2" Ø i.d. Galvanized Pipe driven a minimum of 4'-0" into ground and having tops level with finished ground floor.
   a. Sufficient bench marks shall be installed for each ground floor level so that no level shot will exceed 200 feet.
   b. Level circuits will begin at and close to bench marks referenced on the site plans.

2. The approved Licensed Surveyor shall include in his certification that he has checked (or set) all herein required bench marks.

1.6 QUALITY CONTROL PROCEDURES

A. Monitor quality control over Contractor staff, subcontractors, suppliers, manufacturer's, products, services, site conditions, and workmanship.

B. Comply fully with manufacturer's published instructions, including each step in sequence of installation.

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C. Should manufacturer's published instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Comply with specified standards as a minimum quality for Work, except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Perform Work by persons who are thoroughly qualified and trained in their respective trade, to produce workmanship of specified quality.

F. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

G. Perform tests required by governing authorities having jurisdiction and utilities having jurisdiction.

1.7 TESTING AND INSPECTION LABORATORY SERVICES

A. Selection and Payment:

1. Employment and payment for services of an Independent Testing and Inspection Laboratory to perform specified testing and inspection, by Contractor.
2. Employment of Independent Testing and Inspection Laboratory in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents

B. Quality Assurance:

1. Comply with requirements of ASTM C 802, ASTM C 1077, ASTM C 1093, ASTM D 290, ASTM D 3740, ASTM D 4561, ASTM E 329, ASTM E 543, ASTM E 548, and ASTM E 699.
2. Laboratory: Authorized to operate in State in which Project is located.
3. Laboratory Staff: Maintain a full time registered engineer on staff to review services.
4. Testing Equipment: Calibrated at reasonable intervals with devices of and accuracy traceable to either National Bureau of Standards or accepted values of natural physical constraints.

C. Laboratory Responsibilities:

1. Contractor should ensure the Laboratory has the following responsibilities and limits on authority (See D).
2. Test samples of mixes submitted by Contractor.
3. Provide qualified personnel at Project site. Cooperate with Architect and Contractor in performance of services.
4. Perform specified sampling, testing, and inspection of Products in accordance with specified standards.
5. Determine compliance of materials and mixes with requirements of Contract Documents.
6. Promptly notify Contractor Quality Control Representative and Architect of observed irregularities or non-conformance of Work or Products.
7. Perform additional tests as required by Architect.
8. Attend appropriate preconstruction meetings and progress meetings.

D. Limits on Authority:

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1. Laboratory may not release, revoke, alter, or expand on requirements of Contract Documents.
2. Laboratory may not approve or accept any portion of Work.
3. Laboratory may not assume any duties of Contractors.
4. Laboratory has no authority to stop Work.

1.8 CONTRACTOR FIELD INSPECTION AND TESTING

A. Contractor: Test and Inspect Work provided under this Contract to ensure Work is in compliance with Contract requirements. Required tests and inspections are indicated in each individual Specification Section.

B. Preparatory Inspection: Performed prior to beginning Work and prior to beginning each segment of Work and includes:

1. Review of Contract requirements.
2. Review of shop drawings and other submittal data after return and approval.
3. Examination to assure materials and equipment conform to Contract requirements.
4. Examination to assure required preliminary or preparatory Work is complete.

C. Initial Inspection: Performed when representative portion of each segment of Work is completed and includes:

1. Performance of required tests.
2. Quality of workmanship.
3. Review for omissions or dimensional errors.
4. Examination of products used, connections and supports.
5. Approval or rejection of inspected segment of Work.

D. Follow-Up Inspections: Performed daily, and more frequently as necessary, to assure non-complying Work has been corrected.

E. Testing and Inspection: Perform testing and inspection in accordance with requirements in individual Sections.

1.9 CONTRACTOR'S DAILY REPORT

A. Submit daily report to Architect, for days that work was performed. Include the following information:

1. Contractor name and address.
2. Job reference and information.
3. Date, weather, minimum and maximum temperatures, rainfall, and other pertinent weather occurrences.
4. Daily workforce of Contractor and subcontractors, by trades.
5. Description of work started, ongoing work, and work completed by each subcontractor.
6. Coordination implemented between various trades.
7. Approval of substrates received from various trades.
8. Nonconforming and unsatisfactory items to be corrected.
9. Remarks.

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10. Reports may be faxes to Architect no more than one week's worth of reports at one time. Submit daily if requested by Architect.

1.10 CONTRACTOR'S TEST AND INSPECTION REPORTS

A. Prepare and submit, to Architect, a written report of each test or inspection signed by Contractor Quality Control Representative performing inspection within two (2) days following day inspection was made.

B. Include the following on written reports of inspection:

1. Cover sheet prominently identifying that inspection "CONFORMS" or "DOES NOT CONFORM" to Contract Documents.
2. Date of inspection and date of report.
3. Project name, location, solicitation number, and Contractor.
4. Names and titles of individuals making inspection, if not Contractor's Project Field Superintendent.
5. Description of Contract requirements for inspection by referencing Specification Section.
6. Description of inspection made, interpretation of inspection results, and notification of significant conditions at time of inspection.
7. Requirements for follow-up inspections.

1.11 NON-COMPLIANCE CHECK-OFF LIST

A. Maintain check-off list of Work that does not comply with Contract Documents, stating specifically what non-complying, date faulty Work was originally discovered, and date Work was corrected. No requirement to report deficiencies corrected same day it was discovered. Submit copy of Non-Compliance Check-Off List of non-complying work items to Architect on a weekly basis.

1.12 COMPLETION AND INSPECTION OF WORK

A. Prior to final acceptance by Architect, submit a certification signed by Contractor to Architect stating that all Work has been inspected and all Work, except as specifically noted, is complete and in compliance with Contract Documents.

B. Record Documents:

1. By Contractor Quality Control Representative. Ensure that "As-Builts" required are marked to show any deviations which have been made during the course of construction and are kept current on a daily basis. Upon completion of the Work, certify the accuracy of the "As-Builts" and submit to Architect.
2. Refer to Section 01 3200 - Construction Progress Documentation.
3. Refer to Section 01 7800 - Closeout Submittals.

END OF SECTION 01 4500

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SECTION 01 6500 - PRODUCT DELIVERY AND HANDLING

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. Section Includes:

1. Material shipments and project delivery to job site.
2. Handling of materials and products included in project.
3. Phasing of the work.

1.2 DELIVERY

A. Delivery materials, supplies or equipment to Project site during working hours.

B. Deliveries made during other than normal working hours must be received by an authorized agent of the Contractor.

C. No employee of the Owner is authorized to receive any shipment designated for this project.

D. The Owner assumes no responsibility for receiving any shipments designated for this project.

E. Under no circumstances may shipments be directed to, or in care of, the Owner.

1.3 HANDLING

A. All materials furnished under this Contract shall be identified, shipped, addressed, consigned, etc., to the Contractor who may be charged therewith by giving the name of the Contractor, the name of the project, the street and the city.

1.4 PHASING OF THE WORK

A. Work may be phased, limiting installation of materials to separate areas of site or times of construction.

B. Any and all coordination of materials on site related to phasing of the work shall be accomplished by the Contractor at no additional costs to the Owner.

C. All materials, equipment, and associated items and components for the scope of work are to be delivered to the site only as and when needed for installation. Time allowed on site prior to installation shall be a reasonable timeframe as deemed acceptable by the Architect.

D. All items on site shall be stored off the ground and protected by watertight encapsulating cover in preparation for immediate installation.

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E. Any and all items on site in a timeframe deemed unacceptable by the Architect for any reason, or deemed to be damaged by improper handling or storage, are to be removed from the site and returned to the manufacturer, without cost to the Owner. Products shall be replaced entirely with new materials at the time needed and deemed acceptable for installation.

END OF SECTION 01 6500

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SECTION 01 7329 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. Section Includes:

1. Make several parts fit properly.
2. Uncover work to provide for installation of ill-timed work.
3. Remove and replace defective work.
4. Remove and replace work not conforming with requirements of Contract Documents.
5. Remove samples of installed work as specified for testing.
6. Remove existing construction necessary to install new materials, equipment, mechanical or electrical items.

PART 2 - PRODUCTS

2.1 MATERIALS

A. For replacement of work removed: Comply with Specifications.

PART 3 - EXECUTION

3.1 PREPARATION

A. General:

1. Do not endanger any other work by cutting or altering work or any part of it.
2. Do not cut or alter work of another contractor without the written consent of Architect.
3. Patching and refinishing shall be executed by the trade experienced in such finishing work.

B. Prior to cutting:

1. Provide shoring, bracing and support as required to maintain structural integrity of project.
2. Provide protection for other portions of project.
3. Provide protection from elements.
4. Advise Architect designating time work will be uncovered to provide for observation.

3.2 PERFORMANCE

A. Execute cutting and demolition by methods which will prevent damage to other work and will provide proper surfaces to receive installation of repairs and new work.

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B. Execute excavating and backfilling by methods which will prevent damage to other work and will prevent settlement.

C. Execute fitting and adjustment of products to provide a finished installation to comply with specified tolerances, finishes.

D. Cut existing concrete openings for piping, floor drains, etc., by core drilling.

E. Cut existing walls, floors, ceilings, roofs, etc. necessary for the proper installation of new materials, equipment, mechanical or electrical items. Provide all necessary framing, lintels, hangers, etc. to maintain the structural integrity of the building system after cutting.

F. Employ original installer to perform cutting and patching for exposed finished surfaces.

G. Restore work which has been cut or removed; install new products to provide completed work in accord with requirements of Contract Documents.

H. Contractor is responsible for cost to restore or patch adjacent surfaces to original condition.

I. Fit work airtight to pipes, sleeves, ducts, conduits and other penetrations.

J. Refinish entire surface as necessary to provide an even finish.

1. Continuous surfaces: To nearest intersections.
2. Assembly: Entire refinishing.

END OF SECTION 01 7329

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SECTION 01 7423 - CLEANING

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. Section Includes:

1. Description of general cleaning requirements.
2. Regulatory agency requirements.
3. Cleaning during construction.
4. Final Cleaning.

1.2 DESCRIPTION

A. The General Contractor is responsible for all cleaning unless specifically noted otherwise.

B. Maintain premises and public properties free from accumulations of waste, debris, and rubbish, caused by operations.

C. Remove temporary piping and wiring: by respective contractors.

D. At completion of work, remove waste materials, rubbish, tools, equipment, machinery and surplus materials, and clean all sight-exposed surface; leave project clean and ready for occupancy.

1.3 REGULATORY AGENCY REQUIREMENTS

A. Maintain project in accord with Occupational Safety & Health Act of 1970 as amended, in terms of clean up.

B. Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.

1. Do not burn or bury rubbish and waste materials on project site.
2. Do not dispose of volatile wastes such as mineral spirits, oil or paint thinner in storm or sanitary drains, or bury below ground.

PART 2 - PRODUCTS

2.1 MATERIAL

A. Use only cleaning materials recommended by manufacturer of surface to be cleaned.

B. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

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PART 3 - EXECUTION

3.1 CLEANING DURING CONSTRUCTION

A. Execute cleaning to ensure that building, grounds and public properties are maintained free from accumulations of waste material and rubbish on a daily basis by all trades.

B. Wet down dry materials and rubbish to lay dust and prevent blowing dust.

C. At reasonable intervals during progress of Work, clean site and public properties, and dispose of waste materials, debris and rubbish.

D. Provide on-site containers for collection of waste materials, debris and rubbish.

E. Remove waste materials, debris and rubbish from site and legally dispose of at public or private dumping areas off Owner's property.

F. Handle materials in a controlled manner with as few handlings as possible; do not drop or throw materials from heights.

G. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly painted surfaces.

H. Ensure that no construction materials or items are accessible to public on site or grounds.

3.2 FINAL CLEANING

A. Employ experienced workman or professional cleaners for final cleaning.

B. In preparation for substantial completion or occupancy, conduct final inspection of sight-exposed interior and exterior surfaces, and of concealed spaces.

C. Remove grease, dust, dirt, stains, labels, fingerprints and other foreign materials from sight-exposed interior and exterior finished surfaces; polish surfaces so designated to shine finish.

D. Wash and clean all glass, removing labels.

E. Clean and polish fixtures, equipment and materials.

F. Repair, patch and touch-up marred surfaces to specified finish, to match adjacent surfaces.

G. Vacuum all carpeted areas; wax and polish all tile and resilient flooring areas.

H. Remove all foreign materials from roof and site area.

I. Broom clean paved surfaces; rake clean other surfaces of grounds.

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J. Each Prime Contractor shall be responsible for cleaning all equipment installed by the respective contractors.

K. Mechanical and Electrical Work:

1. Respective contractors shall perform cleaning of their equipment.
2. Mechanical contractor shall clean all strainers in his respective piping work.
3. Replace throw-away type air conditioning filters or media if units were operated during construction, or clean ducts, blowers and coils if air conditioning units were operated without filters.
4. This does not include replacing filters used for performance testing and balancing.
5. Replace burned out or inoperative pilot and lighting lamps; by contractor furnishing respective equipment or fixture.
6. Replace all bulbs in fixtures used for temporary lighting during construction.

L. Conduct final cleaning and preparation of surfaces and materials as per manufacturer's recommendation and in strict accordance with manufacturer's guidelines.

M. All materials and finishes shall be stripped, waxed, polished, buffed, etc., upon Substantial Completion for their use by Owner.

N. Owner will assume responsibility for cleaning as time designated on Certificate of Substantial Completion, Conditional Acceptance or partial occupancy, whichever is first, for Owner’s acceptance of Project or portion thereof.

END OF SECTION 01 7423

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SECTION 01 7700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. Section Includes:

1. Administrative procedures in closing out the work.
2. Procedures for Substantial Completion.
3. Procedures for Final Inspection.
4. Required contractor guarantees.
5. Evidence of payments and release of liens.
6. Final adjustment of accounts.
7. Final Application and Certificate for Payment.
8. Post construction inspection.
9. Closeout submittals required are specified in Section 01 7800.
10. Closeout maintenance materials required are specified in Section 01 7846.

1.2 SUBSTANTIAL COMPLETION

A. Submit written certification to Architect that project or designated portion of project is substantially complete and ready for use by Owner.

B. Architect will make an inspection within a reasonable time after receipt of such notice. The Contractor is responsible for the final punchlist inspection in accordance with the General Conditions. No inspection by the Architect will be made until the Contractor submits written certification that the punchlist has been issued and complete. The Architect's Substantial Completion inspection is not for the purpose of preparing a "to-do" list for the Contractor to use in finishing the work. If it becomes apparent at the time of the Substantial Completion inspection that items affecting life safety, accessibility, security, or full intended use of space are not complete, the inspection will be terminated and the Contractor will be liable for the costs of re-inspection.

C. Should Architect consider that work is not substantially complete:

1. Architect shall immediately notify Contractor, in writing, stating reasons.
2. Contractor to remedy deficiencies and send second written notice of substantial completion to Architect.
3. Architect will re-inspect Work.
4. Contractor to pay costs of Architect's re-inspection.

D. When Architect/Engineer considers that work is substantially complete; Architect will prepare and issue a Certificate of Substantial Completion, AIA Document G704, complete with signatures of Owner and Contractor, accompanied by Contractor's list of items to be completed or corrected ("Punchlist") as verified and amended by the Architect. Retainage amounts will be adjusted per General Conditions and Supplementary General Conditions.

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1.3 FINAL INSPECTION

A. Contractor shall submit written certification that:

1. Contract Documents have been reviewed.
2. Work has been completed and inspected in accordance with Contract Documents.
3. Equipment and systems have been tested in presence of Owner's representative and are operational.
4. Work is completed, and ready for final inspection.
5. If any items from the Certificate of Substantial Completion Inspection are not completed, the final inspection will be terminated and the Contractor will be liable for the costs of re-inspection.

B. Architect will make final inspection after receipt of certification.

C. Should Architect consider that work is incomplete or defective:

1. He shall promptly notify Contractor, in writing, stating reasons.
2. Contractor shall take immediate steps to remedy the stated deficiencies, and send second written notice to Architect/Engineer certifying that Work is complete.
3. Architect will re-inspect Work.
4. Contractor to pay costs of Architect's re-inspection.
5. Final payment will not be released.

D. When Architect finds that work is acceptable in accordance with Contract Documents, he shall request contractor to prepare Project Closeout Submittals in accordance with Section 01 7800.

1.4 GUARANTEES

A. Contractor agrees to make good all damage to the construction of building or site or equipment which in the opinion of the Architect is a result of or incidental to the use of materials, equipment or workmanship which are inferior, defective or not in accordance with the specifications.

B. In case repairs become necessary, the Owner will give written notice to the Contractor to make same and in case of failure of the Contractor to commence such repairs within 30 days after such notice, the Owner may make the repairs either by its own employees or by independent contract and may thereupon recover from the Contractor and his Sureties the cost of the repairs so made together with the cost of supervision and inspection thereof. The Owner will have sixty (60) days after the expiration of said guarantee period in which to notify the Contractor of any such repairs necessary on the date of such expiration. The determination of the necessity for repairs shall rest entirely with the Architect whose decision upon the matter shall be final and obligatory upon the Contractor.

C. The Guarantees herein stipulated shall extend to the whole body of the improvement and all its appurtenances.

1.5 EVIDENCE OF PAYMENTS AND RELEASE OF LIENS

A. Contractor to execute and submit:

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1. Contractor's Affidavit of Payment of Debts and Claims (AIA Document G706).
2. Contractor's Affidavit of Release of Liens (AIA Document G706A)
3. Consent of Surety to Final Payment (AIA Document G707).

B. All submittals shall be duly executed before delivery to Architect.

1.6 FINAL ADJUSTMENT OF ACCOUNTS

A. Submit final statement of account to Architect.

B. Statement shall reflect all adjustments:

1. Original Contract Sum.
2. Additions and deductions resulting from:
   a. Change Orders.
   b. Cash Allowances
   c. Contingency Allowance.
   d. Unit Prices
   e. Deductions for uncorrected work.
   f. Penalties and Bonuses.
3. Total Contract Sum, as adjusted.
4. Previous payments.
5. Sum remaining due.

C. Architect will prepare final Change Order reflecting approved adjustments to Contract Sum not previously made by Change Orders or Allowance Adjustments.

1.7 FINAL APPLICATION AND CERTIFICATE FOR PAYMENT:

A. Contractor shall submit final application in accordance with procedures and requirements of General and Supplementary Conditions prior to submission of Final Application and Certificate for Payment.

B. Architect will review Final Application and issue Final Certificate in accordance with provisions of General Conditions.

C. Should final completion be materially delayed through no fault of Contractor, Architect may issue a Semi-Final Certificate for Payment in accordance with provisions of General Conditions.

1.8 POST CONSTRUCTION INSPECTION

A. Prior to expiration of one year from date of Substantial Completion, Architect may make visual inspection of Project in company with Owner and Contractor to determine whether correction of Work is required in accordance with provisions of General Conditions.

B. For Guarantee beyond one year Architect may make inspections at request of Owner after notification to Contractor.

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C. Architect will promptly notify Contractor, in writing, of any observed deficiencies.

D. Any/all corrections to work at that time to be at Contractor's expense.

END OF SECTION 01 7700

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SECTION 01 7800 - CLOSEOUT SUBMITTALS

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. Section Includes:

1. Operation and Maintenance Manuals.
2. Product Warranties.
3. Project Record Documents (As-Built Drawings).
4. Spare-Parts.
5. Certificates of Inspection.
6. Food Service Equipment Maintenance Manuals.
7. Keys and Keying Schedule.
8. Instruction of Owner's Personnel.
9. Certificate of Occupancy.
10. Certification of Asbestos and Lead-Based Paint.
11. Closeout maintenance materials required.

B. Unless specifically permitted by the Architect, the Contractor is to provide all items listed herein to the Owner via the Architect prior to the date of Substantial Completion.

1.2 OPERATION AND MAINTENANCE MANUALS

A. Submission Requirements:

1. Furnish Owner with all manual information electronically on CD in PDF format.
2. Furnish Owner with two (2) sets of bound hard copy manuals.
3. Submit to Architect for review of information and forwarding to Owner for Owner’s records.

B. Preparation:

1. Prepare data by personnel experienced in maintenance and operation of described products.
2. Obtain information directly from manufacturer of equipment or product.

C. Format:

1. Prepare organization of data in the format of an instructional manual.
2. Cover:
    a. Identify manual with title OPERATION AND MAINTENANCE MANUAL.
    b. Identify title of Project.
    c. Identify subject matter of contents.

3. Organization:
    a. Divide sections for each separate product and system, with description of product and major component parts of equipment.

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b. For any hard copies required, provide tabbed dividers between each section.

4. Text:
   a. Include all manufacturer's published data and product cutsheets.
   b. For any hard copies required, provide on 20 pound paper.

5. Drawings:
   a. Provide applicable drawing files from manufacturer or Architect's drawing files as required. Contact Architect to obtain PDF drawing files as needed.
   b. For any hard copies required, provide with reinforced punched binder tab. Bind in with text. Fold larger drawings to size of text pages.

6. Binders (for any hard copies required):
   a. Commercial quality, 8-1/2 x 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size.
   b. When multiple binders are used, correlate data into related consistent groupings.

D. Contents:

1. Table of Contents: Provide title of Project; names, addresses, and telephone numbers of Architect/Engineer, Subconsultants, and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.
2. For Each Product or System: List names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
3. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
4. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
5. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.
6. Warranties: Include a copy of each.
7. Reports: Include a copy of all test reports, certificates, testing and balance data, etc.

E. Manual for Materials and Finishes:

1. Building Products, Applied Materials, and Finishes: Include product data, with catalog number, size, composition, and color and texture designations. Provide information for re-ordering custom manufactured Products.
2. Instructions for Care and Maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
3. Moisture Protection and Weather Exposed Products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.
4. Additional Requirements: As specified in individual Product specification Sections.
5. Provide a list of all materials and finishes with scanned photo files or actual samples of all products.

F. Manual for Equipment and Systems:

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1. Each Item of Equipment and Each System: Include description of unit or system, and component parts. Identify function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and model number of replaceable parts.
2. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.
3. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
4. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
5. Include color coded wiring diagrams as installed.
6. Provide servicing and lubrication schedule, and list of lubricants required.
7. Include manufacturer's published operation and maintenance instructions.
8. Include sequence of operation by controls manufacturer.
9. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
10. Provide control diagrams by controls manufacturer as installed.
11. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.
12. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
13. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
14. Include test and balancing reports as specified in Section 23 0593 - Testing, Adjusting and Balancing.
15. Additional Requirements as specified in individual Product specification Sections.
16. Provide a list of design data, settings, setpoints, etc., as applicable for equipment.

1.3 PRODUCT WARRANTIES

A. Submission Requirements:

1. Furnish Owner with all warranty information electronically on CD in PDF format.
2. Furnish Owner with two (2) sets of bound hard copy warranties.
3. Submit to Architect for review of information and forwarding to Owner for Owner’s records.

B. Preparation:

1. Gather Warranties required for specific Products or Work as specified in each individual Section.
2. Obtain information directly from responsible Subcontractor, supplier, and manufacturer of equipment or product within 10 days after completion of applicable item of Work.
3. Except for items put into use with Architect approval, leave date of beginning of time of warranty until the Date of Final Acceptance is determined.
4. Verify that documents are in proper form, are complete, contain full information, are notarized, and are fully executed and valid.
5. Co-execute submittals when required.
6. Retain warranties until time specified for submittal.

C. Format:

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1. Prepare organization of data in the format of an instructional manual.
2. Cover:
   a. Identify manual with title WARANTIES.
   b. Identify title of Project.
   c. Identify subject matter of contents.

3. Organization:
   a. Separate each warranty keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary.
   b. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
   c. For any hard copies required, provide tabbed dividers between each warranty.

4. Binders (for any hard copies required):
   a. Commercial quality, 8-1/2 x 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size.
   b. When multiple binders are used, correlate data into related consistent groupings.

D. Contents, Each Volume:

1. Table of Contents: Neatly typed, in sequence of Table of Contents of Project Manual, with each item identified with number and title of specification Section in which specified, and name of Product or Work item.

E. Time of Submittals:

1. For equipment or component parts of equipment put into service during construction with Architects approval, submit documents within 10 days after acceptance.
2. Make other submittals within 10 days after Date of Final Completion, prior to final Application for Payment.
3. For items of Work for which acceptance is delayed beyond Date of Final Completion, submit within 10 days after acceptance.

1.4 PROJECT RECORD DRAWINGS (“AS-BUILTS”)

A. Submission Requirements:

1. Furnish Owner with original record document prints.
2. Furnish Owner with one (1) additional hard copy set of record document prints.
3. Furnish Owner with all as-built information electronically on CD in PDF format.
4. Submit to Architect for review of information and forwarding to Owner for Owner’s records.

B. Project Record Documents required:

1. Marked-up copies of Contract Drawings.
2. Marked-up copies of Shop Drawings.
3. Marked-up copies of Specifications, addenda and Contract Modifications.
4. Marked-up Product Data submittals.
5. Field records for variable and concealed conditions.

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6. Record information on Work that is recorded only schematically.

C. Maintenance of Documents:

1. Store record documents in field office apart from Contract Documents used for construction. Do not permit Project Record Documents to be used for construction purposes. Maintain and protect record documents from damage in a clean, dry, legible condition. Make documents available at all times for inspection by Architect.

D. Record Drawings:

1. During construction, maintain a set of black-line white-prints of Contract Drawings and Shop Drawings for Project Record Document purposes.
   a. Mark these Drawings to indicate actual installation where installation varies from installation shown originally. Give particular attention to information on concealed elements which would be difficult to identify or measure and record later. Items required to be marked include but are not limited to:
      1) Dimensional changes to Drawings.
      2) Revisions to details shown on Drawings.
      3) Depths of foundations below first floor.
      4) Locations and depths of underground utilities.
      5) Revisions to routing of piping and conduits.
      6) Revisions to electrical circuitry.
      7) Actual equipment locations.
      8) Duct size and routing.
      9) Locations of concealed internal utilities.
      10) Changes made by Contract Modification.
      11) Details not on original Contract Drawings.
   b. Responsibility for Markup and Supervision: Contractor Quality Control Representative; as specified in Section 01 4500 - Quality Control. Where feasible, individual or entity who obtained record data, whether individual or entity is installer, subcontractor, or similar entity, is required to prepare mark-up on Record Drawings.
      1) Accurately record information in an understandable Drawing technique.
      2) Record data as soon as possible after it has been obtained. In case of concealed installations, record and check mark-up prior to concealment.
      3) Contractor Quality Control Representative: Affix signature and certify accuracy of Record Drawings.
   c. Mark completely and accurately record prints of Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions. Where Shop Drawings are marked, show cross-reference on Contract Drawings location.
   d. Mark record sets with red erasable colored pencil; use other colors to distinguish between changes for different categories of Work at same location.
   e. Mark important additional information which was either shown schematically or omitted from original Drawings.
   f. Note construction change directive numbers, alternate numbers, Contract Modification numbers and similar identification.
   g. At time of Final Acceptance, submit record Drawings to Architect for Owner records. Organize into sets, bind and label sets for Owner's continued use.

2. Preparation of Transparencies:

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a. Immediately prior to inspection for Final Acceptance, review completed marked-up record Drawings with Architect. When authorized, prepare a full set of corrected transparencies of Contract Drawings and Shop Drawings.
b. Incorporate changes and additional information previously marked on print sets. Erase, redraw, and add details and notations where applicable. Identify and date each Drawing; include printed designation "PROJECT RECORD DRAWINGS" in a prominent location on each Drawing.
c. Refer instances of uncertainty to Architect for resolution.
d. One set of transparencies of original Contract Drawings will be furnished to Contractor by the Owner for use in recording changes and additional information. Other printing as required is Contractor's responsibility.
e. Review of Transparencies: Before copying and distributing, submit corrected transparencies and original marked-up prints to Architect for review. When acceptable, Architect will initial and date each transparency, indicating acceptance of general scope of changes and additional information recorded, and of quality of drafting.
f. Transparencies and original marked-up prints will be returned to Contractor for organizing into sets, printing, binding and final submittal.

3. Copies and Distribution: After completing preparation of transparency Record Drawings, print (three) 3 black-line prints of each Drawing, whether or not changes and additional information were recorded. Organize copies into manageable sets. Bind each set with durable paper cover sheets, with appropriate identification, including titles, dates and other information on cover sheets.
a. Organize and bind original marked-up set of prints that were maintained during construction in same manner.
b. Organize record transparencies into sets matching print sets. Place each set in durable tube-type Drawing containers with end caps. Mark end cap of each container with suitable identification.

E. Additional Record Submittals:

1. Refer to other specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Immediately prior to Final Acceptance, complete additional records and place in order, properly identified and bound or filed, ready for use and reference. Submit to Architect.
a. Categories of requirements resulting in miscellaneous records include, but are not limited to the following:
1) Field records on excavations and foundations.
2) Field records on underground construction and similar Work.
3) Survey showing locations and elevations of underground lines.
4) Inverted elevations of drainage piping.
5) Survey establishing building lines and levels.
6) Authorized measurements utilizing unit prices or allowances.
7) Records of plant treatment.
8) Ambient and substrate condition tests.
9) Certifications received in lieu of labels on bulk products.
10) Batch mixing and bulk delivery records.
11) Testing and qualification of tradesmen.
12) Documented qualification of installation firms.
13) Load and performance testing.
14) Inspections and certifications by governing authorities.

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15) Leakage and water-penetration tests.
16) Fire resistance and flame spread test results.
17) Final inspection and correction procedures.

1.5 SPARE-PARTS

A. Provide Products, replacement stock, spare parts, maintenance, and extra materials in quantities specified in individual specification Sections.

B. Deliver to Project Site and place in location as directed by Architect; obtain receipt prior to Final Payment.

1.6 CERTIFICATES OF INSPECTION

A. General.

B. Plumbing.

C. HVAC.

D. Electrical.

1.7 FOOD SERVICE EQUIPMENT MAINTENANCE MANUALS:

A. Furnish Owner with three (3) separately bound "Food Facilities Equipment Maintenance Manual" for all kitchen equipment, exhaust hoods and specialties. Submit manual to Architect for review and forward to Owner.

B. Instructions for maintenance of food facilities equipment, including the following:

1. Care of finished surfaces.
2. Spare parts lists.
3. Data Sheets.
4. Period of warranty and date warranty goes into effect.
5. List of service agencies responsible for each item of equipment including fabricated equipment.
6. Food Service Equipment Contractor's name and telephone number.

1.8 KEYS

A. Submit keys and keying schedule to Owner.

1.9 INSTRUCTION OF OWNER’S PERSONNEL

A. Prior to final inspection or acceptance, fully instruct Owner’s designated operating and maintenance personnel in the operation, adjustment, and maintenance of all products, equipment and systems.

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B. Such instructions shall occur at a time designated by the Architect/Engineer at the completion of the job at a meeting set up by the contractor and attended by the representatives of the Owner and manufacturer.

C. Services of factory instructor or representative to teach Owner's representative on operation of equipment will be arranged by the contractor, shall begin after equipment has been placed in satisfactory operating condition and shall continue for a period of time as deemed necessary by the Architect.

D. Contractor shall verify in writing that such periods of instruction have been held with the Owner's representative.

E. Minimum length of training session to be two (2) hours.

F. Session will need to be videotaped by Contractor for use by Owner.

G. Notify Architect to attend all training sessions.

1.10 CERTIFICATE OF OCCUPANCY

A. Where the Local Authority of Location of project requires either temporary or permanent Certificate of Occupancy, obtain and pay for Certificates and furnish a copy to the Architect for forwarding to the Owner.

B. Contractor to verify requirements with Local Building Officials.

1.11 CERTIFICATION OF ASBESTOS MATERIAL AND LEAD-BASED PAINT

A. The use of asbestos containing materials, in excess of 1 percent as defined by applicable US Environmental Protection Agency regulations, is prohibited in the project.

B. The use of lead-based paint is prohibited in the project.

C. Prepare and submit to the Architect the "Certification of Asbestos and Lead-Based Paint (Existing Building) " for existing buildings or portions of buildings (attached).

D. Prepare and submit to Architect the "Certification of Asbestos and Lead-Based Paint (New Work) " for new material furnished or installed as part of the Work (attached).

END OF SECTION 01 7800

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Certification of Asbestos and Lead-Based Paint
(Existing Building)

To: TowerPinkster

Subject: Certification for a building built after 1990

Facility name: _____

Facility address: _____

Certification for existing building:

I / We certify under penalty of perjury under the laws of the United States that the following is true and correct. This building was constructed after 1990 and is free of asbestos containing material in excess of 1 percent as defined by applicable US Environmental Protection Agency regulations, and lead-based paint except as specifically listed below. This certification includes all areas of the building(s), including but not limited to; the roof and flooring.

Owner name: _____

Signature: _____

Address: _____

_____

Telephone: _____ Date executed: _____

Materials containing asbestos/lead-based paint	Location/room within facility

The penalty for making a false statement is prescribed by 18 USC 1001.

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Certificate of Asbestos and Lead-Based Paint

(New Work)

To: TowerPinkster

Subject: Certification for new construction

Facility name: _____

Facility address: _____

Certification for new construction:

This Contractor hereby certifies that no asbestos-containing material in excess of 1 percent as defined by applicable US Environmental Protection Agency regulations, and lead-based paint has been furnished or installed at the referenced project.

Contractor name: _____

Signature:

_____

Address: _____

_____

Telephone: _____

Date executed: _____

The penalty for making a false statement is prescribed by 18 USC 1001.

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SECTION 01 7846 - CLOSEOUT MAINTENANCE MATERIALS

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. Section Includes:

1. Maintenance Materials.
2. Owner Verification.

1.2 MAINTENANCE MATERIALS

A. General Requirements:

1. No maintenance stock to be used by the Contractor for any reason.
2. Provide maintenance stock for each and every style, type or color specified for each product.
3. Provide maintenance stock at end of the project and directly to the Owner.
4. Wrap and protect all materials for storage by the Owner.
5. Packages and containers to be manufacturer's unopened and unsealed packaging. If quantities listed exceed a manufacturer's single container, additional unopened and unsealed containers shall be supplied until minimum quantity is met.
6. Packages and containers shall include manufacturer's label and product information.
7. Paint products shall include manufacturer's color and mix formulas.

B. Acoustical Ceiling Tile:

1. Provide to Owner maintenance stock of at least (24) tiles.

C. Luxury Vinyl Tile Flooring:

1. Provide to Owner maintenance stock of at least (10) tiles.

D. Rubber Base:

1. Provide to Owner maintenance stock of at least (20) linear feet.

E. Modular Walk-off Carpet Tiles:

1. Provide to Owner maintenance stock of at least (6) tiles.

F. Paint:

1. Provide to Owner maintenance stock of at least (2) unopened gallon containers.

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1.3 OWNER VERIFICATION

A. Owner to sign-off receipt of each item.

B. Provide to Architect, copy of this Specification Section with Owner's signature next to each item listed, verifying that they have been received by the Owner's representative and entered into their stock.

END OF SECTION 01 7846

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SECTION 02 3000 - SUBSURFACE EXPLORATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Sub-Surface Exploration Report:

1. Prepared by: **CORNERSTONE GEOTECH SERVICES, LLC**
2214 PLANTSIDE DR
LOUISVILLE, KY 40299
502-361-8447
502-361-4793

2. Report is intended for informational purposes of interpolating and understanding subsurface conditions of the project site, and becomes a part of the Contract Documents.

B. Boring Logs:

1. Included for Contractor's information, but not a warranty of subsurface conditions.

C. Representations or Warranties:

1. None are made by the inclusion of this report.
2. Neither the Owner nor the Architect//Engineer will be responsible for interpretations or conclusions drawn from this report by the Contractor.
3. Data is made available solely for the convenience of the Contractor.

D. Additional Investigation:

1. Contractor should visit the site to acquaint himself with site conditions.

END OF SECTION 02 3000

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GEOTECHNICAL EXPLORATION FOR

BUILDING ADDITION

TEAMSTERS LOCAL 2727 SHEPHERDSVILLE

4810 N. PRESTON HIGHWAY

HEBRON ESTATES, KENTUCKY

CORNERSTONE PROJECT NO. CGS-25-0247





TOWER PINKSTER

320 PEARL STREET

NEW ALBANY, INDIANA 47150

OCTOBER 27, 2025

October 27th, 2025

Mr. Jeffrey E. Cobble
Senior Project Architect
Tower Pinkster
320 Pearl Street
New Albany, Indiana 47150

Subject: **Geotechnical Exploration Report**
Building Addition
Teamsters Local 2727 Shepherdsville
4810 N. Preston Highway
Hebron Estates, Kentucky
Cornerstone Project No. CGS-25-0247

Dear Mr. Cobble,

Thank you for selecting **Cornerstone** as your geotechnical engineering consultant for this project. We appreciate the opportunity to work with you and look forward to being a member of the project team!

CORNERSTONE is pleased to present this **Geotechnical Exploration Report** to you, and hope that the information provided within proves valuable to you and the design team. Please contact us if you have any questions about the information or recommendations provided in this report.

Sincerely,

CORNERSTONE

Luke Van Nevel
Project Manager| Engineer

Amin Mohammadzadeh, P.E.
Senior Geotechnical Engineer

Sandor R. Greenbaum

Sandor Greenbaum, P.E.
Senior Geotechnical Engineer



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APPENDIX

Site Location Plan (1 sheet)

Boring Location Plan (1 sheet)

Soil Description Terminology/Rock Quality Determination (1 sheet)

Test Boring Reports (6 sheets)

Cross section Boring Reports (2 sheets)

Classification of Soils for Engineering Reports (1 sheet)

Grain Size Distribution (1 sheet)

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Laboratory Summary (1 sheets)

Report of Geotechnical Exploration
Building Addition
Teamsters Local 2727 Shepherdsville
4810 N. Preston Highway
Hebron Estates, Kentucky
Cornerstone Project No. CGS-25-0247

1.0 ---------- Introduction

Cornerstone Geotech Services, LLC (Cornerstone or CGS) was contracted by Tower Pinkster to perform a geotechnical investigation for a building addition for Teamsters Local 2727 Shepherdsville, located at 4810 North Preston Highway in Hebron Estates, Kentucky. The project consists of a 74- by 46-foot addition to the existing Teamsters Local 2727 facility in the area of a former three-lane bank drive-thru with canopy. There is also to be an expansion of the parking lot measuring approximately 89- by 40-feet. Borings were distributed to represent both the planned building addition and the new parking lot areas. The site's location is shown in the aerial image below (See Figure 1).



Figure 1. General Aerial View of the Site

The scope of our services includes a subsurface exploration program to characterize the site stratigraphy, in-situ soil properties, and groundwater conditions that may influence the performance of the proposed structure and pavement. Cornerstone's primary objectives are to determine the allowable bearing capacity of the underlying soils, evaluate subgrade support conditions, and provide design recommendations for foundations, slabs-on-grade, and pavement. The collected geotechnical data serves as the basis for foundation design recommendations.

A boring location plan, appended to this report, illustrates the layout of the six (6) soil borings performed across the project site which includes four (4) within the planned building addition footprint to auger refusal, shy of the planned 15 feet maximum; and two (2) within the proposed parking lot expansion to auger refusal. The borings were conducted to characterize subsurface conditions for design and construction planning. Additionally, a site location map is included to provide the project's geographical context. Fieldwork was coordinated with representatives of Tower Pinkster.

2.0 ---------- General Site Information

The parcel lies at approximate coordinates of 38.0509° N, 85.6772° W, situated on Lodie Lane, a street that parallels North Preston Highway, at its intersection with East Hebron Lane in Hebron Estates, Kentucky. The existing site condition can be characterized as the Teamsters Local 2727 building (former bank), paved parking areas surrounding the building, with landscaping outside the paved area. The proposed building addition will be constructed in the area currently occupied by the former drive-thru, while the parking lot expansion will extend into the grass area northeast of the existing building.

Topographically, the site is nearly flat, with ground surface elevations around 520 feet above mean sea level. No significant surface depressions were observed within the project limits, and the site is suitable for access and construction. Geologic mapping by the Kentucky Geological Survey (KGS) indicates that the site is underlain by the Louisville Limestone Formation (Middle Silurian) (see Figure 2). KGS describes Louisville Limestone Formation as:

> Dolomitic limestone and dolomite, yellowish-gray, light-olive-gray, pale yellowish brown to very pale orange, very fine grained, argillaceous in part; stylolitic, very thin to thin bedded in upper part, very thick bedded near base; irregular rubbly bedding common, typified in exposures along Kentucky Turnpike; locally shaly in 10 foot zone about 20 feet above base; contains calcite filled pockets and thin veinlets of calcite; chert rare in lower beds but common in discontinuous 0.2 foot thick layers in uppermost few feet. Unit reportedly thickest in vicinity of abandoned quarry 1 mile due east of Hubers Kenlite Station. Supports broad westward dipping surface east of Kentucky Turnpike; outcrop areas locally marked by narrow, steep walled solution cavities and small sinks; some beds form continuous persistent ledges rimming steep walled stream valleys. One such ledge top approximately 40 feet above the base, another at about 60 feet above the base. Dolornitized fossils common as casts are abundant in some layers; include brachiopods,

horn corals, colonial corals, chain corals, and algal mat remains. Basal contact with underlying shale distinct to gradational over as much as 2 feet.

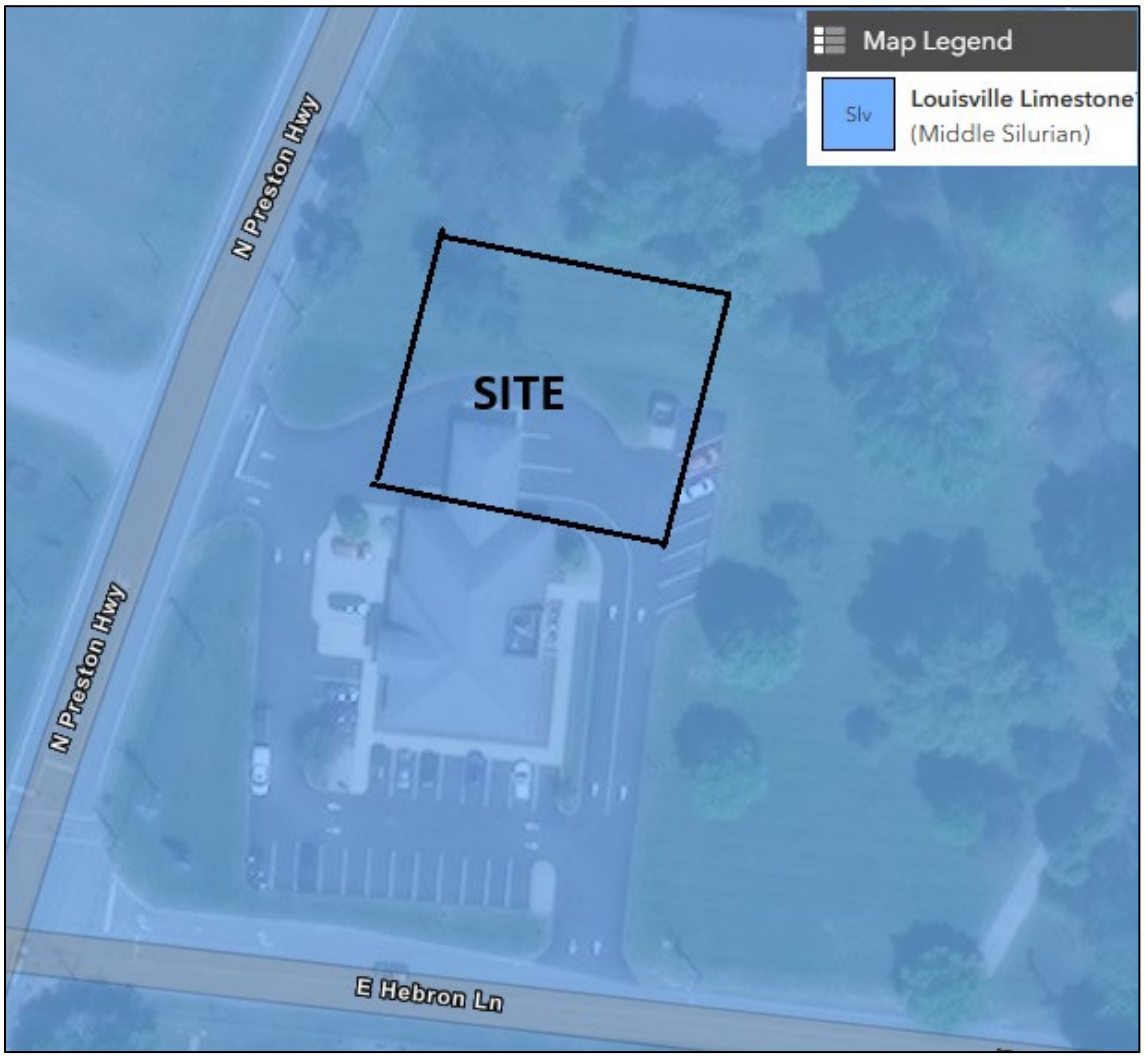


Figure 2 Regional geologic map

3.0 Exploration

A subsurface exploration program consisting of six (6) soil borings was performed for this site (see Figure 3). The drilling was performed utilizing a Diedrich D-25 track-mounted drilling rig equipped with 4-inch diameter solid-flight augers and a 140-pound automatic hammer assembly. All drilling and sampling procedures were executed in strict accordance with ASTM D-1586, employing Standard Penetration Testing (SPT) at consistent intervals to quantify in-situ soil strength, relative density for cohesionless strata, and consistency for cohesive materials. Boring locations were established in the field using a handheld GPS device, noting inherent positional accuracy limitations associated with this method.

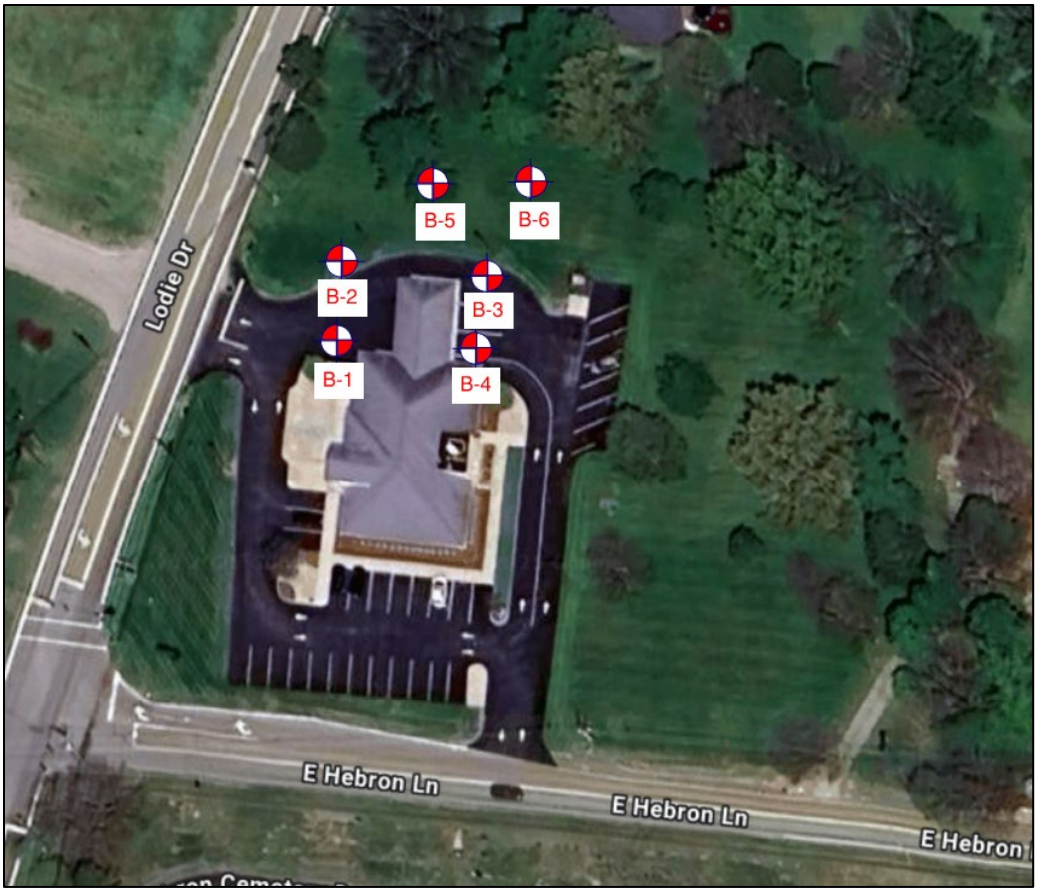


Figure 3. Boring Location Plan- Aerial View of the Site

The Standard Penetration Test (SPT) is a common field test used to evaluate soil strength and consistency. It involves driving a 2-inch diameter split-barrel sampler into the ground using a 140-pound hammer that is dropped from a height of 30 inches. This process is performed at specific depth intervals to gather data on subsurface conditions. The test is conducted in three 6-inch increments, for a total penetration depth of 18 inches. The number of hammer blows required to drive the sampler through each increment is recorded. To determine the SPT N-value, which correlates to soil compressibility and strength, only the blow counts from the second and third increments (the last 12 inches) are added together. The first 6-inch increment is disregarded to account for any soil disturbance by the augers. As the sampler is extracted, it brings up a disturbed soil sample, which, while not suitable for laboratory tests that require undisturbed specimens, provides useful information for soil classification and general characterization. The SPT results help engineers assess the soil's ability to support structures, estimate settlement potential, and design foundations accordingly.

The collected soil samples were transported to the laboratory for testing. The testing program included:

- One Atterberg limits test to evaluate soil's plasticity characteristics,
- One grain size distribution analysis including hydrometer testing, and
- Natural moisture content determinations to assist in assessment of in-situ soil conditions.

Grain size analysis produces a curve showing particle size versus the percentage of soil finer than that size. This method helps determine the proportions of clay, silt, sand, and other fractions in a soil sample. These classifications refine field soil descriptions and adjust the boring logs accordingly. For fine-grained soils, which are mostly silt and clay, traditional sieve analysis is ineffective due to their small particle size. Instead, these soils are suspended in water, and their settling rate is measured to determine grain size distribution. Coarser soil particles, however, are separated and analyzed using a series of sieves to classify the larger fractions more precisely.

The **Atterberg Limits** define the moisture content at which soil transitions between different states. The **plastic limit** is the moisture content where soil changes from a solid to a plastic state, while the **liquid limit** is where soil transitions from plastic state to a liquid state. These limits are determined using standardized tests based on the soil's cohesive properties. Understanding a soil's moisture content relative to these limits helps assess its strength and behavior. The **plasticity index**, calculated as the difference between the liquid limit and plastic limit, indicates the soil's plasticity. These parameters are fundamental for soil classification in various standard classification systems.

Natural moisture content determination measures the in-situ moisture content of the soil. This information helps compare the strength of soil samples with similar texture. When analyzed along with the Atterberg Limits, it provides an indication of the expected strength range of the soil.

4.0 ---------- Findings

4.1 ---------- Boring Results

Subsurface conditions across the site are generally characteristic of soils derived from the weathering of the Louisville Limestone. The soils encountered were predominantly lean clay (CL) with localized deposits of fat clay (CH) and silty clay (CL-ML), particularly at shallow depths beneath the pavement areas. These soils exhibited consistencies ranging from medium stiff to hard.

Auger refusal on limestone bedrock was encountered at relatively shallow depths, ranging from approximately 4.5- to 6.2-feet below existing grades. Laboratory testing indicated natural moisture contents ranging from 9.3- to 37.1-percent, reflecting variability in soil plasticity and depth. Soil colors were observed to be predominantly brown to reddish brown.

No groundwater was encountered in any of the borings during or immediately after drilling, and delayed groundwater measurements were not recorded. Table 1 present standard penetration test (SPT) N-values, adjusted for the energy efficiency of the automatic hammer.

Table 1. Boring's SPT Results B-1 to B-6

Depth	B-1	B-2	B-3	B-4	B-5	B-6
1 to 2½ feet	8	5	8	10	8	16
3½ to 5 feet	9	10	8	13	50/0”	50/3”
6 to 7½ feet	50/1”	50/1”	50/1”	50/2”		
8½ to 10 feet						
13½ to 15 feet						
Refusal	6’1”	6’1”	6’1”	6’2”	4’6”	4’9”

4.2 Laboratory Results

One representative soil sample, obtained from Borings B-3 at a depth of 3.5- to 5-feet, was selected for laboratory testing to evaluate the engineering properties of near-surface soils. The testing program included Atterberg Limits and grain size analysis to classify the soils and assess their plasticity and grain size distribution. Table 2 presents the results of the grain size distribution and Atterberg Limits testing and soil classification under the Unified Soil Classification System (USCS) and American Association of State Highway and Transportation Officials (AASHTO). Detailed tests data are provided in the appendix.

Table 2. Laboratory Results

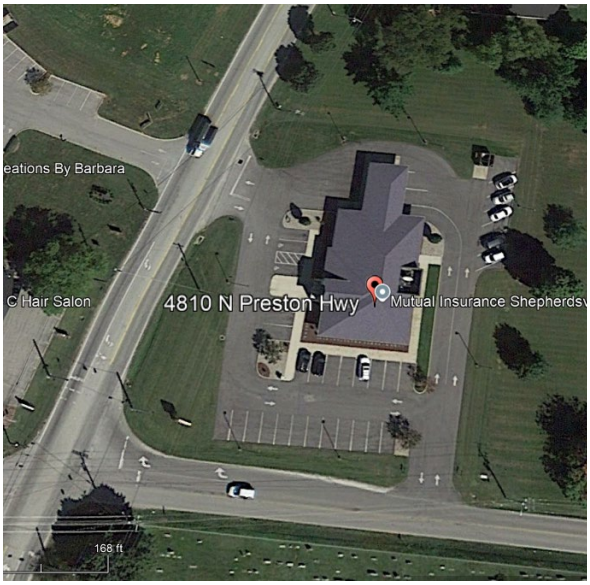
Soil Sample	Grain Size Distribution			Atterberg Limits’			Soil Classification	
	Percent Sand	Percent Silt	Percent Clay	Liquid Limit	Plastic Limit	Plasticity Index	USCS	AASHTO
B-3 @ 3.5 - to 5 feet	24	34	42	39	18	21	CL	A-6

4.3 Historic Aerial Photographs

Historical aerial imagery from 1955 through 2025 was reviewed to evaluate past land use at the project site. The 1955 to 1983 imagery depicts the parcel as undeveloped land. By March 1983, the site still appeared undeveloped; however, between 1983 and 1998 the existing building and associated paved parking areas were constructed. Subsequent imagery, including September 2014, confirms the current facility and site layout, which has remained unchanged through 2025. The area designated for the proposed parking lot expansion is presently lawn and has not been previously developed beyond grading. Representative images from 1983 and 2014 are provided in Figure 4.



March 1983



September 2014

Figure 4. Aerial Imagery

4.4 Seismicity

In accordance with ASCE/SEI 7-10 and the 2018 Kentucky Building Code (which adopts the International Building Code 2015), the site is classified as **Site Class C**. The structure is assigned to **Risk Category II**. The Mapped Maximum Considered Earthquake (MCER) ground motion parameters and site-modified design values were obtained using the FEMA/USGS Seismic Design Maps tool. The relevant Spectral Response Acceleration Coefficients for this site are summarized in Table 3.

Table 3. Seismic Design Parameters

Type	Value (g)	Description
S_S	0.205	MCE_R ground motion. (for 0.2 second period)
S_1	0.107	MCE_R ground motion. (for 1.0s period)
S_{MS}	0.246	Site-modified spectral acceleration value
S_{M1}	0.181	Site-modified spectral acceleration value
S_{DS}	0.164	Numeric seismic design value at 0.2 second SA
S_{D1}	0.121	Numeric seismic design value at 1.0 second SA

5.0 Recommendations

5.1 Foundations

Based on the subsurface conditions encountered during this investigation, conventional shallow spread footing foundations are suitable for supporting the proposed structures. Footings should bear a minimum depth of 2.5 feet below the final exterior grade to ensure adequate frost protection and mitigation of seasonal moisture fluctuations. Foundations may be designed for an allowable bearing pressure of up to **2,000 pounds per square foot (psf)**, **contingent upon verification of suitable subgrade conditions during construction.**

When foundation bearing surfaces are exposed, they must be evaluated by a geotechnical engineer or their representative from this office to confirm the absence of unsuitable bearing conditions. If unsuitable bearing materials are encountered, the identified materials should be undercut to a competent bearing stratum or to a depth deemed acceptable by the geotechnical engineer. The excavation should then be backfilled to the bearing elevation with open-graded stone such as Kentucky Number 57 Stone placed in lifts up to 12 inches with each lift compacted by at least four passes of a vibratory plate over its entire surface.

All foundation excavations and remediation measures must be inspected and approved by a qualified geotechnical engineer to confirm suitability and compliance with these recommendations. Continuous oversight during construction is strongly recommended to verify that all foundation preparations are executed properly, ensuring structural integrity and long-term performance.

To protect foundation-bearing strata from frost effects, soil-bearing foundations must be bear a minimum of 30 inches below finished exterior grade. Interior foundations that remain protected from freezing conditions are not subject to this depth requirement. Additionally, continuous footings must have a minimum width of 16 inches, while isolated footings must be at least 24 inches wide to ensure adequate load distribution and bearing capacity.

Foundations designed in accordance with the recommended criteria are anticipated to undergo total settlement not exceeding one inch, with differential settlement not exceeding three-quarters of an inch.

For shallow foundations, base friction can be utilized to resist lateral forces. A friction coefficient of 0.30 may be assumed, provided that the footing concrete is placed directly against undisturbed natural soil. This value represents the ultimate friction capacity, and a minimum factor of safety of 1.5 should be applied to determine the allowable sliding resistance.

5.2 ---------- Dealing with Karst

If any signs of subsurface voids, soft zones, or unexpected soil loss are encountered during excavation, immediate evaluation by geotechnical personnel is required. If any karst features are discovered during earthwork, the remediation should include the full excavation of overburden soils down to competent bedrock, specifically targeting the exposure of any subsurface voids or “throats” within the limestone formation. Once the feature is fully exposed and cleaned of loose or raveled material, the first step in reconstruction involves the installation of a non-woven geotextile filter fabric. This geotextile acts as a separator to prevent soil migration into the remediation zone and to limit future piping of fine-grained soils. Figure 5 provides illustration of the treatment of a karst feature.

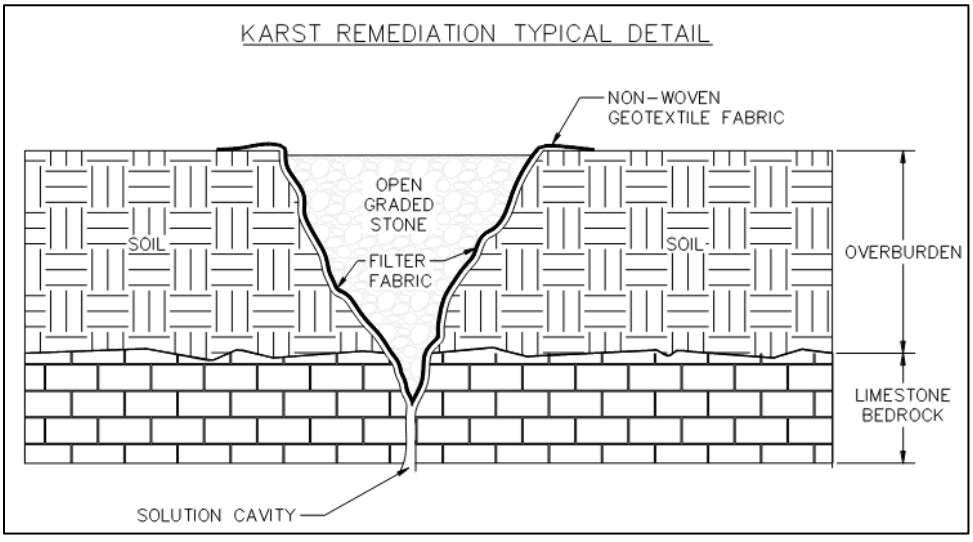


Figure 5. Typical Karst Remediation Detail

The area above the wrapped remediation zone may then be backfilled with either structural fill or compacted native soil, provided that appropriate compaction equipment can access the area. All fill placed above the wrapped stone should be installed in controlled lifts and compacted in accordance with project specifications to restore grade and support surface loads.

5.3 ---------- Slab-on-Grade

Prior to fill placement in the slab area and prior to construction of the slab's underlying aggregate base layer, the subgrade must be proofrolled under the observation of a geotechnical engineer or senior engineering technician from this office to assess for soft or loose soil conditions. The subgrade should also be examined for excessively plastic soils that may be subject to volume change. If excessively plastic soils are encountered, the soils should be undercut to one foot depth and should be refilled with lean clay compacted as discussed in section 5.4 of this report.

Any identified soft or otherwise unsuitable material, other than fat clay, must be undercut and replaced in accordance with the geotechnical engineer's on-site directives. Undercutting should extend to a depth of up to two feet, occasionally more, below the design subgrade elevation, with backfill consisting of open-graded stone such as KYTC Number 57 Stone. Coarse rock should be avoided in areas where subsequent trenching will be required for utility, piping, or conduit installation to prevent construction difficulties. If fat clay is present, lean clay should be used as fill.

A slab-on-grade that is structurally independent of walls, columns, and foundations is the preferred design approach to mitigate the potential effects of differential settlement between the slab and foundation. If necessary, a thickened slab may be implemented; however, maintaining separation from foundation elements is recommended to reduce stress transfer, which may result in slab movement due to foundation settlement with resultant cracking of the slab.

A vapor barrier must be incorporated beneath the slab to mitigate moisture migration and potential slab curling. Additionally, a minimum of four inches of dense graded aggregate should be placed beneath the slab to enhance subgrade uniformity and provide adequate support. The floor slab may be designed using a modulus of subgrade reaction (k) of 90 kips per cubic foot to ensure appropriate load-bearing performance and long-term serviceability.

5.4 ---------- Site Preparation and Earthwork

Prior to the placement of any fill, all vegetation and organic-rich topsoil (defined as soil containing more than 4 percent organic content) must be completely stripped from construction areas (including designated fill areas). In locations where trees or shrubs were previously present, the entire root system, including the root ball, must be fully excavated. Any resulting voids should be backfilled with engineered fill in accordance with the specifications outlined in this section.

Following subgrade preparation, the exposed surface should be proofrolled using a fully loaded tri-axle truck to identify any zones exhibiting excessive yielding or rutting. Areas displaying inadequate subgrade support should be remediated through appropriate measures such as undercut and replacement with suitable fill, moisture conditioning, or chemical stabilization as necessary.

Engineered fill must be placed in controlled lifts not exceeding 10 inches in uncompacted thickness and compacted to a minimum of 98 percent of the material's maximum dry density, as determined by the Standard Proctor test (ASTM D698). To ensure proper compaction and mitigate potential post-construction settlement, the in-situ moisture content of the fill material should be maintained within ±2 percent of its optimum moisture content. Field density testing in accordance with ASTM D6938 (nuclear gauge) should be performed at regular intervals to verify compliance with compaction requirements. Any fill that does not meet the specified density or moisture criteria must be reworked, aerated, or wetted and recompacted as necessary to achieve the required engineering properties.

All soil sourced from off-site borrow locations must be tested and approved by this office prior to placement on-site to ensure compliance with project specifications. Laboratory testing should include grain-size distribution (ASTM D6913), Atterberg limits (ASTM D4318), and moisture-density relationships (ASTM D698 or ASTM D1557) to confirm suitability. Acceptable borrow materials must conform to one of the following Unified Soil Classification System (USCS) designations:

- **GC** – Clayey Gravel
- **SM** – Silty Sand
- **SC** – Clayey Sand
- **CL** – Low to Moderate Plasticity Clay

Materials classified as low-plasticity soils (**ML**), high-plasticity soils (**MH or CH**), organic soils (**OH)**, or peat (**PT**) are unsuitable for use as engineered fill due to their excessive compressibility, high shrink-swell potential, and/or poor load-bearing capacity. These materials must not be incorporated into the project. Additionally, all borrow soils must have a plasticity index (PI) less than 20 and a liquid limit (LL) not exceeding 40 to ensure adequate stability and performance.

The site should maintain well-drained conditions throughout all phases of construction and post-construction to mitigate potential issues related to water infiltration and subgrade softening. Site grading should be designed to facilitate positive drainage, directing surface runoff away from the proposed structure, and pavement areas.

Grading should be performed in accordance with best practices for erosion control and stormwater management to prevent ponding, minimize hydrostatic pressures against foundation elements, and reduce the risk of differential settlement due to moisture fluctuations in the subgrade. Proper drainage provisions, including swales, ditches, and stormwater management infrastructure, should be incorporated to ensure long-term performance and stability of the site.

The placement of compacted fill must be executed by an experienced earthwork contractor utilizing appropriate materials and compaction techniques. The contractor must be capable of adjusting construction methodologies, equipment selection, and material handling procedures to accommodate site-specific conditions, seasonal variations, and the structural requirements outlined by the geotechnical engineer.

Soil placement and compaction procedures that are effective in summer conditions may not be suitable during winter months due to changes in soil moisture, temperature, and freeze-thaw cycles. Depending on the properties of the borrow material, moisture conditioning—either wetting or drying—may be required to achieve the specified compaction and density criteria. Additionally, subgrade and fill conditions may vary across the site or change over the duration of the project, requiring ongoing adjustments to construction practices.

These considerations should be explicitly addressed in the project drawings and technical specifications to ensure compliance with the design intent, minimize construction delays, and achieve the required subgrade stability for long-term performance.

During freezing conditions, all fill material must be delivered to the site in an unfrozen state and must not be allowed to freeze during or after compaction. The workability of the soil and its resistance to freezing depend on its classification; therefore, project specifications should require the contractor to submit a representative sample of the proposed fill material prior to construction for laboratory evaluation. If the geotechnical engineer determines the material to be unsuitable for placement under winter conditions, it must be rejected. In general, silty sands, clayey sands, and cohesive to semi-cohesive soils should not be used as engineered fill when ambient temperatures are below freezing. Any frozen soil, regardless of type, must be deemed unacceptable for use as compacted fill.

Once compacted fill has been placed, it must be adequately protected from freezing to prevent frost-related heaving, loss of compaction, and post-construction settlement. The contractor should be required to submit a detailed frost protection plan outlining the materials and methods intended for thermal insulation, which may include straw, insulating blankets, additional loose fill, or topsoil cover. This requirement applies continuously throughout construction, both before and after concrete placement, until permanent backfilling and final frost protection are completed. If foundations are placed on frozen soil, or if compacted fill is allowed to freeze and subsequently thaw, differential movement in the form of heaving, settlement, or rotation may occur, compromising structural integrity. The need for freeze protection is particularly critical for soils with a high percentage of fines (clay and silt), as these materials exhibit greater volume changes upon freezing and thawing.

The contractor must also maintain strict moisture control of the fill material, ensuring that its in-situ moisture content remains within **±2 percent** of the optimum moisture content, as determined by the Standard Proctor (ASTM D-698) or Modified Proctor (ASTM D-1557) test. The importance of moisture control increases as the percentage of fines in the soil increases. Naturally occurring cohesive and semi-cohesive soils are often significantly wetter than their optimum moisture content, making compaction to the specified density difficult. Even if compacted to the required density, excessively wet soils may be unsuitable for use as pavement subgrades due to their susceptibility to pumping under applied loads. This issue is particularly significant when wet cohesive or semi-cohesive soils are used as backfill in utility trenches or similar confined spaces. Furthermore, thick fill sections composed of excessively wet soils are prone to excessive post-construction settlement beyond what is typically anticipated for fill placed within the specified moisture range.

5.5 Earth Pressures

Retaining walls should be constructed with an effective drainage system to prevent the buildup of hydrostatic pressure, which can lead to instability and structural distress. A drainage blanket composed of sand or a synthetic drainage material should be placed behind the wall to facilitate water movement away from the structure. Synthetic drainage materials, such as geosynthetic drainage composites, are available from geotextile suppliers and can provide efficient water conveyance while minimizing soil migration. To further ensure proper drainage, a perforated PVC underdrain or weepholes should be installed at the base of the wall, with weepholes spaced no more than 10 feet apart. This drainage system is essential in reducing excessive water accumulation, which could otherwise increase lateral pressures and compromise the performance of the retaining wall.

The design of a retaining wall must take into account both the type of backfill material and whether the wall is free to move or rigidly restrained. If the wall can move slightly, it will experience active earth pressure, which is lower than the pressure exerted on a wall that is fully restrained. A rigidly restrained wall, such as a basement wall tied into a floor slab or building frame, must be designed for at-rest earth pressure, which is higher due to the restriction of movement.

The type of backfill used behind the wall significantly affects the lateral pressure exerted. If a thin drainage blanket, such as sand or a synthetic drainage material, is placed behind the wall, the wall should be designed using an active earth pressure coefficient (K_a) of 0.40, with a soil unit weight (γ_w) of 130 pounds per cubic foot, resulting in an equivalent fluid pressure of 52 pounds per cubic foot. If granular backfill extends from the base of the wall upward at a 45-degree angle, the active earth pressure coefficient decreases to 0.29, reducing the equivalent fluid pressure to 38 pounds per cubic foot. This indicates that well-graded granular backfill helps reduce lateral forces on the wall.

For walls that are fully restrained, the at rest earth pressure coefficient (K_0) must be used instead. If a thin drainage blanket is present, the at-rest coefficient is 0.55, producing an equivalent fluid pressure of 72 pounds per cubic foot. When granular backfill is used and extends at a 45-degree angle from the base, the at-rest coefficient decreases to 0.43, corresponding to an equivalent fluid pressure of 56 pounds per cubic foot. These values ensure that the retaining wall is properly designed to withstand expected lateral forces and maintain long-term stability. The following table summarizes the design earth pressures.

Soil Type	Active Earth Pressure Coefficient (K_a)	Passive Earth Pressure Coefficient (K_p)	At Rest Earth Pressure Coefficient (K_0)	Equivalent Fluid Pressure on Cantilever Walls	Equivalent Fluid Pressure on Braced Walls
Cohesive Soils	0.40	2.85	0.55	52 pcf	72 pcf
Granular Backfill	0.29	3.69	0.43	38 pcf	56 pcf

Surcharge above the wall will add additional load. A uniform surcharge must be multiplied by the appropriate coefficient of earth pressure to determine the additional load applied to the wall.

Any retaining wall design must use appropriate factors of safety. It is critical that drainage be provided as mentioned earlier in this section to avoid hydrostatic pressure. Hydrostatic pressure would increase pressure against the wall substantially.

5.6 ---------- Light- and Heavy-Duty Pavement

Pavement subgrades should be examined and proofrolled as described in this report. If soft or unsuitable areas are encountered, the unsuitable soils will need to be undercut and refilled in accordance with the instructions of the geotechnical engineer's on-site representative. A pavement analysis was conducted using a life cycle of 20 years and a cumulative 18-kip equivalent single axle load of 20,000 for light traffic loads and 80,000 for moderate traffic loads. Recommendations are provided for both flexible and rigid pavement systems. However, rigid pavement should be used in special truck traffic areas, such as those areas which receive frequent traffic by fire trucks. The concrete pavement should extend throughout the areas that require extensive turning and maneuvering of fire or other trucks like at garage entrances. Heavily loaded pavement areas that are not designed to accommodate these conditions often experience localized pavement failures, particularly if flexible pavement sections are used.

The minimum recommended thickness for both hot mixed asphalt concrete (HMAC) and reinforced Portland cement concrete (PCC) pavement sections are presented in the table below for the described light, moderate and special traffic condition.

Component	Light-Duty Pavement		Moderate-Duty Pavement		Special-Duty Pavement
	Rigid	Flexible	Rigid	Flexible	Rigid
Reinforced Portland Cement Concrete (PCC)	5 inches		6 inches		7 inches
Hot Mixed Asphalt Concrete (HMAC)		3 inches		4 inches	
Crushed Limestone Base (Dense Graded Aggregate)	5 inches	8 inches	5 inches	8 inches	5 inches

The Portland cement concrete should be air-entrained and conform to ASTM C-94 (Standard Specifications for Ready-Mixed Concrete) and have a minimum compressive strength of 4,000 pounds per square inch. Reinforcing should meet the requirements of ACI.

Hot mix asphalt concrete and Dense Graded Aggregate should meet the requirements of the Kentucky Transportation Cabinet. The top inch and a half of asphalt should be a surface mix, the remainder being a base mix.

5.7 ---------- Temporary Earth Slopes or Cuts

Temporary excavations required for foundation and utility installation should be limited to a maximum depth of 4 feet if constructed with vertical faces, without the need for benching or sloping. For excavations exceeding 4 feet in depth, appropriate benching, sloping, or shoring must be implemented to ensure stability and worker safety.

If vertical cuts deeper than 4 feet are necessary, temporary shoring systems designed to withstand short-term earth pressures may be utilized. The shoring system should be selected based on site-specific soil conditions, excavation depth, and the anticipated duration of exposure.

All excavation activities must be conducted in strict compliance with Occupational Safety and Health Administration (OSHA) regulations, particularly those outlined in 29 CFR 1926 Subpart P – Excavations, to minimize the risk of soil instability and ensure safe working conditions. Soil classification and the corresponding protective system requirements should be determined by a qualified individual before excavation begins.

5.8 Limitations

To ensure proper foundation performance, it is strongly recommended that Cornerstone Geotech Services LLC should be retained to monitor all foundation bearing surfaces and compaction activities. Our engineers and technicians will provide on-site verification to confirm that subsurface conditions align with those identified in the geotechnical investigation. Until these inspections are completed, this report should be considered preliminary, as field conditions may vary.

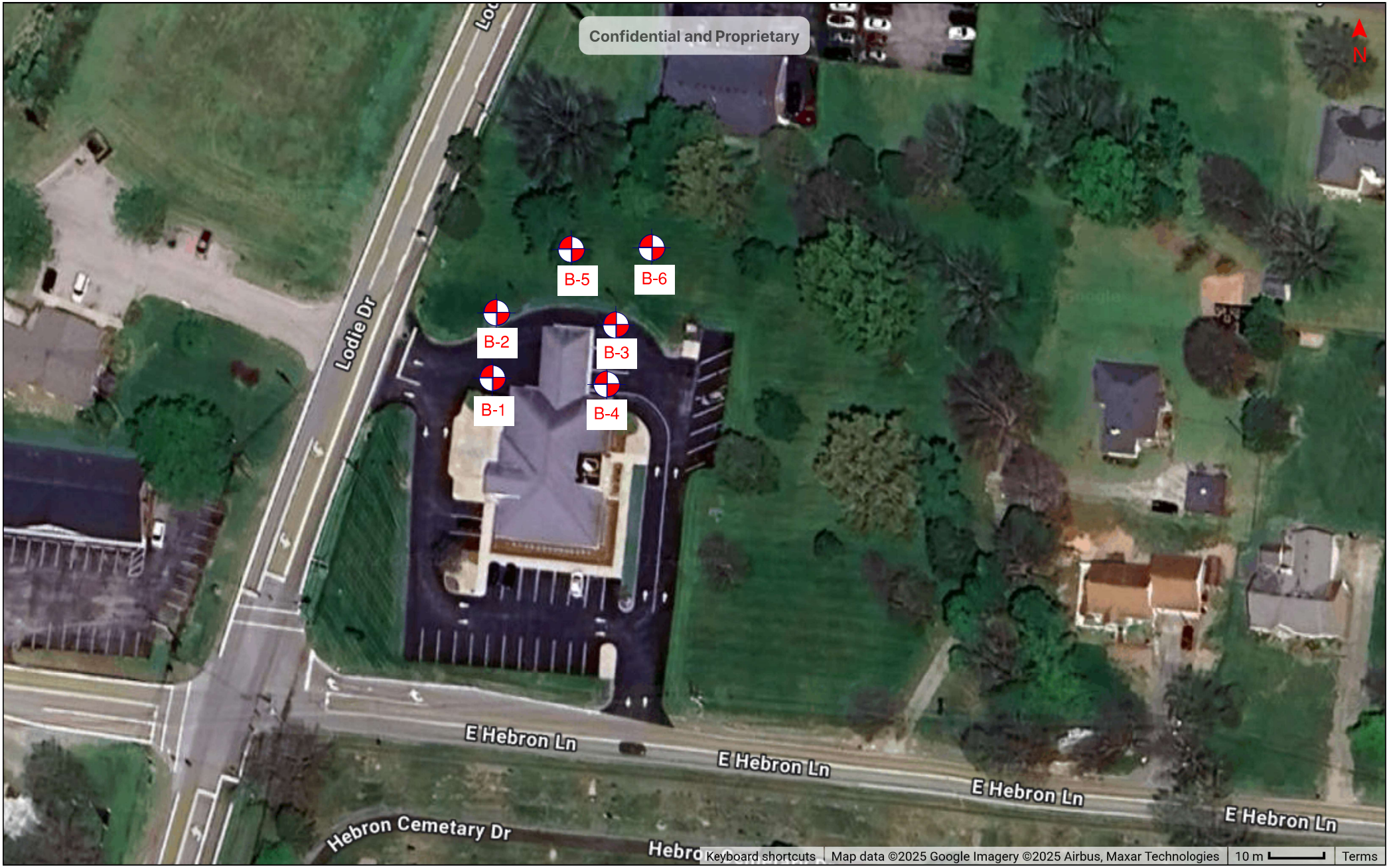
The conclusions and recommendations in this report are based on soil and rock conditions encountered at the locations of the borings. However, due to the natural variability of subsurface materials, conditions may differ between or beyond the borings. If unexpected soil conditions arise during construction, a representative from Cornerstone Geotech Services LLC should evaluate the site to determine if any design modifications are necessary.

This study was conducted specifically for the proposed development at the designated locations. The recommendations provided are based on the assumption that construction will begin within a reasonable timeframe after this investigation. If the project is relocated, significantly modified, delayed, or if any of our assumptions are incorrect, these recommendations may no longer be valid, and the geotechnical engineer should be consulted to reassess the site conditions.

This report addresses only the geotechnical and engineering properties of the subsurface materials. It does not include environmental assessments, contamination testing, or hazardous material evaluations. If environmental concerns exist, a separate environmental study should be conducted.



CORNERSTONE Strong team. Smart solutions.	PREPARED BY Cornerstone Louisville, Kentucky	PROJECT Name: Teamsters Local 2727 Shepherdsville Addition Number: CGS-25-0247	LOCATION 4810 N Preston Hwy, Hebron Estates, KY 40165 Hebron Estates, KY	SYMBOL KEY Soil Boring



CORNERSTONE Strong team. Smart solutions.	**PREPARED BY** Cornerstone Louisville, Kentucky	**PROJECT** Name: Teamsters Local 2727 Shepherdsville Addition Number: CGS-25-0247	**LOCATION** 4810 N Preston Hwy, Hebron Estates, KY 40165 Hebron Estates, KY	**SYMBOL KEY** Soil Boring

CORNERSTONE GEOTECH SERVICES

SOIL DESCRIPTION TERMINOLOGY

Soils are identified and classified in this report according to the Unified Classification System with the following modifiers:

RELATIVE DENSITY OF GRANULAR SOILS

Description	Blows/Foot
Very loose	0 to 4
Loose	5 to 10
Medium dense	11 to 30
Dense	31 to 50
Very dense	51 to 80
Extremely dense	81+

CONSISTENCY OF COHESIVE SOILS

Description	N-value	q_u (tsf)
Very soft	0 to 2	0 to 0.25
Soft	3 to 4	0.26 to 0.50
Medium stiff	5 to 8	0.51 to 1.0
Stiff	9 to 15	1.1 to 2.0
Very stiff	16 to 30	2.1 to 4.0
Hard	>30	4.1 to 8.0
Very hard		8.1+

PARTICAL SIZES

Components	Size or Sieve No.
Boulders	Over 12 inches
Cobbles	3 to 12 inches
Gravel – coarse	¾ to 3 inches
Gravel – fine	No. 4 to ¾ inch
Sand – coarse	No. 10 to No. 4
Sand – medium	No. 40 to No. 10
Sand – fine	No. 200 to No. 40
Fines (silt and clay)	Finer than No. 200

SOIL MOISTURE

	Descriptive Term
Dry	Dry of standard proctor optimum
Moist	Near standard proctor optimum
Wet	Wet of standard proctor optimum
Saturated	Free water in sample

ROCK DESCRIPTION TERMINOLOGY

The Rock Quality Determination (Deere et. Al., 1969) method of determining rock quality as reported here was obtained by summing up the total length of core recovered in each run, counting only those pieces of core which are four inches (10 cm.) in length or longer and which are hard and sound. The sum is then represented as a percentage over the length of the run. If the core is broken by handling or by the drilling process, the fresh broken pieces are fitted together and counted as one piece provided that they the requisite length of four inches (10 cm.). RQD is reported as a percentage.

RELATIONSHIP BETWEEN RQD AND ROCK QUALITY

RQD (%)	Description of Rock Quality
0 to 25	Very poor
26 to 50	Poor
51 to 75	Fair
76 to 90	Good
91 to 100	

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Teamsters Local 2727 Shepherdsville Addition

4810 N Preston Hwy, Hebron Estates, KY 40165

B-1

Drilling Co.:	Cornerstone	Project No.:	CGS-25-0247	Remarks:
Driller:	R. Gonzalez	Date Drilled:	10/13/2025	
Logged By:	Mudasir Stanikzai	Boring Depth:	-	
Equipment:	Diedrich D-25	Boring Elevation:	517.7'	
Hammer Type:	Auto	Coordinates:	38.050727, -85.677540	
Drilling Method:	Auger	▽ Water Level at Time of Drilling	N/A	▼ Delayed Water Level N/A
		Cave-in At Time Of Drilling	N/A	Delayed Water Observation Date -

Depth (ft)	Graphic Log	USCS	Visual Classification and Remarks	AASHTO	USDA	Samples: Depth of Sample	Sample Number	In-Situ Moisture	Blow Counts	Uncorrected	N-Value	Recovery Length (in)	% RQD	Sample Graphic	N60
			Asphalt 0.3												
			Crushed Stone 0.6												
		CL	Medium Stiff, Brown, Low to Medium Plasticity, Moist, **Lean Clay** (CL)			1 ft	S-1	25.4	3-3-3	6	8	16			8
			3.5			3.5 ft									
			Stiff, Brown, Low to Medium Plasticity, Moist, **Lean Clay** (CL)				S-2	22.4	1-3-4	7	9	16			9
5			6.1			6 ft	S-3		50/1"	50/1"					

AUGER REFUSAL AT 6.1 FEET

CL	SPT - Standard Penetration
Asphalt	-

Depth	Comment
-	-
-	-

Project #: CGS-25-0247

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Teamsters Local 2727 Shepherdsville Addition

4810 N Preston Hwy, Hebron Estates, KY 40165

B-2

Drilling Co.:	Cornerstone	Project No.:	CGS-25-0247	Remarks:
Driller:	R. Gonzalez	Date Drilled:	10/13/2025	
Logged By:	Mudasir Stanikzai	Boring Depth:	-	
Equipment:	Diedrich D-25	Boring Elevation:	516.6'	
Hammer Type:	Auto	Coordinates:	38.050840, -85.677531	
Drilling Method:	Auger	▽ Water Level at Time of Drilling	N/A	▼ Delayed Water Level N/A
		Cave-in At Time Of Drilling	N/A	Delayed Water Observation Date -

Depth (ft)	Graphic Log	USCS	Visual Classification and Remarks	AASHTO	USDA	Samples: Depth of Sample	Sample Number	In-Situ Moisture	Blow Counts	Uncorrected	N-Value	Recovery Length (in)	% RQD	Sample Graphic	N60
			Topsoil 0.5												
		CL-ML	Medium Stiff, Brown, Moist, **Silty Clay** (CL-ML),			1 ft	S-1	26	2-2-2	4	5	16			5
		CL	Stiff, Brown, Moist, **Lean Clay** (CL), 3.5			3.5 ft	S-2	22	3-5-3	8	10	16			10
5			6.1			6 ft	S-3	9.3	50/1"	50/1"					

AUGER REFUSAL AT 6.1 FEET

Topsoil	CL
CL-ML	SPT - Standard Penetration Test

Depth	Comment
-	-
-	-

Project #: CGS-25-0247

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Teamsters Local 2727 Shepherdsville Addition

4810 N Preston Hwy, Hebron Estates, KY 40165

B-3

Drilling Co.:	Cornerstone	Project No.:	CGS-25-0247	Remarks:
Driller:	R. Gonzalez	Date Drilled:	10/13/2025	
Logged By:	Mudasir Stanikzai	Boring Depth:	-	
Equipment:	Diedrich D-25	Boring Elevation:	517.8'	
Hammer Type:	Auto	Coordinates:	38.050817, -85.677281	
Drilling Method:	Auger	▽ Water Level at Time of Drilling	N/A	▼ Delayed Water Level N/A
		Cave-in At Time Of Drilling	N/A	Delayed Water Observation Date -

Depth (ft)	Graphic Log	USCS	Visual Classification and Remarks	AASHTO	USDA	Samples: Depth of Sample	Sample Number	In-Situ Moisture	Blow Counts	Uncorrected	N-Value	Recovery Length (in)	% RQD	Sample Graphic	N60
			Asphalt 0.5												
			Crushed Stone 0.8												
		CL	Medium Stiff, Brown, Moist, **Lean Clay** (CL),			1 ft	S-1	23.5	4-3-3	6	8	16			8
			3.5			3.5 ft									
		CH	Medium Stiff, Brown, Medium Plasticity, Moist, **Fat Clay** with **Sand** (CH)				S-2	36.2	2-2-4	6	8	16			8
5			6.1			6 ft	S-3	5	50/1"	50/1"					

AUGER REFUSAL AT 6.1 FEET

Asphalt	CH
CL	SPT - Standard Penetration Test

Depth	Comment
-	-
-	-

Project #: CGS-25-0247

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Teamsters Local 2727 Shepherdsville Addition

4810 N Preston Hwy, Hebron Estates, KY 40165

B-4

Drilling Co.:	Cornerstone	Project No.:	CGS-25-0247	Remarks:
Driller:	R. Gonzalez	Date Drilled:	10/13/2025	
Logged By:	Mudasir Stanikzai	Boring Depth:	-	
Equipment:	Diedrich D-25	Boring Elevation:	518.2'	
Hammer Type:	Auto	Coordinates:	38.050719, -85.677302	
Drilling Method:	Auger	▽ Water Level at Time of Drilling	N/A	▼ Delayed Water Level N/A
		Cave-in At Time Of Drilling	N/A	Delayed Water Observation Date -

Depth (ft)	Graphic Log	USCS	Visual Classification and Remarks	AASHTO	USDA	Samples: Depth of Sample	Sample Number	In-Situ Moisture	Blow Counts	Uncorrected	N-Value	Recovery Length (in)	% RQD	Sample Graphic	N60
			Asphalt 0.3												
			Crushed Stone 0.6												
		CL	Stiff, Brown, Low Plasticity, Moist, **Lean Clay** (CL)			1 ft	S-1	22.5	2-3-5	8	10	16			10
			3.5			3.5 ft									
			Stiff, Brown, Moist, With Ferromagnesian Nodules, **Lean Clay** with **Sand** (CL)				S-2	14.5	3-4-6	10	13	18			13
5						6 ft									
			6.2				S-3	37.1	50/2"	50/2"					

AUGER REFUSAL AT 6.2 FEET

Asphalt	CL
CL	SPT - Standard Penetration Test

Depth	Comment
-	-
-	-

Project #: CGS-25-0247

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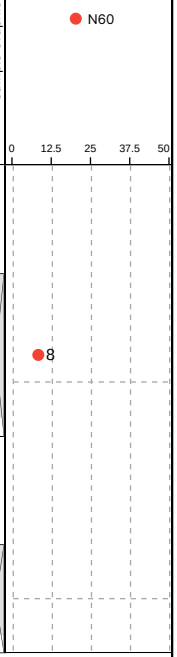
4810 N Preston Hwy, Hebron Estates, KY 40165

B-5

Drilling Co.:	Cornerstone	Project No.:	CGS-25-0247	Remarks:
Driller:	R. Gonzalez	Date Drilled:	10/13/2025	
Logged By:	Mudasir Stanikzai	Boring Depth:	-	
Equipment:	Diedrich D-25	Boring Elevation:	516.0'	
Hammer Type:	Auto	Coordinates:	38.050941, -85.677374	
Drilling Method:	Auger	▽ Water Level at Time of Drilling	N/A	▼ Delayed Water Level N/A
		Cave-in At Time Of Drilling	N/A	Delayed Water Observation Date -

Depth (ft)	Graphic Log	USCS	Visual Classification and Remarks	AASHTO	USDA	Samples: Depth of Sample	Sample Number	In-Situ Moisture	Blow Counts	Uncorrected	N-Value	Recovery Length (in)	% RQD	Sample Graphic
0			**Topsoil** 0.5											
		CL	Medium Stiff, Brown, Low Plasticity, Moist, **Lean Clay** (CL)			1 ft	S-1	21.3	2-3-3	6	8	16		
		CH	Hard, Brown, Low to Medium Plasticity, Moist, **Fat Clay** (CH) 4.5			3.5 ft	S-2	25.7	5-2-50/0"	50/0"		10		

AUGER REFUSAL AT 4.5 FEET



Project #: CGS-25-0247

Topsoil	CL
CH	SPT - Standard Penetration Test

Depth	Comment
-	-
-	-

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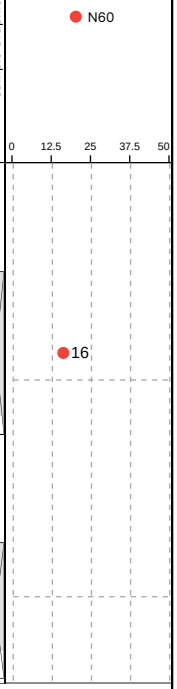
4810 N Preston Hwy, Hebron Estates, KY 40165

B-6

Drilling Co.:	Cornerstone	Project No.:	CGS-25-0247	Remarks:
Driller:	R. Gonzalez	Date Drilled:	10/13/2025	
Logged By:	Mudasir Stanikzai	Boring Depth:	-	
Equipment:	Diedrich D-25	Boring Elevation:	517.6'	
Hammer Type:	Auto	Coordinates:	38.050944, -85.677204	
Drilling Method:	Auger	▽ Water Level at Time of Drilling	N/A	▼ Delayed Water Level N/A
		Cave-in At Time Of Drilling	N/A	Delayed Water Observation Date -

Depth (ft)	Graphic Log	USCS	Visual Classification and Remarks	AASHTO	USDA	Samples: Depth of Sample	Sample Number	In-Situ Moisture	Blow Counts	Uncorrected	N-Value	Recovery Length (in)	% RQD	Sample Graphic
			Topsoil 0.5											
		CL	Very Stiff, Brown, Low Plasticity, Moist, **Lean Clay** (CL) 3.5			1 ft	S-1	21	3-4-8	12	16	16		
		CH	Hard, Brown, Medium Plasticity, Moist, **Sandy Fat Clay** with **Gravel** (CH) 4.8			3.5 ft	S-2	27.7	4-8-50/3"	50/3"		12		

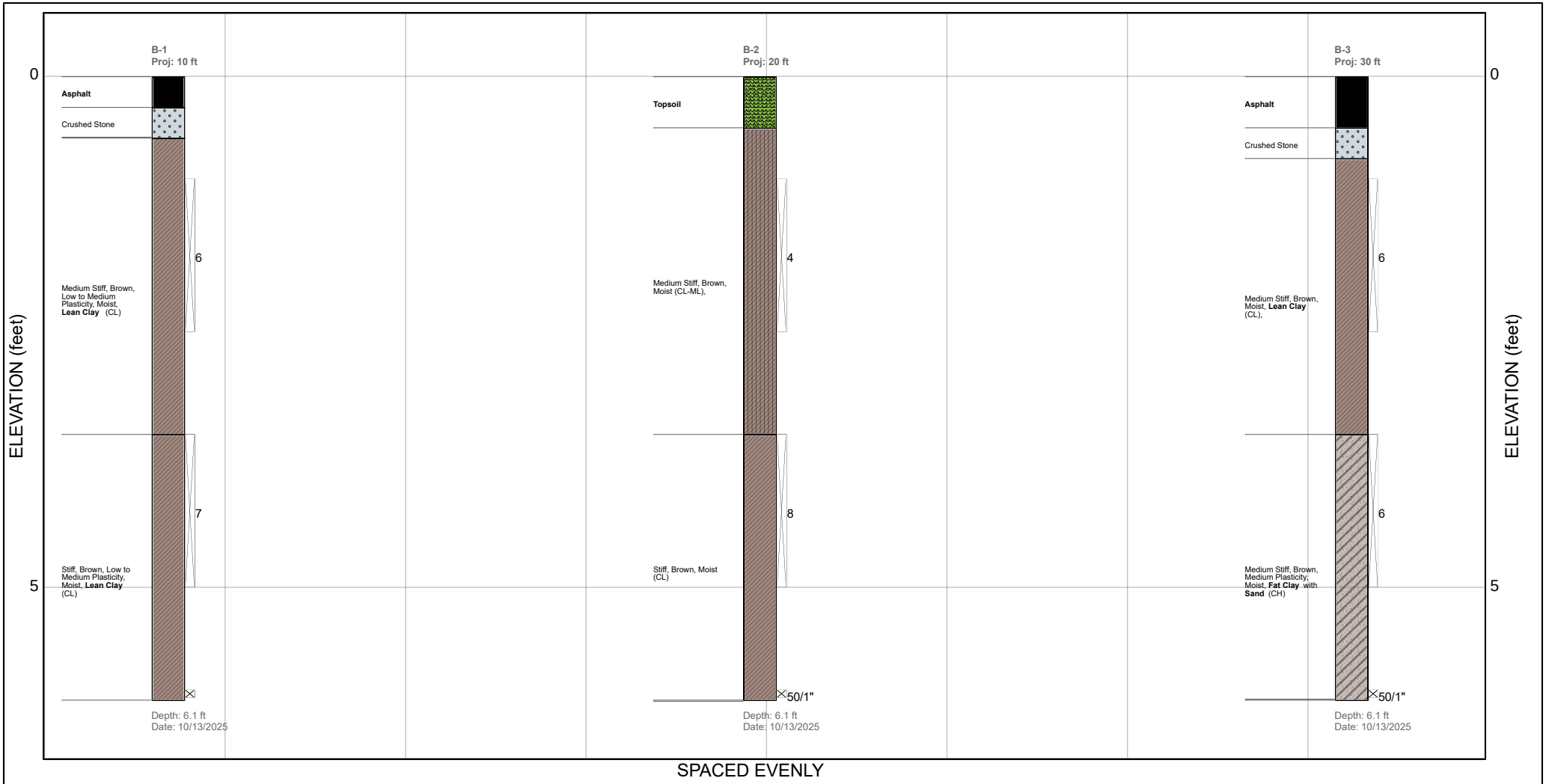
AUGER REFUSAL AT 4.8 FEET



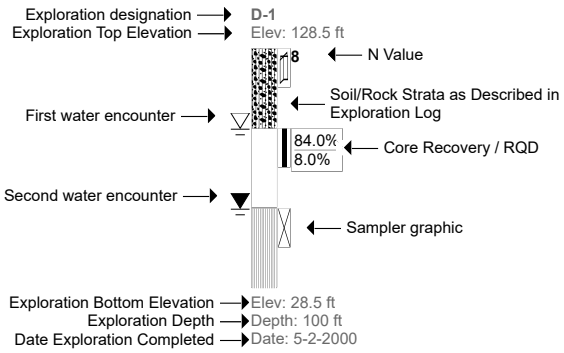
Project #: CGS-25-0247

Topsoil	CL
CH	SPT - Standard Penetration Test

Depth	Comment
-	-
-	-



EXPLORATION LOG LEGEND



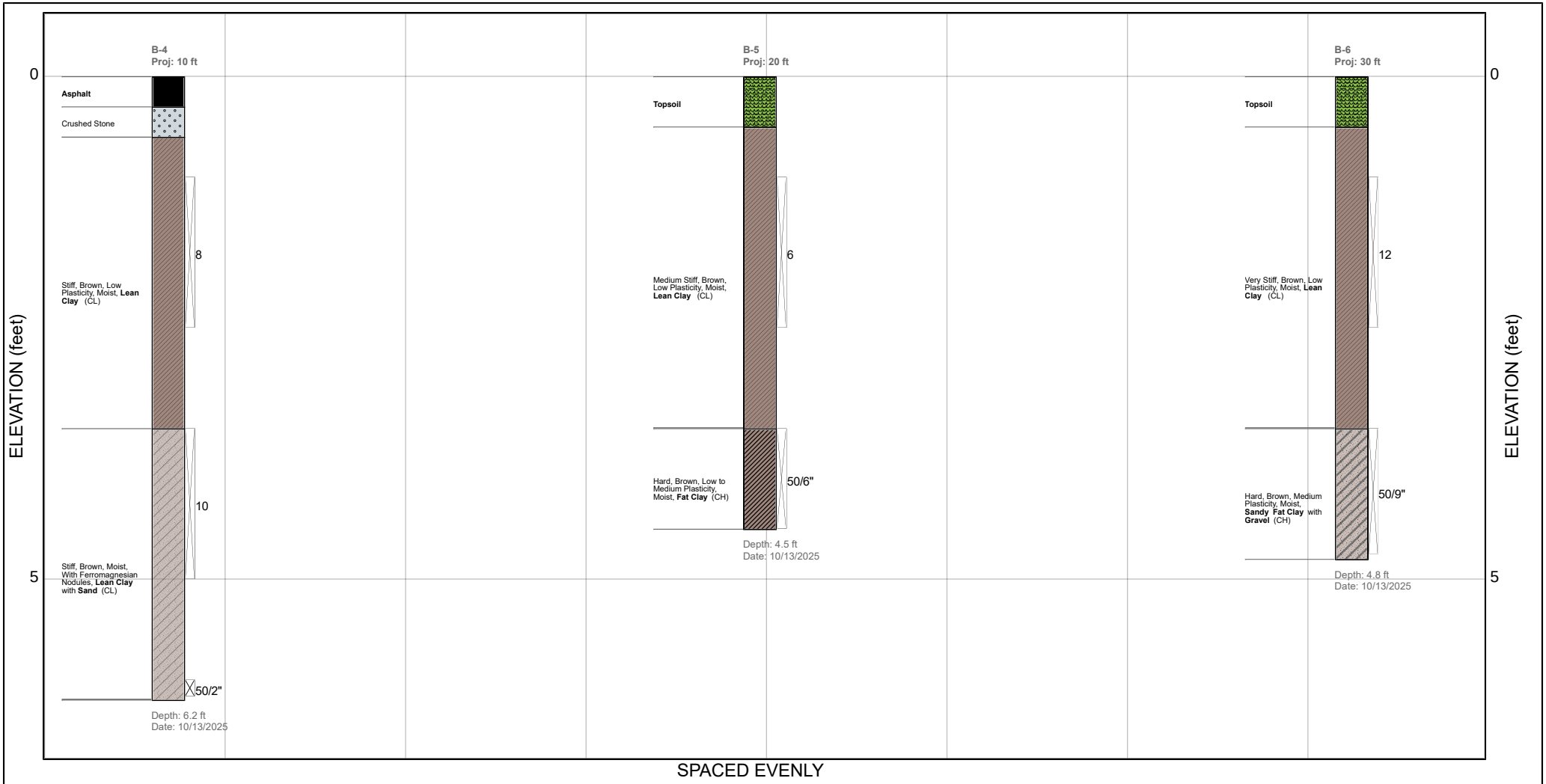
LEGEND KEY

- Asphalt
- CH
- CL
- CL-ML
- Gravel
- Topsoil

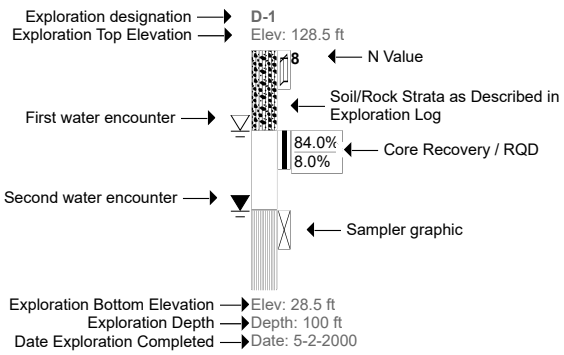
Teamsters Local 2727 Shepherdsville Addition
4810 N Preston Hwy, Hebron Estates, KY 40165

CROSS SECTIONS REPORT

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EXPLORATION LOG LEGEND



LEGEND KEY

- Asphalt
- CH
- CH
- CL
- CL
- Gravel
- Topsoil

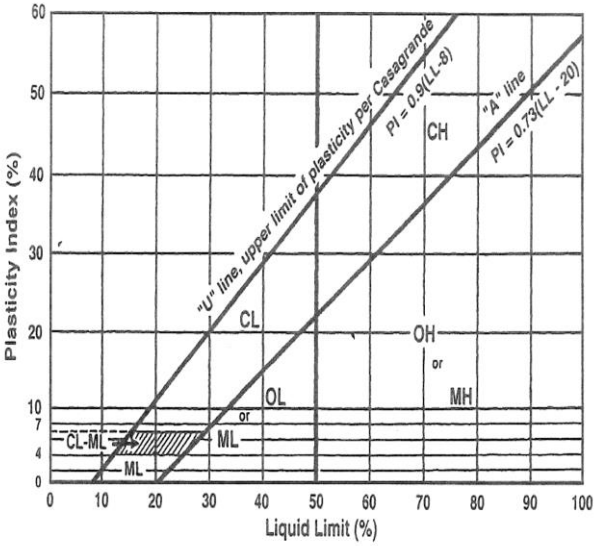
Teamsters Local 2727 Shepherdsville Addition
4810 N Preston Hwy, Hebron Estates, KY 40165

CROSS SECTIONS REPORT

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CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES

ASTM D2487 and D2488

Major Divisions			Group Symbols	Typical Names	Laboratory Classification Criteria		
Coarse-grained soils (More than half of material is *larger* than No. 200 sieve size)	**Gravels** (More than half of coarse fraction larger than No. 4 sieve)	**Clean Gravels** (Little or no fines)	**GW**	Well-graded gravels, gravel-sand mixtures, little or no fines	Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller that No. 200 sieve size), coarse-grained soils are classified as follows: Less than 5 percent GW, GP, SW, SP More than 12 percent GM, GC, SM, SC 5 to 12 percent *Borderline* cases requireing dual symbols[b]	$C_u=D_{60}/D_{10}$ greater than 4 $C_u=(D_{30})^2/(D_{10}\times D_{60})$ between 1 and 3	
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW	
		Gravels with fines (Appreciable amount of fines)	**GM**[a] d, u	Silty gravels, gravel-sand-silt mixtures		Atterberg limits below "A" line with P. I. less than 4	Above "A" line with P. I. between 4 and 7 are *borderline* cases requireing us of dual symbols
			GC	Clayey gravels, gravel-sand-clay mixtures		Atterberg limits below "A" line with P. I. greater than 7	
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	**Clean Sands** (Little or no fines)	**SW**	Well-graded sands, gravelly sands, little or no fines		$C_u=D_{60}/D_{10}$ greater than 6 $C_u=(D_{30})^2/(D_{10}\times D_{60})$ between 1 and 3	
			SP	Poorly graded sands, gravelly sands, little or no fines		Not meeting all gradation requirements for SW	
		Sands with fines (Appreciable amount of fines)	**SM**[a] d, u	Silty sands, sand-silt mixtures		Atterberg limits above "A" line or P.I. < 4	Limits plotting in hatched zone with P.I. between 4 and 7 are *borderline* cases requireing use of dual symbols
			SC	Clayey sands, sand-clay mixtures		Atterberg limits above "A" lime with P.I. > 7	
Fine-grained soils (More than half meterial is smaller than No. 200 sieve)	Silts and clays (Liquid limit less than 50)		**ML**	Inorganic silts and very fine sands, silty or clayey fine sands, or clayey silts with slight plasticity		
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays			
			OL	Organic silts and organic siltyclays of low plasticity			
	Silts and clays (Liquid limit less that 50)		**MH**	Inorganic silts, micaceous or diatomaceous fine sand or silty soils, elastic silts			
			CH	Inorganic slays of high plasticity, fat clays			
			OH	Organic clays of medium to high plasticity, organic silts			
	Highly organic soils		**Pt**	Peat and other highly organic soils			

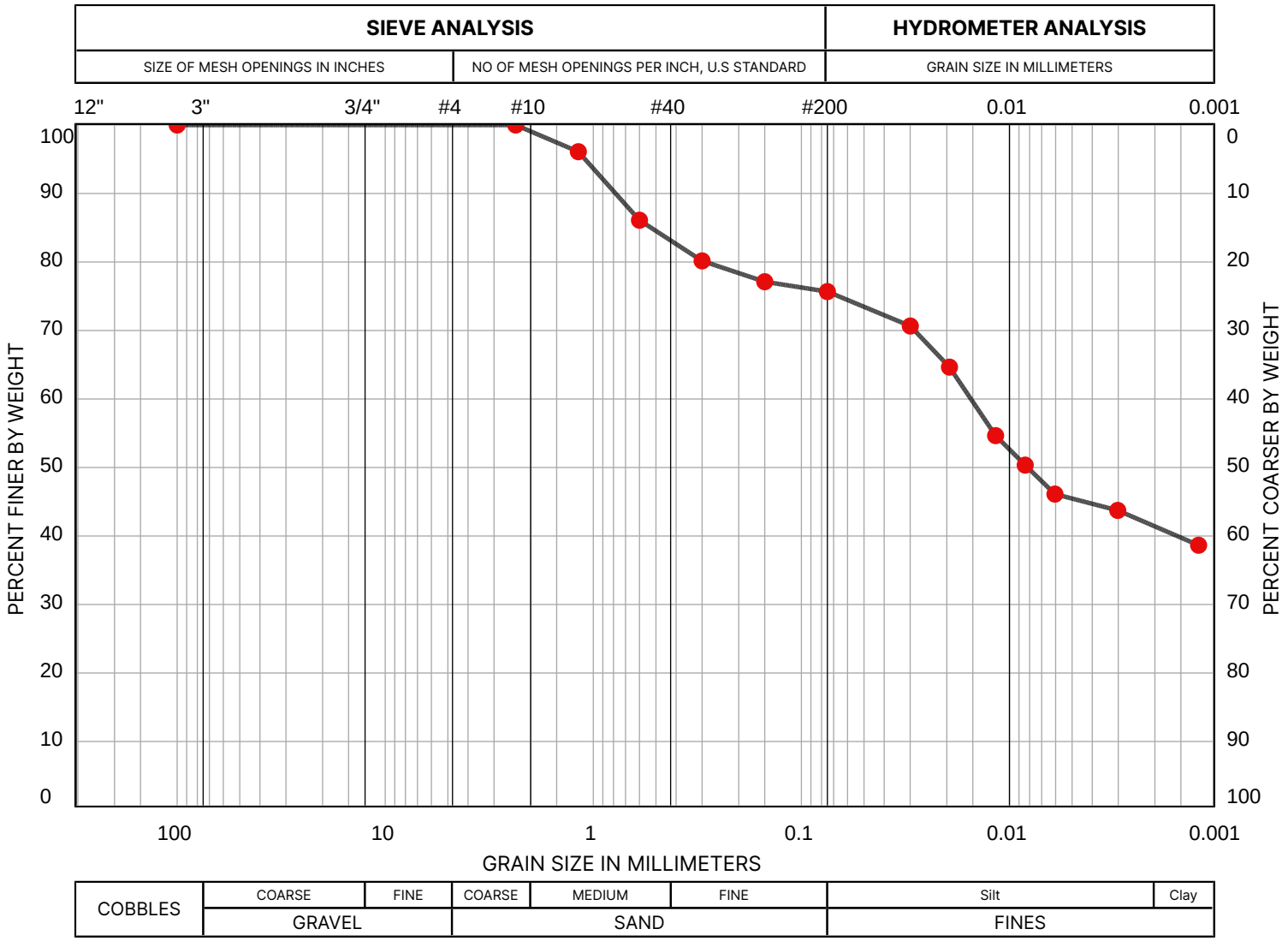
Plasticity Chart

[a] Division of GM and SM groups into subdivisions of d and u are for roads and airfields only. Subdivision is based on Atterberg limits :suffix d used when L. L. is 28 or less and the P. I. is 6 or les; the suffix u used when L. L. is greater than 28.

[b] Borderline classifications, used for soils possessing characeristics of two groups, are designated by combinations of group symbols. For exampls: GW-GC, well-graded gravel-sand misture with clay binder.

GRAIN SIZE DISTRIBUTION TEST RESULTS

B-2, 3.5'



TEST RESULTS

SIEVE SIZE	% PASSING
4"	100
#8	100
#16	96
#30	86
#50	80
#100	77
#200	76

SPECIMEN DESCRIPTION

DESCRIPTION **Lean Clay**

USCS CLASS. **CL**

AASHTO CLASS. **A-6**

ATTERBERG LIMITS

LL	PL	PI
39	18	21

COEFFICIENTS

D10	D30	D60	C_u	C_c	D85	D15
		0.02			0.53	

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PROJECT Teamsters Local 2727 Shepherdsville Addition **PROJECT NO.** CGS-25-0247

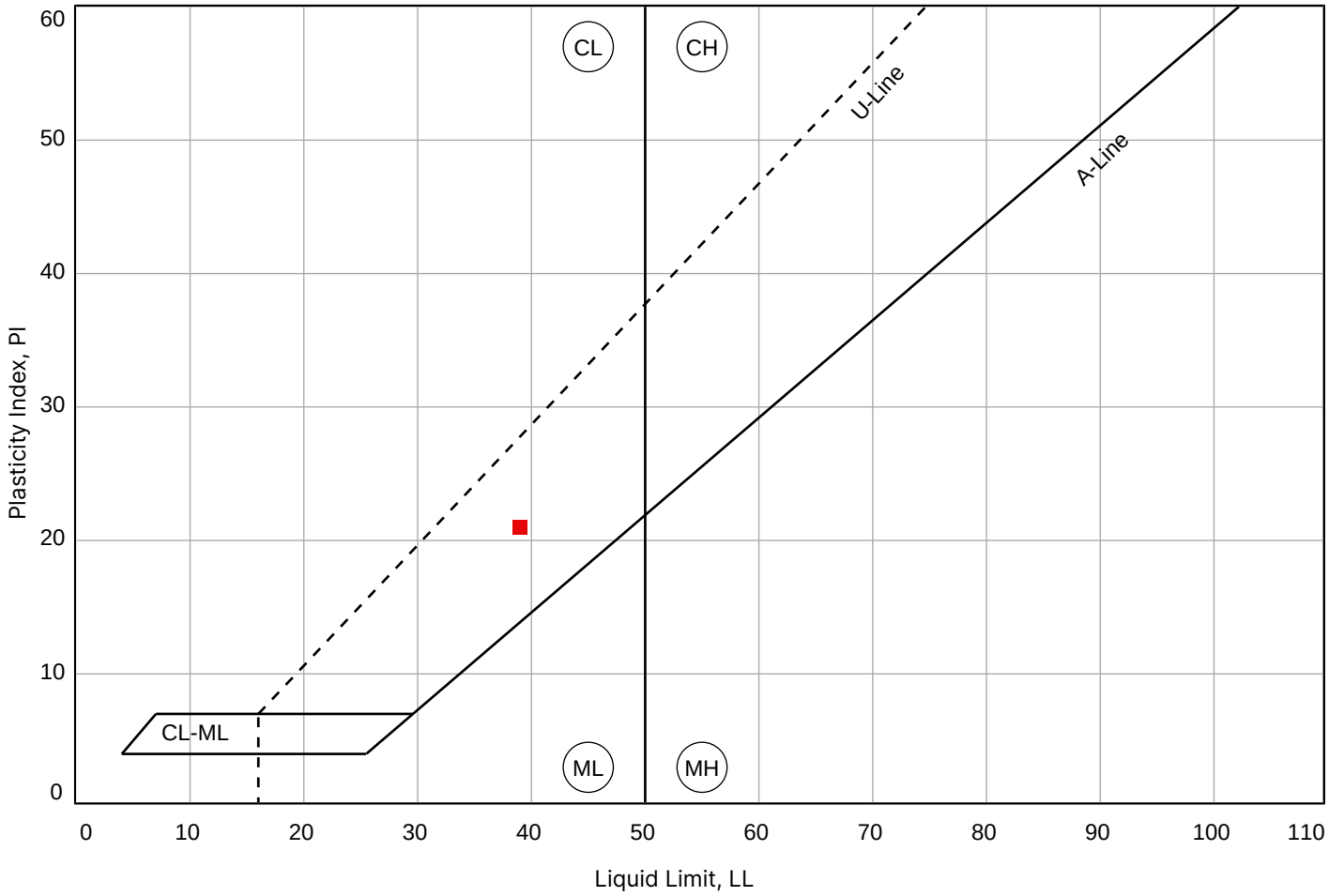
CLIENT Tower Pinkster **FIGURE NO.** -

LOCATION 4810 N Preston Hwy, Hebron Estates, KY 40165

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ATTERBERG LIMITS TEST RESULTS

PROJECT Teamsters Local 2727 Shepherdsville Addition
CLIENT Tower Pinkster
PROJECT NO. CGS-25-0247
LOCATION 4810 N Preston Hwy, Hebron Estates, KY 40165



EXPLORATION	SAMPLE NUMBER	DEPTH	UNIFIED SOIL CLASSIFICATION SYSTEM (USCS) GROUP NAME	USCS SYMBOL	LL	PL	PI	FINES (%)	NAT MC (%)	TEST BY/RVW	TEST STD	TEST NOTE
B-2		3.5	Lean Clay	CL	39	18	21	76	22		D4318	A-6

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Laboratory Results Summary

PROJECT Teamsters Local 2727 Shepherdsville Addition **PROJECT NO.** CGS-25-0247
CLIENT Tower Pinkster **LOCATION** 4810 N Preston Hwy, Hebron Estates, KY 40165

Boring ID	Depth (ft)	Moisture Content (%)
B-1	1	25.4
B-1	3.5	22.4
B-2	1	26
B-2	3.5	22
B-2	6	9.3
B-3	1	23.5
B-3	3.5	
B-3	6	5
B-4	1	22.5
B-4	3.5	14.5
B-4	6	37.1
B-5	1	21.3
B-5	3.5	25.7
B-6	1	21
B-6	3.5	27.7

SECTION 02 4119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. Section Includes:

1. Selective Demolition work included in project.
2. Project demolition conditions.
3. Electrical, Plumbing and HVAC Demolition.
4. Utility demolition.
5. Subsurface filling.
6. Protection.
7. Sawcutting and Demolition Through Existing Terrazzo Flooring.

1.2 WORK INCLUDED

A. The extent of demolition work shown on drawings and specified herein, including, but not limited to:

1. Opening of exterior walls for new doors, windows, grilles, louvers, mechanical, and electrical and providing weather-tight enclosures.
2. Opening of interior walls, ceilings and floors necessary for proper installation of new materials, equipment, mechanical or electrical items.
3. Removing interior walls, ceilings, floor finishes.
4. Removing doors and frames.
5. Removing casework and equipment.
6. Removing existing HVAC system and components, both exposed to view and concealed.
7. Removing existing plumbing fixtures, piping and components, both exposed to view and concealed.
8. Removing existing lighting and electrical distribution, switches, outlets, conduit and other devices both exposed to view and concealed.
9. Complete removal of existing building and all components.

B. Interior demolition includes complete wrecking of interior partitions, finishes and structures and removal and disposal of demolished materials, as shown on drawings and herein specified.

C. The Owner shall have the option of retaining any item removed. The Contractor shall deliver these items to the Owner's designated storage area. Any items not retained by the Owner shall be disposed of offsite by the Contractor. All items are to remain property of the Owner unless specifically designated otherwise.

D. Some removed items are to be salvaged for re-use. Drawings indicate extent of such work.

PART 2 - PRODUCTS

A. Not Applicable

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PART 3 - EXECUTION

3.1 PROJECT DEMOLITION CONDITIONS

A. Conditions of Structures:

1. The Owner assumes no responsibility for actual conditions of structures to be demolished.

B. Conditions of the structure existing at time of inspection for bidding purposes will be maintained by Owner in so far as possible. However, variations within structure may occur by Owner's removal and salvage operations prior to start of demolition work.

C. Pollution Controls:

1. Use water sprinkling, temporary enclosures, and other suitable methods to limit dust and dirt rising and scattering in air to lowest practical level.
2. Comply with governing regulations pertaining to environmental protection.

D. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.

E. Clean adjacent structures and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to condition existing prior to the start of work.

F. Partial Removal:

1. Items of salvable value to Contractor, and not retained by Owner, may be removed from structure as work progresses. Salvaged items must be transported from site as they are removed.
2. Storage or sale of removed items on site will not be permitted.
3. Store items noted on drawings and specified to be salvaged for use in the project, so as to prevent damage or deterioration.

G. Disposal of Demolished Materials:

1. Remove from site debris, rubbish, and other materials resulting from demolition operations.
2. Pay all fees related to removal and dumping.
3. Remove and dispose of interior demolition debris off job site.
4. Burning of removed materials from demolished structures will not be permitted.
5. Transport materials removed from demolished structures and dispose of off site.

H. Traffic:

1. Conduct demolition operations and removal of debris to ensure minimum interference with roads, streets, walks, occupied areas, and other adjacent occupied or used facilities.
2. Do not close or obstruct streets, walks or other occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

I. Protections:

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1. Ensure safe passage of persons around or through area of demolition. Conduct operations to prevent injury to adjacent buildings, structures, other facilities, and persons. Provide protection in accordance with ANSI/NFPA 241.
2. Erect temporary covered passageways as required by the Owner or authorities having jurisdiction.

J. Use of explosives will not be permitted.

K. Provide temporary enclosures at doors and other penetrations in walls, necessitated by weather and demolition conditions, and where dust proof partitions are indicated. Enclosures shall be constructed with fire retardant treated lumber, insulated and painted. Joints shall be taped and caulked to prevent dust and debris from migrating beyond construction areas. Maintain enclosures in good repair and remove when no longer needed. Extend partitions to deck.

L. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement or collapse of structures to be demolished and adjacent facilities to remain.

M. Repair any damage to property which is to remain in use, or that of any person, or persons on or off site caused by the demolition work without additional expense to Owner.

N. Use of jackhammers during normal operating hours of the facility will not be permitted.

O. Where a portion of construction (walls, floors, ceilings, etc.) is indicated to be removed, demolition shall include the removal of any and all items either surface-mounted on it, or concealed within it, unless otherwise indicated to remain or be salvaged for reuse.

3.2 ELECTRICAL

A. Visit the site before submitting a bid to observe existing conditions.

B. Work in existing building shall be scheduled well in advance with the Owner. Work shall be performed at such times and under such conditions as suit the convenience of the Owner. Plan the Work to minimize disruption of normal operations.

C. Remove wiring devices, fixtures, components, electrical equipment, conductors, boxes and conduits not required to remain in service in remodeled areas when this Project is complete.

D. Reconnect circuits to other panelboards when necessary to complete the renovation.

E. Remove existing conduit and wire from areas to be remodeled, back to panelboard, cabinet or junction box. Where such Work would not be possible without disturbing areas not being renovated, consult with the Architect prior to performing the Work.

F. When outlets are covered up or are otherwise rendered inaccessible, all wiring shall be removed to the source. If a circuit that must remain in service is interrupted, it shall be reconnected by the most inconspicuous means so that it remains operational, with the same capacity as before. All building surfaces damaged, and openings left by removal of boxes, conduit, or other equipment shall be repaired. All holes left in junction boxes, switches, panels and other equipment shall be closed.

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G. Where new openings are cut and concealed conduits or other electrical items are encountered, they shall be removed or relocated as required. Where conduit to be removed stubs through floors, walls, and ceilings, such conduit shall be removed to the point where the finished surfaces can be patched so that no evidence of the former installation remains.

H. Where a circuit is interrupted by removal of a device or fixture from that circuit, install wire and conduit as required to restore service to the remaining devices and fixtures on that circuit. If the interrupted piping is concealed in walls or under floors, an alternate route may be required.

I. Lighting fixtures, wiring devices, panelboards, and conductors removed shall be offered to the Owner's Representative. If he chooses to retain these items or a part of these items, turn those chosen over to him. Items rejected by Owner's Representative shall be removed from the project site by the Contractor.

3.3 PLUMBING

A. Visit the site before submitting a bid to observe existing conditions.

B. Work in existing building shall be scheduled well in advance with the Owner. Work shall be performed at such times and under such conditions as suit the convenience of the Owner. Plan the Work to minimize disruption of normal operations.

C. Remove piping, fixtures, components, valves, insulation and fittings not required to remain in service in remodeled areas when this Project is complete.

D. Reconnect piping to provide service when required to complete the renovation.

E. Remove existing piping from areas to be remodeled, back to service branch. Where such Work would not be possible without disturbing areas not being renovated, consult with the Architect prior to performing the Work.

F. When outlets are covered up or are otherwise rendered inaccessible, all piping shall be removed to the source. If a fixture that must remain in service is interrupted, it shall be reconnected by the most inconspicuous means so that it remains operational, with the same capacity as before. All building surfaces damaged, and openings left by removal of fixtures, piping, or other equipment shall be repaired. All holes left shall be closed.

G. Where new openings are cut and concealed piping or other plumbing items are encountered, they shall be removed or relocated as required. Where piping to be removed stubs through floors, walls, and ceilings, such piping shall be removed to the point where the finished surfaces can be patched so that no evidence of the former installation remains.

H. Where piping is interrupted by removal of a piping or fixture, install piping as required to restore service to the remaining fixtures on that service line. If the interrupted circuit is concealed in walls or under floors, an alternate route may be required. If the interrupted piping is concealed in walls or under floors an alternate route may be required.

I. Plumbing fixtures, valves, and gages removed shall be offered to the Owner's Representative. If he chooses to retain these items or a part of these items, turn those chosen over to him. Items rejected by Owner's Representative shall be removed from the project site by the contractor.

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3.4 HVAC

A. Visit the site before submitting a bid to observe existing conditions.

B. Work in existing building shall be scheduled well in advance with the Owner. Work shall be performed at such times and under such conditions as suit the convenience of the Owner. Plan the Work to minimize disruption of normal operations.

C. Remove piping, ductwork, equipment, components, valves, insulation, fittings and controls not required to remain in service in remodeled areas when this Project is complete.

D. Reconnect piping and ductwork to provide service when required to complete the renovation.

E. Remove existing piping and ductwork from areas to be remodeled, back to service branch. Where such Work would not be possible without disturbing areas not being renovated, consult with the Architect prior to performing the Work.

F. When grilles and diffusers are covered up or are otherwise rendered inaccessible, all ductwork shall be removed to the source. If an HVAC equipment item which must remain in service is interrupted, it shall be reconnected by the most inconspicuous means so that it remains operational, with the same capacity as before. All building surfaces damaged, and openings, left by removal of grilles, piping, or other equipment shall be repaired. All holes left shall be closed.

G. Where new openings are cut and concealed piping, ductwork, or other HVAC items are encountered, they shall be removed or relocated as required. Where piping, ductwork or controls to be removed stubs through floors, walls and ceilings, such items shall be removed to the point where the finished surfaces can be patched so that no evidence of the former installation remains.

H. Where piping or ductwork is interrupted by removal of a branch or equipment, install material as required to restore service to the remaining items on that service line. If the interrupted piping or duct is concealed in walls or under floors, an alternate route may be required.

I. HVAC equipment, valves, and gages removed shall be offered to the Owner's Representative. If he chooses to retain these items or part of these items, turn those chosen over to him. Items rejected by Owner's Representative shall be removed from the project site by the Contractor.

J. Equipment removed from roof shall include curbs, sleepers, flashing boxes, etc. Install new roof decking to match existing. Install roof insulation and matching membrane system to maintain any roof warranties.

K. Equipment removed from finished interior spaces shall include patching and restoration to match all adjacent finishes.

L. All temperature controls shall be maintained, rerouted, reconnected, or reprogrammed to maintain operation of HVAC equipment.

3.5 UTILITY DEMOLITION

A. Utility Services:

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1. Maintain existing utilities indicated to remain, keep in service, and protect against damage during demolition operations.
2. Allow no interruption in service unless coordinated with Owner at least 72 hours in advance.

B. Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to governing authorities.

C. Disconnect and seal utilities serving each structure to be demolished, or interior area to be demolished, prior to start of demolition work.

D. If utility service or other services to an occupied area (such as emergency power, heating, medical gas, air conditioning), are to be disconnected, provide temporary or alternative service to that area.

E. Cap all utility lines terminated by the demolition work in a manner approved by the governmental authorities and utility companies having jurisdiction.

F. Mark location of disconnected utilities. Identify and indicate capping location on project record documents.

3.6 SUBSURFACE FILLING

A. Filling Basement and Voids:

1. Completely fill below-grade areas and voids resulting from demolition of structures.
2. Perform filled and compaction in accordance with requirements of Section 31 0000 - Earthwork.

3.7 PROTECTION

A. Provide temporary construction in accordance with requirements of Section 01 5300 - Temporary Construction as required in all areas of demolition work.

B. Provide levels of protection as deemed necessary by Owner for protection of public into space, project, and site.

3.8 SAWCUTTING AND DEMOLITION THROUGH EXISTING TERRAZZO FLOORING

A. Contractor is to take extreme care to coordinate sawcutting through areas of existing terrazzo flooring to provide ease of patching and repairing surfaces with new terrazzo.

B. Contractor shall coordinate sawcutting of all trades with the Architect so that a review of proposed cuts can be analyzed and discussed prior to completing the cutting.

C. Sawcuts are to be made parallel and perpendicular to the walls of the room in which they occur and are to be straight, true and smooth. Whenever possible, sawcuts are to be made in areas that will be located beneath permanent new construction, such as installed casework or equipment, so that the new terrazzo patching will be less conspicuous.

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D. When area of room or space has more than 75% of the surface of existing terrazzo removed for installation of new work by any trades, the Contractor is to remove the remaining portion of existing terrazzo, whether indicated or not, so that the entire area will receive new terrazzo and not require a match of new to existing.

END OF SECTION 02 4119

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SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish labor, material, equipment, special tools, supervision and services required to deliver and properly place and complete all cast-in-place concrete work, both plain and reinforced, indicated, noted and detailed on the drawings and specified herein, including (but not limited to) reinforcing steel, anchor bolts, forms, and form removal.

B. 15 mil Vapor Barrier Systems throughout the project.

1.2 QUALITY ASSURANCE

A. Comply with the following standards:

1. ACI Standards (latest editions) for construction procedures. Including but not limited to:
   a. Specifications for Structural Concrete for Buildings (ACI-301-05).
   b. Recommended Practice for Hot Weather Concreting (ACI-305).
   c. Recommended Practice for Cold Weather Concreting (ACI-306).
   d. Building Code Requirements for Reinforced Concrete (ACI-318-02).
   e. Guide To Evaluation of Strength Test Results Of Concrete (ACI-214).
   f. ACI 302.2: Guide for Concrete Slabs that Receive Moisture-sensitive Flooring Materials.

2. ASTM Standards (latest editions) for material specifications.

B. Testing:

1. See Section 01 45 00 - Quality Control.
2. Pay costs of geotechnical engineer and testing laboratory approved by the Architect/Engineer, tests, inspections and necessary re-testing and re-inspection.
3. Perform following tests, by certified concrete field technician.
   a. Selection and securing of samples ..... ASTM C172
   b. Air content*……..ASTM C231 or ASTM C173
   c. Slump test*……..ASTM C143
   d. Cylinders - Five - 6" x 12" ……...ASTM C31
   e. Cylinder Test*…….ASTM C39 *Results to be reported by laboratory on test reports

4. Concrete Cylinders:
   a. Taken for each 50 cubic yards or each day's pour if less than 50 yards.
   b. Remain undisturbed in a secure location on the site for 24 hours after which they shall be removed to the testing lab by laboratory personnel.
   c. Two of the cylinders shall be tested at 7 days and two at 28 days for acceptance.
   d. One cylinder shall be kept in reserve for 56-day test if needed.
   e. Testing reports shall be made directly by laboratory as follows:

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1) One copy to Architect
2) One copy to Contractor
3) One copy to Ready Mix Producer

f. Failure of the concrete to meet the specification requirement's may result in its complete removal and replacement at the Contractor's expense.

g. Cost of re-test, if any, will be at the Contractor's expense.

C. Test Failure:

1. In the event results do not meet the specification requirements, one or more of the following will be required at no cost to the Owner:
   a. Windsor Probe test conforming to ASTM C803.
   b. Core-boring test conforming to ASTM C42.
   c. Load test in accordance with Chapter 20, ACI 318-05.

2. In event Windsor Probe, core-boring or load test indicates concrete does not conform to specifications, contractor shall take such measurements as Architect prescribes or remove defective work as directed by Architect.

D. Allowable Tolerances:

1. The surface plane tolerance for cast slabs shall be such that depressions between high spots are not greater than 1/8" under a 10 foot straight-edge.
2. Slabs on grade overall floor flatness and levelness minimums: $F_F = 35$ and $F_L = 25$.
3. Concrete floor tolerances shall be tested within 72 hours after floor installation.
4. Testing procedures shall comply with ASTM E1155 “Standard Test Method for Determining F_F Floor Flatness and F_L Floor Levelness Numbers”. An Independent Testing Laboratory shall be retained by the Contractor to provide floor tolerance testing.

E. Footings and Slabs On Grade:

1. All footing excavations shall be inspected by the geotechnical engineer and testing laboratory before concrete is placed. The adequacy of the soil shall be determined.
2. Footings and slabs on grade shall bear on firm natural soil, or on properly compacted engineered fill over firm natural soil, as recommended by the geotechnical engineer.

Engineered fill and backfill under all footings and slabs on grade shall be placed and compacted as recommended by the geotechnical engineer.

1.3 DELIVERY, STORAGE AND HANDLING

A. Store materials to prevent contamination, deterioration, and weather damage.

B. Deliver ready-mixed concrete to destination in conformance with ASTM C94.

1.4 ENVIRONMENTAL REQUIREMENTS

A. Cold Weather:

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1. Comply with ACI 306.
2. Temperature of concrete when placed shall not be less than 50°F.
3. Maximum concrete temperature 90°F, minimum 50°F per ASTM C94, for duration of curing period.
4. Concrete shall be placed within 90 minutes of batch time.

B. Hot Weather:

1. Comply with ACI 305.
2. Temperature of concrete when placed shall not be greater than 90°F.
3. Maximum concrete temperature 90°F, for duration of curing period.
4. Concrete shall be placed within 90 minutes of batch time. Shorter time limits may apply when air temperature is in excess of 90°F.
5. Protect from rapid evaporation by spraying or sheeting.

C. The Contractor shall consider the timing required for placement of concrete for the entire project. He shall include in his bid all work and costs associated with the proper protection, procedures and materials required for the weather and environmental conditions for the time of year the work is to occur. No additional costs will be borne by the Owner, Architect or their consultants for failure by the Contractor to include these costs in the bid or make reasonable assumptions as to the requirements needed or limitations that may be incurred.

1.5 SUBMITTALS

A. Concrete Mix Designs:

1. A separate mix design for each class and type of concrete is required.
   a. Include literature for admixtures.
   b. Include applicable compliance with referenced ASTM number.

B. Reinforcing Steel Shop Drawings:

1. Indicate all reinforcing steel sizes, locations, supports, details, lengths laps and bends.
2. Indicate all reinforcing strengths and quantities.

C. Vapor Barrier Product Data:

1. Submit manufacturer’s published literature describing products and system.
2. Submit manufacturer’s installation procedures and MSDS sheets.

D. Curing and Sealing Materials Product Data:

1. Submit manufacturer’s published literature describing products.
2. Submit manufacturer’s installation procedures and MSDS sheets.

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PART 2 - PRODUCTS

2.1 MIX DESIGNS

A. Design mix with appropriate adjustments for air content and aggregate proportions.

B. Compressive Strength (minimum) reached by 28 days:

1. 4,000 psi: All concrete for general use, unless indicated otherwise.
2. 4,500 psi (with entrained air): All concrete permanently exposed to the weather:
3. 3,000 psi: Building footings.

C. Air Entrainment:

1. For exterior concrete slabs exposed to weather: Controlled between 4%-6% by volume.
2. **DO NOT USE** for interior concrete and site-cast tilt-walls.
3. Comply with ASTM C260.

D. Slump:

1. Footings: 3 inches +/- 1 inch.
2. Foundation walls: 4 inches +/- 1 inch.
3. Interior slabs on grade and slabs over metal decking: 4 inches +/- 1 inch.
4. Exterior slabs, pads, walks, steps and stoops: 4 inches +/- 1 inch.
5. Curbs: 1 inches +/- .5 inch.
6. When water reducing admixtures are used: 7.0 inches maximum.

E. Water / Cement Ratio:

1. Maximum water to cement ratio for all interior slabs (on grade or over metal decking) to be 0.50.
2. Regardless of any contrary notes on Drawings, in no case shall the water to cement ratio exceed this amount for slabs scheduled to receive floor finishes. Provide admixtures as required for weather conditions at time of pour.
3. If water to cement ratio exceeds this amount in quality control test, that area of slab must be removed at contractor's expense, the mix design corrected as required, and a new slab installed which complies with the proper water to cement ratio. All admixtures required are to be included in the corrected mix design submittal.

F. Cement Content:

1. Minimum cement content: 564 lb. per cu. yd., unless the supplier can substantiate with test data that a lower content is acceptable to achieve specified compressive strength per mix design.

2.2 CONCRETE MATERIALS

A. Portland Cement:

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1. ASTM C150-05, Type 1.
2. One brand shall be used throughout the work.

B. Air Entraining Cement:

1. ASTM C150, Type IA or IIIA.

C. Aggregates:

1. ASTM C33:
2. Coarse Aggregates:
   a. Clean, tough, durable fragments of crushed stone, uncrushed gravel or dredged river gravel free from dirt or objectionable matter.
   b. Size: Maximum 1-1/2" at footings; 1" in slabs.

3. Fine aggregate: Natural sand; clean, sound, hard, durable particles; gradation size No. 1.

D. Water:

1. Clean, potable and free from injurious amounts of oil, acids, alkalies, organic matter or deleterious substances.

E. Fly Ash/Pozzolans:

1. ASTM C618.
2. Class F or C.
3. Content shall not exceed 20% by weight of the total cementitious content of the mix.
4. If used in conjunction with Ground Granulated Blast Furnace Slag, the total content of Fly Ash and Ground Granulated Blast Furnace Slag shall not exceed 50% by weight of the total cementitious content of the mix.

F. Ground Granulated Blast Furnace Slag:

1. ASTM C989.
2. Content shall not exceed 30-40% by weight of the total cementitious content of the mix.
3. If used in conjunction with Fly Ash, the total content of Fly Ash and Ground Granulated Blast Furnace Slag shall not exceed 50% by weight of the total cementitious content of the mix.

2.3 ADMIXTURES

A. Air Entraining Agent:

1. ASTM C260.
2. Neutralized vinsol resin solution.

B. Water Reducing Agent:

1. ASTM C494.

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2. Types as required to provide controlled setting and/or controlled rate of hardening without increase in water/cement ratio or loss in strength.

C. Chemical Accelerators and Retarders:

1. ASTM C494.
2. Permitted only upon approval of Architect/Engineer.

D. Prohibited Admixtures:

1. Calcium chloride, thiocyanates or admixtures containing more than 0.05% chloride ions are NOT permitted.

2.4 MIXING

A. Measure and mix materials for ready mixed concrete in conformance with ASTM C94.

B. Take into account free moisture in the aggregate weight.

2.5 CURING MATERIALS

A. Provide one of the following acceptable products:

1. “BASF/Sonneborn”; Kure-N-Seal WB.
2. “Foxfire International”; Foxfire P-1007 Sealer.
3. “Master Builders”; Masterseal.
4. “W.R. Grace”; Clear Seal.
5. “W.R. Meadows/Sealtight”;, VOCOMP-20.
6. “The Euclid Chemical Company”; Super Diamond Clear VOX.

B. Liquid Membrane: AASHTO M-148 and ASTM C309, Type 1, class A and B.

C. Waterborne acrylic polymer in a co-solvent emulsion, transparent, quick drying, non-yellowing.

D. Compatible with flooring adhesives.

2.6 METAL REINFORCEMENT

A. Bars: ASTM A 615 Grade 60, Type "S", deformed.

B. Deformation: ASTM A305.

C. Stirrups and Column Ties: ASTM A 615 Grade 60.

D. All Other Reinforcement: ASTM A 615 Grade 60, with supplementary requirements (S1).

E. Welded Wire Reinforcement (WWR), Welded Wire Fabric (WWF), Welded Wire Mesh (WWM):

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1. ASTM A 185.
2. 6 x 6 W1.4 x W1.4, or as otherwise indicated.
3. All splices shall be Class B tension lap splice.

F. Metal Accessories:

1. Including spacers, chairs, ties and other devices necessary for properly assembling, placing, spacing and supporting all reinforcement in place shall be provided.
2. Ties shall be of such type as to leave no metal closer than 3/4" from concrete surface.

2.7 VAPOR BARRIER

A. Provide one of the following acceptable products:
   a. "Stego Industries"; Stego Wrap.
   b. "Reef Industries"; Vapor Guard.
   c. "Viper"; VaporCheck II.
   d. W.R. Meadows"; Perminator.
   e. "Raven Industries"; Vaporblock VBLP15.

B. 15 mil polyethylene or polyolefin film slab underlay system.

C. System shall be comprised of manufacturer's tested assembly of vapor barrier film, seaming tape and penetration sealer tape, sealant or mastic.

D. Shall meet the following minimum requirements:

1. Classification: Class A per ASTM E1745-11.
2. Tensile Strength: 70 lbs/in per ASTM E154 / ASTM D882.
3. Puncture Resistance: 2,200 grams per ASTM D1709.
4. Permeance: Shall not exceed .01 perms as tested after conditioning per ASTM E154. (as per the definition of a vapor barrier in lieu of a vapor retarder).

2.8 EXPANSION JOINT FILLER

A. Provide one of the following acceptable products:

1. "BASF/Sonneborn"; Expansion-Joint Filler.
2. "W.R. Meadows/Sealtight"; Fibre Expansion Joint.

B. Pre-molded joint filler strips of resilient, flexible, closed cell, compressible, re-expanding, non-extruding material backing for sealants.

2.9 NON-SHRINK GROUT

A. Provide one of the following acceptable products:

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1. "Euclid Chemical Co.", NS Grout.
2. "BASF", Masterflow 713.

B. Pre-mixed, factory-packaged, non-staining, non-shrink, non-metallic, non-gassing mortar grouting compound.

C. ASTM C827, C191, C109, and C1107.

D. Minimum compressive strength: 5,000 psi

E. Provide test data that grout when placed at a fluid consistency shall achieve 95% bearing under a 4' x 4' base plate.

2.10 BONDING AND REPAIR MATERIALS

A. Bonding Compounds:

1. Polyvinyl acetate type.
2. Provide one of the following acceptable products - Rewettable: (Use only in areas not subject to moisture):
   a. "Euclid Chemical Co."; Euco Weld.
   b. "Larsen Co."; Weldcrete.

3. Provide one of the following acceptable products - Non-rewettable polymer modified compound:
   a. "Euclid Chemical Co."; Euco-Bond.

B. Epoxy Adhesive:

1. Two component, 100% solids, 100% reactive compound.
2. Suitable for use on dry or damp surfaces.
3. Provide one of the following acceptable products:
   a. "Euclid Chemical Co."; Euco Epoxy No. 452MV.
   b. "Euclid Chemical Co."; Euco Epoxy No. 620.
   c. "Silka Chemical Corp."; Sikadure Hi-Mod.

2.11 FORM WORK

A. Provide formwork to conform to shape, lines and dimensions of members indicated on Drawings.

B. Construct formwork sufficiently tight to prevent leakage.

C. Construct formwork for exposed smooth surfaces of plywood or other similar smooth material.

D. Bevel exposed concrete corners 3/4 inch unless otherwise indicated on drawings.

E. Form Coatings:

1. Approved commercial formulation of proven performance that will not bond with concrete surfaces.

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2. Shall not impair subsequent treatment and curing of, or otherwise adversely affect, concrete surfaces.
3. Non-staining.
4. Apply before reinforcing steel is placed.

F. Tolerances:

1. ACI 347.

2.12 DRAINAGE FILL / GRANULAR FILL BELOW SLABS-ON-GRADE

A. See Section 31 00 00 – Earthwork.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prior to placement of any permanent concrete, footings, slabs or other construction, remove all existing surficial fill, topsoil, organic material, wet soil, loose soil, undesirable soils, abandoned concrete and other materials to the extent indicated by the geotechnical engineer.

B. Prior to placing concrete, notify all trades to be certain that all sleeves, conduit, chases, etc. are installed and properly located. . Coordinate all openings and chases required in the concrete work and provide all items to be cast into the concrete pour.

C. Ensure slab subgrade is well drained, of adequate, uniform load bearing nature, and not muddy, soft or frozen.

D. Dampen subgrade ahead of concreting.

E. Test Below-slab pipes prior to casting concrete.

F. Footing excavations shall be drained and firm at time of concrete placement.

G. Vapor Barrier:

1. Shall be properly installed and ready to receive concrete.
2. Damp proof slab on grade with film underlay between fill and concrete.

H. Verify reinforcement and anchors, expansion joint material and embedded items are secured in position. Install anchor rods, dovetail slots and other embedded items as required for support of other work that is attached to or supported by cast-in-place concrete.

I. Joints in Work:

1. Slabs and footings shall have no horizontal joints.
2. Any stop in concrete work shall be made with keyed vertical bulkheads.

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3. All reinforcing shall continue through the joint.

J. The Architect or his representative shall be given 24 hours notice to inspect placement of reinforcing steel before concrete is placed.

K. Coordination With Floor Finishes:

1. Contractor is responsible for determining maximum floor moisture levels and ph levels acceptable to floor finish manufacturers and installers.
2. Schedule concrete floor slab pours to allow adequate time for moisture to evaporate prior to installing finish flooring.
3. Provide concrete with a maximum water to cement ratio of 0.50.
4. Allow minimum 3 months curing time before installing floor finish materials.
5. Do not densify surfaces of slabs to receive moisture sensitive floor finishes to the point that the slab cannot dry to the surface.

3.2 VAPOR BARRIER

A. Vapor Barrier:

1. Install the entire system in accordance with ASTM E1643-Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
2. Unroll vapor barrier film over entire area of aggregate or compacted earth base as indicated.
3. Smooth all surfaces and keep clean and free of debris, contamination, tears or damage.
4. Overlap all seams, ends and edges a minimum of 6" in direction of pour.
5. Seal all seams using manufacturer's sealing tape, sealant or mastic.
6. Seal all penetrations through film using manufacturer's sealing tape, sealant or mastic, or a combination as required to fully seal around all penetrating items.
7. Correct any damages or tears in film materials and seam systems to protect integrity of system.
8. Provide temporary overlayments as required to protect vapor barrier during slab installation.

3.3 REINFORCEMENT

A. Provide bar supports and spacers in accordance with ACI Detailing Manual.

1. All bar supports in areas where concrete will be exposed shall have plastic feet.
2. Precast concrete blocks, 3"x3"x3", 3000 psi, shall be used to support reinforcing off the ground.
3. At all other locations, chairs or standees shall be used.

B. Detailing, fabrication and placing of reinforcing shall conform to applicable provisions of ACI 315 and ACI 318.

C. Spread bars around small openings and sleeves in slabs and walls where possible and where bar spacing will not exceed 1-1/2 times the normal bar spacing.

D. Discontinue bars at large openings where necessary and provide an area of reinforcement equal to the interrupted reinforcement distributing 1/2 of this reinforcement each side of the opening (Class B tension lap splice).

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E. Holes larger than 12 inches in any direction shall have (1) #5 x 5'-0" long diagonal bar in both faces at each corner, whether indicated, detailed or not.

F. Pier reinforcement shall be doweled to the footing. Provide dowels equal in size, number and grade to the pier reinforcement, unless otherwise indicated.

1. Dowels shall be hooked 90 degrees at the bottom level of footing reinforcement.
2. Dowels shall be lapped with the pier reinforcement.

G. Pier reinforcement shall be the same size, number and grade as the column/pilaster reinforcing, unless otherwise indicated.

H. Reinforcing bars and welded wire fabric or mesh shall be placed and secured prior to pouring concrete.

I. Minimum concrete protection for steel reinforcement:

1. 3/4" for elevated slabs and walls not exposed to earth or weather.
2. 1-1/2" for walls exposed to weather.
3. 3" for footings and other concrete cast against earth.
4. Comply with ACI 318 and 301 requirements for minimum concrete cover for reinforcement.

3.4 CONVEYING AND DEPOSITING

A. Concrete for footings shall be placed the same day excavations are opened. If this is not possible, steps shall be taken to properly and adequately protect the excavation and maintain its integrity and levels of acceptability.

B. Convey concrete from mixer to form as rapidly as practicable, by methods which will prevent segregation or loss of materials.

C. Vertical drops: maximum three feet free fall.

D. Place concrete as nearly as possible to its final position at a rate so it remains plastic and flows readily into position. Proceed with placing as a continuous operation until unit of construction is complete. Use vertical construction joints to avoid horizontal joints between concrete placements.

E. Do not use retempered concrete or concrete partially hardened or contaminated with foreign material.

F. Ensure forms and conveyance equipment are clean and free of ice, water, debris and hardened concrete.

G. All vertical concrete surfaces shall be formed, including all footings.

H. Provide shear keys in the top of all wall and column footings at concrete walls.

I. Minimum depth for all footings for exterior walls to be 24" below finish grade.

J. No water may be added to any concrete.

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3.5 CURING

A. Formwork shall remain in place five (5) days before being removed. Remove all formwork in such a manner and at such time as to not damage concrete surfaces and to ensure complete safety to the structure.

B. Perform curing of concrete of slabs and other horizontal surfaces by moist curing or by use of curing compounds.

C. Moist Curing: Moist curing shall be performed by application of polyethylene sheeting per ASTM C171 or continuous wetting of burlap or other type of absorptive cover or mat. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers. Cure for seven days.

D. Curing Compounds:

1. Apply curing compound immediately following completion of finishing after water sheen has disappeared.
2. Spray or brush uniformly in a single coat immediately after final finishing operation, at rate recommended by manufacturer.
3. Do not use material which discolors concrete or inhibits adherence of other materials.

E. Meet requirements of hot and cold weather concreting.

F. For slabs to receive moisture sensitive floor coverings, cure in accordance with recommendations of ACI 302.2.

G. Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture-retaining cover, unless otherwise directed.

H. Do NOT use membrane curing compounds on surfaces which are to receive coatings applied directly to concrete surfaces (liquid floor hardeners, waterproofing, dampproofing, membrane roofing, flooring, concrete coatings, painting, staining, etc.) unless specifically permitted by the Architect, and written documentation is provided by the coating manufacturer that such compound will not have an adverse effect on adhesion, longevity, durability, performance, or any other issue of the product.

3.6 COLD WEATHER REQUIREMENTS

A. Temperature of concrete when placed shall be not less than 50° F.

B. Temperature of concrete shall be maintained above 50° F and below 90° F for duration of curing period

C. Procedures shall be in accordance with ACI 306. Concrete shall be placed within 90 minutes of batch time.

3.7 HOT WEATHER REQUIREMENTS

A. Temperature of concrete when placed shall be less than 90° F.

B. Concrete shall be placed within 90 minutes of batch time. Shorter time limits may apply when air temperature is in excess of 90° F.

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C. Procedures shall be in accordance with ACI 305.

3.8 CONSOLIDATION

A. Consolidate concrete with high-frequency vibrators.

B. Insert vibrators into each 18" lift at intervals not to exceed 12". Insert for sufficient duration to produce complete consolidation without over-vibrating to cause separation.

C. Remove excess free water collecting on the surface during the vibration before finishing.

3.9 JOINTS

A. Locate and construct all joints as shown on the Drawings, or if not shown, as specified herein, or if not specified, as directed by Architect.

B. Construction Joints.

1. May be substituted for control or contraction joints in slabs on grade at the indicated locations of such joints or as approved by the Architect.
2. Provide keyed joints between all cast sections of slabs on grade.

C. Control Joints:

1. Depth: 1/3 thickness of slab or 1" minimum depth, whichever is greater.
2. Width: Maximum 3/16".
3. Spacing:
    a. Slabs:
        1) 4" slab = 12'-0" o.c. maximum.
        2) 5" slab = 13'-0" o.c. maximum.
        3) 6" slab = 14'-0" o.c. maximum.
        4) At greater frequency and other locations as indicated on Drawings.
    b. Walks:
        1) 4'-0" o.c. or the width of the walk whichever is less.
        2) At greater frequency and other locations and patterns as indicated on Drawings.
    c. Walls:
        1) At 20'-0" o.c. each way, maximum.
        2) At greater frequency and other locations as indicated on Drawings.
4. Wet cut joints immediately after concrete set and able to support machine and personnel. Maximum 24 hours after placing.
5. Saw cut joints are not acceptable unless authorized in writing by Architect.If permitted, joints shall be made using the early entry dry-cut method.
6. For control joints scheduled to receive joint fillers, comply with joint filler manufacturer's recommendations for depth and preparation of joint.

D. Expansion Joints: Install 1/2" expansion joint filler at concrete pavement joints; hold down below surface or cut the required depth for sealant.

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E. Carry reinforcement across joints in slabs except at expansion joints.

3.10 FINISHING: CONCRETE FINISH SCHEDULE

A. Interior:

1. Hard trowel smooth finish.

B. Exterior:

1. Stoops: Hard trowel smooth finish.
2. Walks: Broom finish. (Hard trowel smooth at expansion and control joints).
3. Steps: Vertical surfaces rubbed; horizontal surfaces broom finish.

C. Broom finish by drawing broom across surface, transversely after hard troweling (not just floating).

3.11 BOLLARD CAP

A. After filling pipe bollard with concrete, install precast bollard cap while concrete is still wet.

3.12 PROTECTION

A. Protect fresh concrete from heavy rains, extreme air temperatures, injurious sun, mechanical injury and other deleterious elements.

B. If scaling occurs from failure to take protective precautions, repair or replace damaged concrete.

3.13 PATCHING

A. Do not patch any surface until examination is made by the Architect and permission is given.

PART 4 - SUBMITTAL CHECK LIST

A. Concrete Mix Designs.

B. Reinforcement Steel Shop Drawings.

C. Vapor Barrier Product Data.

D. Curing and Sealing Materials Data.

END OF SECTION 03 30 00

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SECTION 03 6000 - POST INSTALLED ANCHORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes post installed concrete anchors requirements for the following:

1. Mechanical Anchors.
2. Adhesive Anchors.

B. Related Sections:

1. Division 03 Section "Cast-In-Place Concrete".

1.2 DEFINITION

C. Post Installed Anchors: Anchors installed into hardened concrete or fully constructed hollow or grouted masonry.

1.3 REFERENCE MATERIAL

D. ACI 318 – Building Code Requirements for Structural Concrete
E. ACI 355.2 – Standard for Evaluating the Performance of Post-Installed Mechanical Anchors in Concrete
F. ASTM A36 – Standard Specification for Carbon Structural Steel
G. ASTM A153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
H. ASTM A193 – Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
I. ASTM C881 – Standard Specification Epoxy-Resin-Based Bonding Systems for Concrete
J. ASTM E488 – Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements
K. ASTM E1512 – Standard Test Methods for Testing Bond Performance of Bonded Anchors
L. ASTM F593 – Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
M. ICC-ES AC01 – Acceptance Criteria for Expansion Anchors in Masonry Elements
N. ICC-ES AC58 – Acceptance Criteria for Adhesive Anchors in Masonry Elements
O. ICC-ES AC60 – Acceptance Criteria for Anchors in Unreinforced Masonry Elements
P. ICC-ES AC106 – Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Concrete or Masonry Elements
Q. ICC-ES AC193 – Acceptance Criteria for Mechanical Anchors in Concrete Elements
R. ICC-ES AC308 – Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements

1.4 SUBMITTAL

S. General: Submit in accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.

1. Product specifications with recommended design values and physical characteristics for epoxy dowels, expansion and undercut anchors.

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2. Quality Assurance Submittals:

    a. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
    b. Certificates

        1) ICC ES Evaluation Reports

T. Manufacturer's installation instructions.

U. Installer Qualifications & Procedures: Submit installer qualifications to special inspector for approval prior to commencement of work.

1.5 QUALITY ASSURANCE

V. Installer(s) Training:

1. Product Manufacturer's certificate for each installer certifying they have been trained on the means and methods for installing the particular anchor.

W. For horizontal and upwardly inclined adhesive installations, the installer shall be certified by an ACI/CRSI Adhesive Anchor Installing Certification Program or equivalent.

X. Certifications: Unless otherwise authorized by the Engineer, anchors shall have one of the following certifications.

1. ICC ES Evaluation Report indicating conformance with current applicable ICC ES Acceptance Criteria.

1.6 DELIVERY, STORAGE, AND HANDLING

Y. Deliver products to job site in manufacturer's or distributor's packaging undamaged, complete with installation instructions.

Z. General: Comply with Division 1 Section–Product Storage and Handling Requirements

1. Store anchors in accordance with manufacturer's recommendations.

PART 2 - PRODUCTS

1.7 MANUFACTURER

A. All products are based on Hilti Corporation.

B. Substitution:

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1. Upon approval by the engineer, the installer may substitute a product by a different manufacturer, provided that the manufacturer submits calculations signed and sealed by an engineer registered in the state of the project's location.

    a. These calculations must show that the strength of the substituted anchor meets or exceeds the strength of the specified anchor at each application in the project where a substituted anchor is proposed, with consideration for combined stress and any applicable reduction factors.

C. The substitution request and submittal shall be made a minimum of 2 weeks prior to planned installation of the anchors.

D. The finish of the anchor shall remain the same as specified.

1.8 MECHANICAL ANCHORS

E. Torque Controlled (TC) Anchors. Hilti Kwik Bolt TZ is a torque controlled expansion anchor suited to seismic and cracked concrete applications.

1. Size: As indicated on drawings
2. Finish: Plain carbon steel or stainless steel type 304 (316) as indicated on drawings.

F. Screw Anchors: Hilti Kwik HUS-EZ anchors are comprised of a body with hex washer head.

1. Size: As indicated on drawings
2. Finish: As indicated on drawings

G. Sleeve Anchors: Hilti HLC Sleeve Anchor are mechanical expansion anchors consisting of an externally threaded stud with an expanding sleeve for use in concrete and hollow and solid masonry base material.

1. Size: As indicated on drawings
2. Finish: As indicated on drawings

1.9 ADHESIVE ANCHORS

H. In contract documents adhesive anchors may be generically referred to as epoxy anchors. Where this is the case the word adhesive should be substituted for epoxy.

I. Adhesive anchors used in concrete under a tension condition cannot be installed until after the concrete has cured for a minimum 21 days in accordance with ACI 17.4.5.2.

J. Concrete Anchor

1. Hilti HIT-RE 500-V3 is a high strength, two part epoxy adhesive.

    a. Base material temperature range: 23 degrees up to 120 degrees Fahrenheit.
    b. Size: As indicated on drawings, up to 1.25" diameter maximum.
    c. Finish: As indicated on drawings
    d. Anchor material: HAS Threaded Rod Standard ISO 898 Class 5.8, and Deformed Reinforcing Bars.

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2. Hilti HIT HY 200 is a two-component hybrid adhesive.

    a. Base material temperature range: 14 degrees up to 104 degrees Fahrenheit.
    b. Size: As indicated on drawings, up to 1" diameter maximum.
    c. Finish: As indicated on drawings
    d. Anchor material: HY200 HAS Threaded Rod Standard ISO 898 Class 5.8, and Deformed Reinforcing Bars.

3. Hilti HIT HY 200 Safeset is a two-component hybrid adhesive.

    a. Base material temperature range: 14 degrees up to 104 degrees Fahrenheit.
    b. Size: As indicated on drawings, up to 1" diameter maximum.
    c. Finish: As indicated on drawings
    d. Anchor material based on cleaning:

        1) No cleaning of hole:

            a) HIT-Z, HIT-Z-R Threaded Rods

        2) Automatic cleaning of hole:

            a) HY200 HAS Threaded Rod Standard ISO 898 Class 5.8, and Deformed Reinforcing Bars.

PART 3 - EXECUTION

1.10 POST INSTALLED ANCHORS

A. All installation shall be done in accordance with manufacturer's ICC-ES report.

B. Drilling:

1. Drill holes with rotary impact hammer drills. Drill bits shall be of diameters as specified by the anchor manufacturer. Unless otherwise shown on the Drawings, all holes shall be drilled perpendicular to the concrete surface.
2. Embedded Items: Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Exercise care in coring or drilling to avoid damaging existing reinforcing or embedded items. Notify the Engineer if reinforcing steel or other embedded items are encountered during drilling. Take precautions as necessary to avoid damaging prestressing tendons, electrical and telecommunications conduit, and gas lines.
3. Base Material Strength: Unless otherwise specified, do not drill holes in concrete or masonry until concrete, mortar, or grout has met Manufacturer's specifications.

C. Torque Controlled Anchors and Sleeve Anchors: Protect threads from damage during anchor installation. Set anchors to manufacturer's recommended torque, using a torque wrench. Following attainment of 10% of the specified torque, 100% of the specified torque shall be reached within 7 or fewer complete turns of the nut. If the specified torque is not achieved within the required number of turns, the anchor shall be removed and replaced unless otherwise directed by the Engineer.

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D. Screw Anchors: Install screw anchors to a snug tight condition unless noted otherwise.

E. Adhesive Anchors: Clean all holes per manufacturer instructions to remove loose material and drilling dust prior to installation of adhesive. Inject adhesive into holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive. Follow manufacturer recommendations to ensure proper mixing of adhesive components. Sufficient adhesive shall be injected in the hole to ensure that the annular gap is filled to the surface. Remove excess adhesive from the surface. Shim anchors with suitable device to center the anchor in the hole. Do not disturb or load anchors before manufacturer specified cure time has elapsed.

1.11 FIELD QUALITY CONTROL

F. Testing and Inspecting: Engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

G. Continuous special Inspection of post-installed anchors shall be provided as required by ICC-ES evaluation reports. This service shall be performed by personnel independent of the Manufacturer or Contractor so as to prevent a conflict of interest.

H. The Engineer or Architect of Record may require pullout or shear tests, in addition to Special Inspection, to determine the adequacy of anchors. A field testing program shall be established by the independent testing and inspecting agency and/or Engineer of Record and performed in accordance with appropriate ASTM test standards. Field tests shall be non-destructive whenever possible.

END OF SECTION 03 6000

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SECTION 04 0100 - MASONRY PROTECTION AND CLEANING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish labor, materials, equipment, special tools, supervision and services required to protect masonry materials and masonry work and to complete the cleaning of masonry work.

1.2 DELIVERY, STORAGE AND HANDLING

A. Store masonry and mortar materials in a high, dry location and in such a manner as to prevent absorption of moisture from the ground.

1. Cover materials completely with waterproof covering securely tied or weighted in place.
2. Store accessory items to prevent damage from construction operations and elements.

1.3 SUBMITTALS

A. Manufacturer's Literature:

1. Manufacturer's data sheets, cutsheets and materials description.

PART 2 - PRODUCTS

2.1 CLEANING COMPOUND

A. Provide one of the following approved products (as applicable to specific project conditions):

1. Brick, Concrete Block, Tile:
   a. "ProSoCo", Sure Klean #600.
   b. "ProSoCo", Sure Klean #101 Lime Solvent (Red and Dark Colored Brick and Surfaces).
   c. "ProSoCo", Sure Klean #800 Stain Remover (Buff or White Brick).
   d. "ProSoCo", Enviro Klean Safety Klean.
   e. "Sonneborn", Sonokleen 88.
   f. “EaCo Chem”, NMD 80.

2. Pre-Cast Concrete, Poured-In-Place Concrete:
   a. "ProSoCo", Sure Klean #600.
   b. "ProSoCo", Sure Klean Light Duty Concrete Cleaner.
   c. "ProSoCo", Sure Klean Heavy Duty Concrete Cleaner.
   d. "ProSoCo", Enviro Klean Safety Klean.
   e. “EaCo Chem”, NMD 80.

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3. Limestone, Natural Stone, Non-Cementitious Manufactured or Synthetic Stones:
   a. "ProSoCo", Sure Klean #800 Stain Remover.
   b. “EaCo Chem”, NMD 80 (not permitted for polished stone).

4. Cementitious Manufactured or Synthetic Stones:
   a. "ProSoCo", Sure Klean Manufactured Stone Cleaner.
   b. “EaCo Chem”, NMD 80 (not permitted for polished stone).

2.2 MATERIALS

A. Use cleaning product especially formulated for cleaning the particular masonry materials involved.

1. Use only non-staining and non-corrosive products.

PART 3 - EXECUTION

3.1 PROTECTION

A. When masonry work has been stopped for the day, courses shall be leveled and all joints, other than required cavities, shall be well filled with mortar.

B. Protect masonry in place from rain with waterproof coverings securely fastened in place, until roof coverings, copings, flashing, or other permanent protection of the top of walls is in place.

C. Protect all masonry protections from damage by use of wood covers or protective barricades.

3.2 COLD-WEATHER PROTECTION

A. When ambient temperature is below 40°F the temperature of the masonry when laid shall not be less than 40°F.

1. Thaw frozen sand before use. Do not scorch.
2. The temperature of the mixed mortar to be at least 70°F but not more than 120°F.
3. Do not exceed a mixing water temperature of 160°F.
4. Do not use admixtures or anti-freeze compounds for the purpose of reducing the freezing temperature of mortar.

B. When the ambient temperature is below 20°F, heat masonry units to 40°F. Maintain a temperature of at least 40°F on both sides of the wall for not less than 48 hours.

3.3 HOT WEATHER PROTECTION

A. In hot dry weather, wet the mortar board and cover mortar to retard the drying out of the mortar.

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B. When the ambient temperature is above 80°F, mortar which dries too rapidly may be retempered with the addition of small quantities of water. Discard mortar if more than 2 hours after mixing.

3.4 CLEANING

A. After all masonry work is completed, repair and point all defective work to the Architect's approval.

1. Clean all exposed new work with masonry cleaning products used in accordance with the manufacturer's printed instructions.
2. Protect all sash and other corrodible materials.

SUBMITTAL CHECK LIST

1. Manufacturer's Literature.

END OF SECTION 04 0100

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SECTION 04 0513 - MORTAR

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment, special tools, supervision and services required to provide and complete all mortar for setting of all masonry work on this Project as indicated, noted, detailed and scheduled on the drawings and specified herein.

1.02 REFERENCES

A. Publications of the following Institutes, Associates, Societies and Agencies are referred to in this section:

1. American Society for Testing and Materials (ASTM).

1.03 SUBMITTALS

A. Manufacturer's Literature:

1. Materials description of cement.
2. Manufacturer's test data for mortar mixtures.

B. Samples:

1. Manufacturer's actual sample bars of entire selection of standard mortar colors.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver mortar materials, except sand, in full, unopened bags.

1. Store packaged materials off the ground and keep covered and protected from weather until used.

B. Deliver and stockpile sand in vicinity of the approved batch mixing location.

C. Pre-mixed sand/mortar, silo type batch plants may be used on site.

D. Use pipe or hose to provide clean fresh water at the batch mixing location.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Masonry Cement:

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1. Provide one of the following approved products:
   a. “Essroc”, Brixment.
   b. “Cemex”, Kosmortar.
   c. “Lafarge”, Masonry Cement.

2. Masonry Cement shall comply with the requirements of ASTM C91.
3. Portland Cement, Type 1, shall comply with the requirements of ASTM C150.

B. Hydrated Lime:

1. To comply with the requirements of ASTM C207.

C. Aggregates to Setting Mortar:

1. Shall comply with the requirements of ASTM C144.
2. For joints 1/4 inch thick or less, 100% shall pass No. 8 sieve and 95% shall pass No. 16 sieve.

D. Water:

1. Clean, fresh and potable.
2. Free from injurious amounts of oils, acids, alkalies, organic matter or deleterious substances.

E. Water Repellent:

1. Provide one of the following approved products:
   a. "Grace Construction Products"; Dry-Block.
   b. “BASF”; Rheopel Plus.
   c. “ACM”; RainBloc.
   d. “Krete”; HQ.

2. Use for all mortar on exterior concrete masonry walls.

F. Silo Batch Plant:

1. As approved by the Architect.

2.02 MIXES

A. Mortar Mixes:

1. All components to be pre-measured, pre-packaged and pre-mixed by the manufacturer.
2. Ready-mixed mortar, prepared offsite and delivered for storage in tubs, will NOT be acceptable.

B. Type S Mortar:

1. 1,800 psi minimum, high compressive strength tested in accordance with ASTM C270.
2. For use at all exterior masonry walls.
3. For use at all at grade and below grade masonry walls.
4. For use at all interior, reinforced masonry walls.

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C. Type N Mortar:

1. 750 psi minimum, medium compressive strength tested in accordance with ASTM C270.
2. For use at all interior, non-reinforced masonry walls.
3. For use at all exterior veneers, brick and stone.

D. No chemical admixtures shall be added to the mortar without the express permission of the Architect.

E. Mortar Color:

1. Standard natural mortar, uncolored.
2. Tinted, colored mortar.
3. Color as selected by Architect from manufacturer's entire standard selection.
4. Separate mortar colors may be selected for differing materials, or differing colors or textures of the same materials, throughout the project.

PART 3 - EXECUTION

3.01 MIXING

A. Mix mortar mix and water proportions by volume per manufacturer's requirements.

B. Mix mortar in an approved drum type batch mixer to a uniform color, texture and consistency.

1. Measure ingredients carefully and completely empty drum between batches.
2. Hand mixing will not be permitted.

C. Add water repellent to mortar per manufacturer's instruction.

3.02 CONSISTENCY

A. Mortar shall be consistent to the satisfaction of the mason and may be re-tempered on the boards by adding small amounts of water and remixing if stiff due to evaporation.

B. Do not use mortar that has become stiff due to hydration or that has been mixed more than two hours.

SUBMITTAL CHECK LIST

1. Manufacturer's Literature.
2. Color samples.

END OF SECTION 04 0513

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SECTION 04 0523 - MASONRY ACCESSORIES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. All labor, materials, equipment, special tools, supervision, and services required to provide and complete all masonry accessories for all masonry work on this Project as indicated, noted, detailed, and scheduled on the Drawings or specified herein.

1.2 DELIVERY, STORAGE AND HANDLING

A. Storage: Store steel accessories off of the ground, on blocking, with waterproof cover.

1.3 QUALITY ASSURANCE

A. All work shall comply with ACI-530 and recommendations of The Masonry Society.

B. Hot dipped galvanizing after fabrication per ASTM A153 (1.5 oz./ft.).

1.4 SUBMITTALS

A. Manufacturer's Literature:

1. Manufacturer's data sheets, cutsheets and materials description.

B. Samples:

1. Provide actual sample of unit as requested by the Architect.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide products, as approved by the Architect, by one of the following acceptable manufacturers:

1. Hohmann & Barnard (H&B).
2. Masonry Technology Inc. (MTI).
3. Advanced Building Products.
4. Sandell Manufacturing.
5. A-A Wire Products Company.
6. Baltimore Birmingham.
7. DUR-O-WALL, Inc.
8. Heckman Building Products, Inc.

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9. Masonry Reinforcing Corp. of America.
10. National Wire Products Corp.

2.2 MATERIALS

A. Weep Holes:

1. Provide one of the following approved products:
   a. "H&B", #QV-Quadro Vent.
   b. "MTI", Cavity Vent.
   c. "Advanced Building Products", Mortar Maze.
   d. "Sandell Manufacturing", Mortar Net Weep Vents.

B. Control Joints:

1. Provide one of the following approved products:
   a. "H&B", RS Series.
   b. “BoMetals, Inc.”, BCJ Series.

2. Preformed elastomeric rubber, with shear keys and flanges.

C. Veneer Wall Ties:

1. At veneer cavity walls with wood stud, metal stud, concrete, or concrete masonry back-up (with continuous insulation):
   a. Provide one of the following approved products:
      1) "Heckman Building Products", Pos-I-Tie wire ties with "Tapcon" screws.
   b. Length as required by manufacturer for full extension into substrate material.
   c. Hot dipped galvanized, typical.
   d. Stainless steel, type 304, at stone veneer.

2. At veneer cavity walls with wood stud, metal stud, or poured concrete back-up (without continuous insulation):
   a. Provide one of the following approved products:
      1) "H&B", #DW-10 with #VWT vee wall ties.
   b. Hot dipped galvanized.

3. At veneer cavity walls with concrete masonry back-up (without continuous insulation):
   a. See Specification 04160 - Masonry Reinforcement.

D. Stone Anchors:

1. Provide one of the following approved products:
   a. "H&B", #303 corrugated veneer tie and #305 dovetail slot.

2. 2-piece dovetail design comprised of continuous dovetail slot and corrugated masonry tie.
3. Stainless steel, type 304.

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E. Column Anchors:

1. Provide one of the following approved products:
   a. "H&B", #359-FH Weld-On Tie with #302W Column Web Tie.

2. Hot dipped galvanized.

F. Beam Anchors:

1. Provide one of the following approved products:
   a. "H&B", #357.

2. Hot dipped galvanized.

G. Mortar/Grout Screen:

1. Provide one of the following approved products:
   a. "H&B", #MGS.

2. 1/4" square microfiliment screen.
3. Polypropylene polymer, non-corrosive.

H. Rebar Positioners:

1. Provide one of the following approved products:
   a. "H&B", #RB and #RB-Twin.

2. Z-shaped wire bridge.
3. 9 gauge wire.
4. Size for block width and core dimension as required.
5. Hot dipped galvanized.

I. Masonry Slip Joint:

1. Provide one of the following approved products:
   a. "H&B", #NS.

2. Placed in masonry coursing below relieving angle.
3. Closed cell neoprene sponge.
4. 3/8" thickness to match mortar joint coursing x width of entire masonry unit.
5. Adhesive backing, one side only.

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PART 3 - EXECUTION

3.1 INSTALLATION

A. Weep Holes:

1. Install in strict accordance with the manufacturer's published recommendations.
2. Provide in head joints in first course immediately above all flashing, at spacing as indicated on the drawings. If not indicated, provide at 32” o.c.
3. Keep area above flashing free of mortar droppings.

B. Control Joints:

1. Install in strict accordance with the manufacturer's published recommendations.
2. Provide control joints at all inside corners and where new masonry abuts existing masonry.
3. Lap horizontal joint reinforcing at all control joints.
4. Locate vertical control joints at 16'-0" o.c. maximum for all masonry.
5. Locate elsewhere where indicated on the Drawings.

C. Ties and Anchors:

1. Install in strict accordance with the manufacturer's published recommendations.
2. Install ties into projecting eyes of truss or ladder type wall reinforcement, or into retainer area of supportive stud clip or anchor device.
3. Position for proper placement in veneer wall.

D. Rebar Positioners:

1. Install in strict accordance with the manufacturer's published recommendations.
2. Secure all vertical reinforcing bars in all masonry walls by use of positioners.
3. Position re-bar in center of concrete block core.
4. Rest bends of wire on shell of block to allow wire to span and bridge cell.

E. Masonry Slip Joint:

1. Install in strict accordance with the manufacturer's published recommendations.
2. Place at horizontal mortar joint coursing located just below the steel relieving angle in both the veneer and the masonry back-up wall.
3. Install with adhesive backing, bottom side only. Top side shall be free to "float" below course above.

SUBMITTAL CHECKLIST

1. Manufacturer's Literature.
2. Samples.

END OF SECTION 04 0523

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SECTION 04 0523.16 – MASONRY EMBEDDED FLASHING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Flexible flashing as shown for drawings and specified herein. Including, but not limited to thru-wall flashing and other flashing for masonry work.

1.2 SUBMITTALS

A. Submit manufacturer's data sheets for each product used.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS AND TYPES

A. Provide one of the following or an approved equivalent:

1. York Manufacturing “Multi-Flash 500”.
2. STS Coatings “Wall Guardian Copper TWF”
3. Wire-Bond “Copper Seal”

2.2 MATERIAL

A. Characteristics:

1. Type: Copper core with polymer fabric laminated to copper face on both sides with non-asphalt adhesive.
2. Copper core: ASTM B370, CDA Alloy 110
3. Weight: 3 oz. per square foot.
4. Fabric: Polymer fabric; laminated both faces of copper core
5. Size: Manufacturer’s standard width rolls

PART 3 - EXECUTION

3.1 INSTALLATION

A. Whether shown on Drawings or not, install flashing at the following locations:

1. Install at heads and sills of all openings in walls, base courses, sill courses, angles and wall penetrations.

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2. Install thru-wall flashing at top course of all brick walls at retaining walls, planter walls, walls at site stairs and ramps, and all other similar conditions.

B. Extend flashing 6" beyond opening or joint.

C. Build in flashing with mortar as masonry work progresses.

SUBMITTAL CHECK LIST

1. Manufacturer's material data sheet.

END OF SECTION 04 0523.16

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SECTION 04 2113 - FACE BRICK MASONRY

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish labor, materials, equipment, special tools, supervision and services required to complete brick masonry work.

1.2 QUALITY ASSURANCE

A. Qualifications:

1. Employ masons skilled and experienced in the setting of brick.
2. Only first-class brickwork will be accepted.

B. Mock-Up Panel:

1. Construct on site sample panel 4 foot wide x 4 foot high, of typical wall thickness and construction.
2. Show proposed color range, texture, bond, mortar color, mortar joint and workmanship of masonry materials.
3. Do not proceed with masonry work until sample panel has been approved.
4. Use panel as standard of comparison for all masonry work.
5. Do not destroy or remove panel until all masonry work is complete and accepted.

1.3 SUBMITTALS

A. Samples:

1. If specific brick has been specified: Masonry contractor to submit brick panels or 5-brick pallet samples for final approval by Architect. Color, texture and range of brick to be submitted as specified.
2. If specific brick has not been specified: Masonry contractor to select and submit brick panels or 5-brick pallet samples for final selection by Architect. Color, texture and range of brick to be submitted to be per direction of the Architect.
3. Brick submitted shall conform to these specifications and be within color and texture range specified.
4. Selected brick samples shall have mock-up panels constructed for final selection and approval.
5. Lay additional sample panels as directed by Architect
6. Architect reserves the right to select any brick from any supplier.

B. Test reports indicating compressive strength, water absorption, saturation and suction.

1.4 DELIVERY, STORAGE AND HANDLING

A. Store brick off ground to prevent contamination by mud, dust or materials likely to cause staining or other defects.

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B. Cover materials as necessary to protect from elements.

PART 2 - PRODUCTS

2.1 FACE BRICK

A. Size:

1. Typical standard Modular units: 8 inches long x 2-1/4 inches high x not less than 3-5/8 inches deep.

B. Special Shapes:

1. Cut standard unit with power saw or provide units manufactured to sizes or shape required.
2. Provide solid brick, watertable profile, finished ends, special sizes, etc. as required.
3. Special shape items to match selected brick in every other respect.

C. Conform to ASTM C 216, Grade SW, Type FBS.

D. Brick submitted shall be from brick manufacturers who are able to provide certification and physical evidence that the brick has been successfully used in projects of similar exposure for at least three complete climatic cycles without physical or visual changes.

E. Do not exceed variations in color and texture of accepted samples and mock-up.

F. Match color of existing blog masonry.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify initial absorption rate of brick is within acceptable limits.

B. Reduce initial absorption exceeding 20 g./30sq. in/min by thoroughly wetting with clean water 24 hours prior to placement.

3.2 INSTALLATION

A. General:

1. Lay brick plumb and true to lines.
2. Cut exposed brick with masonry saw.
3. Anchor brick veneer to backing with metal reinforcement.
4. Where fresh masonry joins partially set masonry.
    a. Remove loose brick and mortar.

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b. Clean and lightly wet exposed surface of set masonry.

5. Stop off horizontal run of masonry by racking back 1/2 length of unit in each course.
6. Toothing is not permitted except upon written acceptance of the Architect.

B. Weep Holes:

1. See Section 04 0523 - Masonry Accessories.
2. Keep weep holes and area above flashing free of mortar droppings.

C. Sealant Recesses:

1. Retain joints around outside perimeters of exterior doors, windows frames and other wall openings.
2. Depth: Uniform 3/4 inch.
3. Width: 3/8 inch.

D. Movement Joints:

1. Keep clean from all mortar and debris.
2. Locate as shown on drawings.

E. Sealant:

1. See Section 07 9200-Joint Sealers for all labor and material for sealing perimeter recesses and joints.

3.3 PROJECT CONDITIONS

A. Staining: Prevent grout or mortar from staining the face of masonry to be left exposed or painted.

1. Remove immediately grout or mortar in contact with face of masonry.
2. Protect sills, ledges and projections from mortar droppings.
3. Protect door jambs and corners from damages during construction.

B. Cold Weather Protection:

1. Preparation:
   a. If ice or snow has formed on masonry bed, remove by carefully applying heat until top surface is dry to the touch.
   b. Remove all masonry deemed frozen or damaged.

2. Products:
   a. When brick suction exceeds 20 g/30 sq. in./min., sprinkle with heated water.
      1) When units are above 32°F, heat water above 70°F.
      2) When units are below 32°F, heat water above 130°F.
   b. Use dry masonry units.
   c. Do not use wet or frozen units.

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SUBMITTAL CHECK LIST

1. Brick Samples. (Match existing building color)
2. Test Reports.
3. Mock-up Panel.

END OF SECTION 04 2113

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SECTION 05 5000 - MISCELLANEOUS METALS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Miscellaneous metals include items made from iron and steel shapes, plates, bars, strips, tubes, pipes and castings which are not a part of structural steel or other metal systems specified elsewhere.

B. Types of work in this section include, but are not limited to the following:

1. Steel Pipe Railings and Brackets.
2. Loose Steel Lintels.
3. Miscellaneous Framing and Supports.
4. Steel Concrete Inserts.
5. Pipe Bollards.
6. Steel Pan Stairs.
7. Interior Ladders (contractor's option to aluminum specified in section 07 7233).

1.2 QUALITY ASSURANCE

A. Comply with the applicable requirements of the following manuals, specifications and codes:

1. "Specification for Design, Fabrication and Erection of Structural Steel for Buildings", AISC.
2. "Code for Arc and Gas Welding in Building Construction", AWS.
3. "Structural Steel Detailing", AISC.

1.3 REFERENCES

A. Publications of the following institutes, associations, societies and agencies are referred to in this Section.

1. American Society for Testing and Materials, ASTM.
2. National Association of Architectural Metals Manufacturers, NAAMM.
3. Steel Structures Painting Council, SSPC.
4. American Welding Society, AWS.
5. American Institute of Steel Construction, AISC.

B. All Miscellaneous Metals and fabricated items shall be domestic manufacture. Imported metals and products will not be approved or used.

1.4 SUBMITTALS

A. Furnish to the Architect for approval, complete shop and field erection drawings.

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1.5 DELIVERY, STORAGE AND HANDLING

A. Fabricate and deliver miscellaneous metal items in ample time to avoid delays in the progress of any trade working on the project.

B. Store on blocks off ground and cover to prevent rusting, denting and damage to materials or structure.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials shall conform with the following requirements:

1. "Structural Steel", ASTM Designation A36.
2. "Low and Intermediate Tensile Strength Carbon Steel Plates of Structural Quality", ASTM Designation A283.
3. "Cold-Rolled Carbon Sheets, Commercial Quality", ASTM Designation A36.

B. Structural Steel: 36,000 psi yield point rolled to the size and shapes indicated on the drawings.

C. Welding Electrodes: Series #70, Grade AWS-2.

D. Primer Paint: Supplier's standard shop primer paint.

2.2 MISCELLANEOUS METAL ITEMS

A. Miscellaneous Metal Items but are not necessarily limited to the following:

1. Steel angles, shelf angles, receiving angles, lintels and miscellaneous supports requiring fabrication.
2. All bolts, inserts, clip angles, struts and channel framing.
3. Handrails shall be steel pipe with welded joints. All welds shall be ground smooth. Provide closure plates at ends of all rails. Return all ends to wall unless otherwise detailed.

2.3 WORKMANSHIP

A. Workmanship required in the execution of the work shall be of the best quality and subject to the approval of the Architect.

B. Form metal work to shape and size, with sharp lines and angles. Leave clean, true lines and surfaces when shearing or punching. Weld permanent connections where practical.

C. Holes in structural steel framing for attaching miscellaneous metal items will be provided by the miscellaneous metal erector.

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2.4 FABRICATION

A. The Contractor is responsible for verifying all dimensions of work adjoining. Inspect such work before fabrication and/or installation of items specified. Obtain measurements of adjoining work so work will fit closely to spaces provided.

B. Provide opening angles, lintels and miscellaneous supports shown, requiring fabricating in accordance with notes and details.

C. The fabricator shall furnish all necessary templates and patterns required by other trades. Also furnish all items except otherwise specified, pertaining to work under other sections.

2.5 SHOP PAINTING

A. Clean all ferrous metals of all rust, scale, oil, grease or other foreign matter in accordance with SSPC Specification SP2-63.

B. After cleaning apply one coat Type 1, oil alkyd, red oxide to minimum 2 mil dry film thickness

C. All exterior miscellaneous steel to be hot dipped galvanized.

1. Hot dip galvanizing per ASTM A123, min. 2.0 ounces per square foot.
2. Touch up primer: SSPC 20, Type I inorganic zinc rich.

PART 3 - EXECUTION

3.1 FIELD MEASUREMENT

A. The Contractor is responsible for obtaining all necessary field measurements at the job site and will be held responsible for their accuracy and for the accurate fitting of this work with the work of others.

3.2 GENERAL

A. Perform all cutting, fitting and drilling necessary to properly set the work herein specified and as required for proper installation of adjacent or engaging work of all trades.

3.3 ADJUST AND CLEAN

A. Touch Up Painting:

1. 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.
2. Apply to provide a minimum dry film thickness of 2.0 mils.

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PART 4 - SUBMITTAL CHECK LIST

A. Shop and setting drawings.

END OF SECTION 05 5000

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SECTION 06 1000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish labor, materials, equipment, special tools, supervision and services required to complete all rough carpentry work indicated, noted and detailed on drawings and specified herein including:

1. Framing, blocking and furring.
2. Wood treatment.
3. Fasteners in treated wood.
4. Blocking as required for items such as casework, cabinets, toilet accessories, lockers, and any other items requiring wood blocking for support, bracing, mounting, and securing in place.

1.2 QUALITY ASSURANCE

A. Grading Rules:

1. Lumber grading rules and wood species shall conform with Voluntary Product Standard PS-20. Grading rules of the following associations shall also apply to materials produced under their supervision.
   a. Northeastern Lumber Manufacturer's Association, Inc. (NELMA).
   b. Southern Pine Inspection Bureau (SPIB).
   c. West Coast Lumber Inspection Bureau (WCLIB).
   d. Western Wood Product Association (WWPA).

2. Plywood shall conform to the following:
   a. Softwood Plywood - Product Standard PS-1.
   b. Hardwood Plywood - Product Standard PS-51.

B. Grade Marks:

1. Identify all lumber and plywood by official grade mark.
2. Lumber: Grade stamp to contain symbol of grading agency, mill number or name, grade of lumber, species or species grouping or combination designation, rules under which graded, where applicable and condition of seasoning at time of manufacture.
   a. S-Dry: Maximum 15 percent moisture content.
   b. MC-5 or KD: Maximum 15 percent moisture content.
   c. Dense.

3. Softwood Plywood: Appropriate grade trademark of the American Plywood Association.
   a. Type, grade, class and identification index.
   b. Inspection and testing agency mark.

4. Hardwood Plywood: Appropriate grade mark of qualified inspection, testing, or grading mark.

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C. Requirements of Regulatory Agencies:

1. Preservative Treated Lumber and Plywood: American Wood Preservers Bureau, Quality Mark.
2. Pressure Treated Material: American Wood Preserves Bureau Standards.
3. Span Tables: National Forest Products Association.
4. Working Stresses: Softwood Lumber, National Design Specification, National Forest products Association.

1.3 SUBMITTALS

A. Submit the following:

1. Treating Plant Certification:
Submit certification by treating plant stating chemicals and process used, net amount of salts retained, and conformance with applicable standards.

2. Preservative Treated Wood:
Submit certification for water-borne preservative that moisture content was reduced to 19 percent maximum, after treatment.

3. Fasteners Product Data:
Submit manufacturer's published literature and product data sheets.

1.4 DELIVERY, STORAGE AND HANDLING

A. Immediately upon delivery to job site, place materials in area protected from weather.

B. Store materials of minimum of 6" above ground on framework or blocking and cover with protective waterproof covering, providing adequate air circulation or ventilation.

C. Do not store seasoned materials in wet or damp areas.

D. Protect sheet materials from corners breaking and surface damage.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Lumber:

1. Dimension:
a. Specified lumber dimensions are nominal.
b. Actual dimensions conform to industry standards established by the American Lumber Standards Committee and the rules writing agencies.

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2. Moisture Content:
   a. 19 percent maximum at time of permanent closing of building or structure, for lumber 2" or less nominal thickness.

3. Surfacing:
   a. Surface four sides (S4S), unless otherwise shown, or specified.

4. Framing Lumber:
   a. 2" to 4" thick, 2" to 4" wide.
   b. Any commercial softwood species, unless otherwise shown, or specified.

5. Miscellaneous Lumber:
   a. Provide wood for support or attachment of other work including cant strips, bucks, nails, blocking, furring, grounds, stripping and similar members.
   b. Provide lumber of sizes shown or specified, worked into shapes shown on Drawings.
   c. 15 maximum moisture content for lumber items not specified to receive wood preservative treatment.

6. Grades:
   a. General Framing: Standard and Better Grade.
   b. Plates, Blocking, Bracing and nailers: Utility Grade.
   c. Miscellaneous Lumber: Construction Grade.

B. Plywood:

1. Exterior graded plywood where indicated, or where edge or surface is permanently exposed to weather: B-B EXT-APA, graded for treatment where preservative treated plywood is indicated.
2. Plywood Backing Panel: For mounting electrical or telephone equipment, provide fire-retardant treated plywood panels, APA C-D PLUGGED INT with exterior glue, thickness indicated, or if not otherwise indicated, 3/4".

C. Preservative Treated Wood:

1. Waterbourne Salt Preservatives for Painted, Stained or Exposed Natural Wood Products:
   a. AWPB LP-2, above ground application.
   b. AWPB LP-22, ground contact application.

2. Treat indicated items and the following:
   a. Wood sills, sleepers, blocking, furring, stripping, roofing, and similar concealed members in contact with masonry, concrete, or around windows and doors.
   b. Use **MCA** (Micronized Copper Azole) preservative treatment only.

D. Fasteners in Treated Wood:

1. Shall be resistant to corrosion or be protected to resist corrosion.
2. Where sacrificial coatings are applied to fasteners, a minimum coating thickness capable of protecting the fastener for the expected service life of the structure shall be provided. Provide manufacturer's product information, test results, and certifications to substantiate these claims.
3. Coating weights for zinc-coated fasteners shall be in accordance with ASTM A153M or ASTM A641, Supplementary Requirements.

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4. Fasteners shall be one of the following:
   a. Stainless steel.
   b. Standard Single-dipped, Double-dipped, Hot-dipped, or zinc-coated galvanized steel.
   c. Silicon bronze.
   d. Copper.

PART 3 - EXECUTION

3.1 GENERAL

A. Discard units of material with defects which might impair quality of work, and units which are too small to fabricate work with minimum joints or optimum joint arrangement.

B. Set carpentry work accurately to required levels and lines, with members plumb and true and accurately cut and fitted.

C. Securely attach carpentry work to substrate by anchoring and fastening as shown 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. 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.

3.2 INSTALLATION

A. Wood Grounds, Nailers, Blocking and Sleepers:

1. Provide where shown and where required for screeding or attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached.
2. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise shown. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement. Do not use power driven anchors unless approved by Architect.
3. Provide permanent grounds of dressed, preservative treated, key-beveled lumber not less than 1-1/2" wide and of thickness required to bring face of ground to exact thickness of finish material involved. Remove temporary grounds when no longer required.

B. Apply two brush coats of same preservative used in original treatment to all sawed or cut surfaces of treated lumber.

3.3 TEMPORARY WORK

A. Provide temporary stairs, ramps, runways, ladders, etc., as required for the purpose of handling materials, personnel and access to the work and temporary exits from the building.

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3.4 CUTTING, FITTING AND PATCHING

A. Include all cutting, fitting and patching of work in connection with other trades which adjoin any part of this work.

PART 4 - SUBMITTAL CHECK LIST

A. Treating plant certification.

B. Preservative treatment certificate.

C. Fasteners product data.

END OF SECTION 06 1000

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SECTION 06 1600 - SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wall sheathing.
2. Roof sheathing.
3. Sheathing joint and penetration treatment.

B. Related Requirements:

1. Section 06 1000 "Rough Carpentry" for plywood backing panels.
2. Section 07 2500 "Weather Barriers" for water-resistive barrier applied over wall sheathing.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
2. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer of air-barrier and water-resistant glass-mat gypsum sheathing.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WALL SHEATHING

A. Plywood Sheathing: DOC PS 1, Exterior, Structural I sheathing.

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1. Span Rating: Not less than 24/0.
2. Nominal Thickness: Not less than 1/2 inch.

B. Oriented-Strand-Board Sheathing: DOC PS 2, Exposure 1 sheathing.

1. Span Rating: Not less than 24/0.
2. Nominal Thickness: Not less than 1/2 inch.

2.2 ROOF SHEATHING

A. Plywood Sheathing: DOC PS 1, Exposure 1 sheathing.

1. Span Rating: Not less than 40/20.
2. Nominal Thickness: Not less than 5/8 inch.

B. Oriented-Strand-Board Sheathing: DOC PS 2, Exposure 1 sheathing.

1. Span Rating: Not less than 40/20.
2. Nominal Thickness: Not less than 5/8 inch.

2.3 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Screws for Fastening Sheathing to Wood Framing: ASTM C 1002.

2.4 MISCELLANEOUS MATERIALS

A. Adhesives for Field Gluing Panels to Wood Framing: Formulation complying with APA AFG-01 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

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B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
2. ICC-ES evaluation report for fastener.

D. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:

1. Wall and Roof Sheathing:
   a. Nail to wood framing. Apply a continuous bead of glue to framing members at edges of wall sheathing panels.
   b. Space panels 1/8 inch apart at edges and ends.

END OF SECTION 06 1600

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SECTION 06 1613 – INSULATING SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating wall sheathing with integral water-resistive barrier and air barrier for exterior walls.

1.2 REFERENCES

A. American Society of Mechanical Engineers (ASME): www.asme.org

1. ASME B18.6.1 - Wood Screws (Inch Series)

B. ASTM International (ASTM): www.astm.org

1. ASTM A153/A153M - Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
2. ASTM C1289 - Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
3. ASTM D779 - Test Method for Water Resistance of Paper, Paperboard, and Other Sheet Materials by the Dry Indicator Method
4. ASTM D1621 - Test Method for Compressive Properties Of Rigid Cellular Plastics
5. ASTM D2247 - Practice for Testing Water Resistance of Coatings in 100% Relative Humidity
6. ASTM E96/E 96M - Test Methods for Water Vapor Transmission of Materials
7. ASTM E331 - Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
8. ASTM E2357 - Test Method for Determining Air Leakage of Air Barrier Assemblies
9. ASTM F1667 - Specification for Driven Fasteners: Nails, Spikes, and Staples
10. ASTM G154 - Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials

C. US Department of Commerce (DOC): http://gsi.nist.gov/global/index.cfm/L1-5/l2-44/A-355

1. DOC PS 2 - Performance Standard for Wood-Based Structural Panels

D. International Code Council (ICC): www.iccsafe.org

1. ICC IBC - International Building Code

E. ICC Evaluation Service, Inc. (ICC-ES): www.icc-es.org

1. ICC-ES AC12 - Acceptance Criteria For Foam Plastic Insulation
2. ICC-ES AC38 - Acceptance Criteria for Water-Resistive Barriers
3. ICC-ES AC116 - Acceptance Criteria for Nails and Spikes
4. ICC-ES AC148 - Acceptance Criteria For Flexible Flashing Materials
5. ICC-ES AC201 - Acceptance Criteria for Staples

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6. ICC-ES AC269 - Acceptance Criteria for Racking Shear Evaluation of Proprietary Sheathing Materials attached to Light-Frame Wall Construction or Code-Complying Sheathing Attached to Light-Framed Walls with Proprietary Fasteners
7. ICC-ES AC310 - Acceptance Criteria for Water-Resistive Membranes Factory-bonded to Wood-based Structural Sheathing, Used as Water-Resistive Barriers
8. ICC-ES ESR-1539 - Power Driven Staples and Nails for Use in Engineered and Non-Engineered Connections
9. ICC-ES NER-272 - Power Driven Staples and Nails for Use in All Types of Building Construction

F. Sustainable Forestry Initiative (SFI): www.sfiprogram.org/

1. SFI 2010 - 2014 Standard

1.3 ACTION SUBMITTALS

A. Product Data: For each type of sheathing product specified.

1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: From ICC-ES, for wood sheathing and seam tape.

B. Product Certifications: From manufacturer, indicating that sheathing products comply with ICC-ES AC269 and ICC-ES AC310.

1.5 CLOSEOUT SUBMITTALS

A. Warranty: Executed copy of manufacturer special warranties.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Provide wood products from manufacturer certified by SFI, FSC, or comparable sustainable forestry program acceptable to Architect.

B. Provide wall sheathing products meeting requirements for water-resistive barrier in accordance with ICC-ES AC310.

C. Provide wall sheathing products meeting requirements of ICC-ES AC269.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's written instructions for protection of sheathing products from weather prior to installation.

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1.8 WARRANTY

A. Special Manufacturer's Warranty: Manufacturer's standard form in which sheathing manufacturer agrees to repair or replace sheathing products that demonstrate deterioration or failure under normal use due to manufacturing defects within warranty period specified, when installed according to manufacturer's instructions.

1. Warranty Period for Sheathing Products: [30] years following date of Substantial Completion.
2. Warranty Conditions: Special warranties exclude deterioration or failure due to structural movement resulting in stresses on sheathing products exceeding manufacturer's written specifications, or due to air or moisture infiltration resulting from cladding failure or mechanical damage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Provide sheathing products manufactured by Huber Engineered Woods LLC, Charlotte NC; Phone: (800) 933-9220; Website: www.zipsystem.com.

2.2 PERFORMANCE REQUIREMENTS

A. Air-Barrier Assembly Air Leakage: Less than 0.04 cfm/sq. ft. at 1.57 lbf/sq. ft., per ASTM E2375.

B. Water-Vapor Permeance, Facer: Minimum 12 perms, ASTM E96/E96M

C. Weather Exposure: Manufacturer warranty applies for maximum allowable exposure period of 180 days.

2.3 MATERIALS

A. Oriented Strand Board: DOC PS 2, made with binder containing no added urea formaldehyde.

B. Rigid Foam Plastic Insulating Board: Rigid polyisocyanurate foam core complying with ASTM C1289 Type II, Class 2, and ICC-ES AC12, with coated glass fiber facers on both sides, with the following characteristics:

1. Nominal Density: 2.0 pcf.
2. Compressive Strength, ASTM D1621: Not less than 20 psi (150 kPa).
3. Vapor Permeance, ASTM E96/E96M: Less than 1.0 perm.
4. Edge Configuration: Square finished.

2.4 COMPOSITE INSULATING WALL SHEATHING

A. Composite Insulating Wall Sheathing: Oriented-strand-board Exposure 1 sheathing 7/16 inch thick, with factory-laminated water-resistive barrier exterior facer, and with rigid foam plastic insulating board laminated to interior face.

1. Basis-of-Design Product: Provide Huber Engineered Woods LLC; ZIP System R Sheathing.

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2. Span Rating and Performance Category of Sheathing Layer: Not less than 24/16; 7/16 Performance Category.
3. Overall Thickness: 1 inch
4. Thermal Resistivity (R Value): 3.6 deg F x h x sq. ft./Btu x in. at 75 deg F
5. Edge Profile: Square edge.
6. Exterior Facer: Medium-density, phenolic-impregnated polymer-modified sheet material meeting requirements for ASTM D779 Grade D weather-resistive barrier in accordance with ICC AC38 and AC310, with fastener spacing symbols on exterior facer for 16-inch on center spacing, with the following characteristics
    a. Water Resistance of Coatings, ASTM D2247: Pass 14 day exposure test.
    b. Moisture Vapor Transmission, ASTM E96: Not less than 12 perms.
    c. Water Penetration, ASTM E331: Pass at 2.86 lbf/sq. ft.
    d. Wind Driven Rain, TAS-100: Pass.
    e. Accelerated Weathering, ASTM G154: Pass.

2.5 FASTENERS

A. Fasteners, General: Size and type complying with manufacturer's written instructions for Project conditions and requirements of authorities having jurisdiction.

1. Corrosion Resistance: Hot-dip zinc coating, ASTM A153/A 153M.

B. Nails, Brads, and Staples: ICC AC116 and ICC AC201.

C. Power-Driven Fasteners: ICC-ES-1539 or NER-272.

D. Wood Screws: ASME B18.6.1.

2.6 ACCESSORY PRODUCTS

A. Self-Adhering Seam and Flashing Tape: Pressure-sensitive, self-adhering, cold-applied, seam tape consisting of polyolefin film with acrylic adhesive, meeting *ICC-ES AC148 – Acceptance Criteria for Flexible Flashing Materials*, and tested as part of an assembly meeting performance requirements.

1. Basis-of-Design: Huber Engineered Woods; ZIP System™ flashing tape.
2. Characteristics
    a. Adhesive type: Acrylic
    b. Thickness: 0.012 inch (0.3 mm).
    c. Tensile Strength: 938 psi
    d. Elongation: 400-800 percent

B. Liquid-Applied Flashing Membrane: Gun-grade, cold-applied, silyl-terminated polymer (STP) liquid flashing membrane compatible with sheathing/weather barrier, self-adhering seam and flashing tape, and tested as part of an assembly meeting performance requirements.

1. Basis-of-Design: Huber Engineered Woods; ZIP System™ liquid flash.
2. Characteristics
    a. Composition: Single component silyl-terminated polymer (STP)

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b. Application Temperature Range: Between 35 Deg F (2 Deg C) and 110 Deg F (43 Deg C) surface and ambient.
c. VOC Content: 30 g/L
d. Hardness, Shore A: 40 to 45 in accordance with *ASTM C661 – Standard Test Method for Indentation Hardness of Elastomeric Type Sealants by Means of a Durometer*
e. Tensile Strength: 75 psi in accordance with *ASTM D412 – Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers*
f. Elongation at Break: 225 percent in accordance with *ASTM D412 – Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers*

C. Self-Adhering Flexible Flashing Tape: Pressure-sensitive, self-adhering, cold-applied, seam tape consisting of polyolefin film with acrylic adhesive; tested as part of an assembly meeting performance requirements.

1. Basis-of-Design: Huber Engineered Woods; ZIP System™ stretch tape.
2. Characteristics
   a. Adhesive type: Acrylic
   b. Thickness: 0.042 inch (1.067 mm).
   c. Tensile Strength: 225 psi
   d. Elongation: 800-1200 percent

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing spacing and alignment to determine if work is ready to receive sheathing. Proceed with sheathing work once conditions meet requirements.

3.2 SHEATHING INSTALLATION

A. Install sheathing panels in accordance with manufacturer's written instructions, requirements of applicable Evaluation Reports, and requirements of authorities having jurisdiction.

B. Air and Moisture Barrier: Coordinate sheathing installation with flashing and joint sealant installation and with adjacent building air and moisture barrier components to provide complete, continuous air- and moisture- barrier.

C. Do not bridge expansion joints; allow joint spacing equal to spacing of structural supports

D. Install panels with laminated facer to exterior. Stagger end joints of adjacent panel runs

E. Attach sheathing panels securely to substrate with manufacturer-approved fasteners in compliance with the following:

1. ICC-ES ESR-1539 or ICC-NES NER-272 for power-driven fasteners.
2. IBC: Table 2304.9.1 Fastening Schedule.

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F. Apply seam tape at all panel seams, penetrations, and facer defects or cracks to form continuous weathertight surface. Apply tape according to manufacturer's written instructions and requirements of ICC-ES applicable to tape application.

3.3 SEAM AND PENETRATION TREATMENT

A. Assembly continuity: Coordinate sheathing installation with flashing and joint sealant sequencing and installation and with adjacent building air and moisture barrier components to provide complete, continuous air- and moisture- barrier.

B. Tape panel seams, penetrations, and facer defects or cracks with self-adhering seam tape to form continuous weathertight surface. Apply tape according to manufacturer's written instructions and requirements of ICC-ES applicable to tape application.

C. Flash penetrations, gaps, and cracks with liquid-applied flashing membrane to form continuous weathertight surface. Apply according to manufacturer's written instructions. Follow manufacturer’s recommendation for integration with self-adhering seam tape.

D. Tape window and doors openings and radius penetrations with self-adhering flexible flashing tape to form continuous weathertight surface. Apply tape according to manufacturer’s written instructions and requirements of ICC-AC applicable to tape application.

END OF SECTION 06 1613

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SECTION 06 1753 - PREFABRICATED WOOD TRUSSES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Pre-engineered, prefabricated wood roof trusses, truss girders, truss bracing and bridging, and all connections, including those between the trusses and common building framing, as indicated on the Drawings and specified herein.

B. Drawings indicate overall intent, and may include profiles and dimensions of trusses for communication of intent only.

1.2 QUALITY ASSURANCE

A. Conform to the following design standards:

1. "National Design Specification for Wood Construction", published by the National Forest Products Association.
2. "Design Specification for Metal Plate Connected Wood Trusses", published by the Truss Plate Institute (TPI).
3. "American Institute for Timber Construction" (AITC).
4. All applicable state and local building codes.

B. Provide trusses fabricated in accordance with designs prepared under the supervision and bearing the seal of a Professional Structural Engineer, registered in the state of project location.

C. Conform to the following Fabrication and Erection Standards:

1. "Bracing Wood Trusses", published by the TPI.
2. "Quality Control Manual", published by TPI.

D. Design trusses to the Structural Design Criteria and Pre-Fabricated Wood Truss Notes indicated on the Drawings and as specified herein:

1. Design all truss connector plates using an extra safety factor of 1.20 in addition to the standard design requirements listed above.
2. Camber Trusses to equal the dead load deflection.

1.3 SUBMITTALS

A. Shop Drawings:

1. Details and elevations on the Drawings are diagrammatic and are intended to span the basic intent of the truss requirements for design by the truss manufacturer.

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2. Submit shop drawings for review of intent, profiles and overall dimensions to verify conformance with the design intent, and not for structural capability of design.
3. Indicate length, depth, bearing points, pitch, span, profile, quantity, components, grades, configuration, required openings and critical dimensions.
4. Prepare drawings for field erection. Mark and locate all trusses on Drawings. Indicate all bracing and anchoring.

B. Engineer's Certification:

1. Shop drawings and design load calculations shall be prepared, stamped and certified by a Structural Engineer registered to practice in the State of the project location.
2. Structural Engineer shall be hired by the truss manufacturer and shall oversee design of the structural requirements, truss components and connection members.
3. Design truss and wood framing connections in accordance with all requirements of the "Truss Plate Institute", the "National Forest Products Association" and the "American Institute for Timber Construction".
4. Design calculations shall indicate vertical displacement due to loading conditions.

1.4 DELIVERY, STORAGE AND HANDLING

A. Handle prefabricated trusses to avoid damage, and in accordance with manufacturer's instructions.

B. Protect trusses from construction operations.

C. Replace damaged trusses. Do not attempt to repair damaged prefabricated trusses.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Lumber:

1. Species, and grade as required for design load.
2. All lumber for chords and webs to be No. 2 or Better. No. 3 lumber is NOT permitted.
3. Nominal thickness: 2 inches.
4. Nominal width: as required for design load.

B. Metal Connector Plates:

1. Minimum thickness: 0.036 inches.
2. ASTM A446, Grade A.
3. Hot Dip Galvanized per ASTM A525, G60.

C. Connections between wood trusses and common lumber framing shall be made with the appropriate "Simpson" Strong-Tie anchor and connector.

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PART 3 - EXECUTION

3.1 PREPARATION

A. Field verify all dimensions and conditions prior to fabrication.

B. Wood trusses shall NOT be assumed structurally stable until all members are in place. Any use of the partially erected framework for temporary support of any kind shall be done only at the sole risk of the Contractor.

3.2 FABRICATION

A. Fabricate trusses with wood chords and metal or wood webs in accordance with designs certified by the Structural Engineer.

B. Fabricate and install metal connector plates in accordance with latest edition of "Truss Plate Institute" Standards and Procedures.

C. Fabricate and install truss and wood framing connections in accordance with all requirements of the "Truss Plate Institute", the "National Forest Products Association" and the "American Institute for Timber Construction".

D. Multiple trusses, double or triple trusses, shall be utilized, as required, to maintain deflection limits.

3.3 ERECTION

A. Install trusses in accordance with manufacturer's instructions, recommendations and design.

B. Hoist trusses into position so as to prevent damage and minimize out-of-plane bending.

C. Install temporary horizontal and cross bracing to hold trusses plumb and in safe.

D. Install permanent bracing and related components prior to application of loads to trusses.

E. Restrict construction loads to prevent over stressing of truss members.

F. Do not cut or remove truss members or metal connector plates.

PART 4 - SUBMITTAL CHECK LIST

A. Shop Drawings.

B. Engineer’s Certification.

END OF SECTION 06 1753

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SECTION 07 2100 - INSULATION

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Extent of insulation work is indicated on the Drawings and specified herein.

B. Applications of insulation specified in this section include the following:

1. Foundation Wall Insulation.
2. Board Cavity Wall Insulation.
3. Batt/Blanket Thermal Insulation.
4. Batt/Blanket Sound Insulation.
5. Board Insulation At Concrete Tilt Walls.
6. Masonry Core Insulation Inserts.
7. Insulation/Protection Board at Bentonite Clay Board Waterproofing.
8. Interior Vapor Retarder.

1.02 QUALITY ASSURANCE

A. Thermal Conductivity:

Thicknesses shown are for thermal conductivity (k-value at 75°F) specified for each material. Provide adjusted thicknesses as directed for equivalent use of material having a different thermal conductivity. Where insulation is identified by "R" value, provide appropriate thickness.

B. Fire and Insurance Ratings:

Comply with fire-resistance, flammability and insurance ratings indicated, and comply with governing regulations as interpreted by authorities.

1.03 SUBMITTALS

A. Product Data:

1. Manufacturer's specifications and installation instructions for each type of insulation required.
2. Material Safety and Data Sheets (MSDS).

1.04 DELIVERY, STORAGE AND HANDLING

A. Do not allow insulation materials to become wet, soiled, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storage and protection during installation.

B. Protection for Plastic Insulation:

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1. Do not expose to sunlight.
2. Protect against ignition at all times. Do not deliver plastic insulation materials to project site ahead of installation time. Complete installation and concealment of plastic materials as rapidly as possible in each work area.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Foundation Wall Insulation:

1. Provide one of the following approved products:
   a. "Dow Chemical Company", Styrofoam.
   b. "Owens-Corning", Foamular.

2. Rigid, closed-cell, extruded polystyrene insulation board with integral high-density skin:
   a. 25 psi minimum compressive strength.
   b. K-value of 0.20.
   c. 0.5% maximum water absorption.
   d. Minimum value "R-5" per inch thickness, or as otherwise indicated on drawings.
   e. Meeting all requirements of ASTM C578 Type IV.

3. Size:
   a. Manufacturer's standard lengths and widths.
   b. Thicknesses and R-Value as indicated on Drawings, or if not indicated, 2" thick, R-10.0 min.

B. Batt/Blanket Thermal Insulation (formaldehyde, acrylic and dye free):

1. Unfaced Batts:
   a. Provide accepted products from one of the following acceptable manufacturers:
      1.) "Owens Corning".
      2.) "USG".
      3.) “Johns Manville”.
      4.) "CertainTeed".
   b. Fiberglass Batts.
   c. Continuous rolls in width of 16" or 24”, as required to accommodate building component spacing.
   d. Thickness to completely fill stud space and also provide R-value indicated on drawings. If not indicated, provide either 3-1/2" thick R-11 minimum or 6” thick R-19 minimum.
   e. Provide unfaced batts for all batt/blanket thermal insulation, unless otherwise indicated.

2. Kraft Faced Batts:
   a. Use of Kraft Faced Batts is NOT permitted.

3. Foil Faced Batts:
   a. Provide accepted products from one of the following acceptable manufacturers:

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1.) "Owens Corning".
2.) "USG".
3.) “Johns Manville”.
4.) "CertainTeed".

b. Fiberglass Batts.
c. Continuous rolls in width of 16" or 24”, as required to accommodate building component spacing.
d. Foil scrim vapor barrier facing, Class A rated, Type FSK-25.
e. Thickness to provide R-value indicated on drawings, or if not indicated, 3-1/2" thick, R-11.

4. Vinyl Faced Batts (for metal roof systems):
a. Provide accepted products from one of the following acceptable manufacturers:
1.) "Owens Corning".
2.) "USG".
3.) “Johns Manville”.
4.) "CertainTeed".
b. Fiberglass Batts.
c. Continuous rolls in widths from 24" to 72", as required to accommodate joist or purlin spacing.
d. White, vinyl polyester facing, .02 perm rating, 0-25 flame spread rating and 0-450 smoke developed rating.
e Thickness to provide R-value indicated on drawings. Back fill with unfaced fiberglass blankets if required to meet indicated R-values.

G. Batt/Blanket Sound Insulation (formaldehyde, acrylic and dye free):

1. Fiberglass Batts.
a. Provide one of the following approved products:
1). "Owens Corning" Sound Attenuation Batts Fiber Glass.
b. Unfaced.
c. Continuous rolls in width of 16" or 24”, as required to accommodate building component spacing.
d. Thickness to completely fill stud space.
At a minimum, provide 3-1/2" thickness to provide NRC value of 1.00 minimum.
e. Friction fit between studs at partition walls, or as indicated on the drawings.

2. Mineral Wool Batts.
a. Provide one of the following approved products:
1). "Owens Corning" Sound Attenuation Fire Batts (Mineral Wool).
2). “Thermafiber” Safing Insulation.
b. Unfaced.
c. 48” lengths in width of 16" or 24”, as required to accommodate building component spacing.
d. 3” thick minimum to provide NRC value of 1.05 minimum.
e. Friction fit between studs at rated partition walls, or as indicated on drawings.

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PART 3 - EXECUTION

3.01 INSPECTION

A. Installer must examine substrate and conditions under which insulation work is to be performed and must notify Contractor in writing of unsatisfactory conditions. Do no proceed with insulation work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General:

1. Comply with manufacturer's instructions for particular conditions of installation in each case. If printed instructions are not available or do not apply to project conditions, consult manufacturer's technical representative for specific recommendations before proceeding with work.
2. Extend insulation full thickness as shown over entire area to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation.
3. Apply a single layer of insulation of required thickness, unless otherwise shown or required to make up total thickness.
4. For horizontal floor or roof applications, provide separate support system as required to hold insulation in its intended location. If not otherwise indicated, provide continuous single cables attached to bottom chord of trusses at 24” o.c. spacing to allow access to above insulation as desired. Chicken wire or other method of support shall be permitted as approved by the Architect.

B. Perimeter Insulation:

1. On vertical surfaces, set units in adhesive applied in accordance with manufacturer's instructions. Use type adhesive recommended by manufacturer of insulation.
2. At interior side of foundation walls, extend insulation continuous from top of footing to bottom of slab.
3. At exterior side of foundation walls, extend insulation from top of footing to grade line and cut top of insulation board along grade line as required.

C. Cavity-Wall Insulation:

1. On units of plastic insulation, install small pads of mastic spaced approximately 1'-0'' o.c. both ways on inside face, as recommended by manufacturer.
2. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways.
3. Press units firmly against inside wythe of masonry or other construction as shown.

SUBMITTAL CHECK LIST

1. Product Data.

END OF SECTION 07 2100

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SECTION 07 2400 - EXTERIOR INSULATION AND FINISH SYSTEM

PART 1 - GENERAL

1.01 WORK INCLUDED

Furnish labor, materials, equipment, special tools, supervision and services required to install a complete exterior insulation and finish system (E.I.F.S.), as indicated, noted, detailed and scheduled on the Drawings and specified herein.

1.02 QUALITY ASSURANCE

A. Exterior Insulation and Finish System shall be installed only be factory-trained and manufacture approved and licensed contractors familiar with the product and in strict accordance with the manufacturer's instructions.

B. All details relating to the installation by the approved contractor and/or by the manufacturer will furnish a 5 year Warranty for the installation.

C. All materials used shall be as furnished or approved by the E.I.F.S. manufacturer for use and compatibility with the entire E.I.F.S. system.

D. Manufacturer shall send a qualified technical representative to the project site for purpose of advising Installer of procedures and precautions related to use of E.I.F.S. materials.

E. UL Listing: Flamespread less than 25.

1.03 SUBMITTALS

A. Product Data:

1. Manufacturer's published specifications, installation instructions and general recommendations.
2. Include data substantiating that materials comply with specification requirements.

B. Shop Drawings:

1. Complete drawings, showing configuration, joint layout, connections, expansion joints and details.

C. Samples:

1. Samples of manufacturer's selection of colors for selection by Architect.
2. Samples of manufacturer's entire selection of surface textures for selection by Architect.
3. Submit 24 inch square sample of finished E.I.F.S. system, including gypsum board, insulation and all finish materials.

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1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver packaged materials to site in manufacturer's original unopened, labeled, bundles or containers.

B. Arrange deliveries to provide sufficient quantities to permit continuity of any phase of work.

C. Do not store material on floor or roof construction in concentrations large enough to impose excessive stress on decking or structural members.

D. Materials shall be stacked and protected from moisture penetration and freezing.

1.05 JOB CONDITIONS

Proceed with E.I.F.S. installation when existing and forecasted weather conditions permit work to be performed in accordance with manufacturer=s recommendations and warranty requirements.

1.06 SPECIAL PROJECT WARRANTY

Provide written warranty, signed by manufacturer of primary E.I.F.S. for materials and workmanship for a period of 5 years after date of Final Acceptance.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURER'S

A. Primary E.I.F.S. System Materials:

1. "Dryvit Systems, Inc."
2. "STO Corporation"
3. “BASF/Senergy”

2.02 MATERIALS

A. All components shall be obtained from or approved by the primary E. I. F.S. manufacturer.

B. Gypsum Board Sheathing Substrate (Non-Fire Rated Assemblies):

1. Provide one of the following approved products:
   a. “Georgia-Pacific”, "Dens-Glass Sheathing".

2. Manufacture to meet specifications for ASTM D 3273.
3. Provide in maximum lengths available to minimize end-to-end butt joints.
4. Fiber glass mats over moisture-resistant gypsum core. Paperless facings.
5. Thickness:

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a. Framing at 16 inches o.c.: 1/2 inch, or as otherwise indicated on the Drawings.
b. Framing at 24 inches o.c.: 5/8 inch, or as otherwise indicated on the Drawings.

6. Width: 4 feet.
7. Length: 8 feet minimum.
8. Edges: Square.

C. Gypsum Board Sheathing Substrate (Fire Rated Assemblies):

1. Provide one of the following approved products:
   a. “Georgia-Pacific”, "Dens-Glass Fireguard".

2. Manufacture to meet specifications for ASTM D 3273.
3. Provide in maximum lengths available to minimize end-to-end butt joints.
4. Fiber glass mats over moisture-resistant gypsum core. Paperless facings.
5. Thickness:
   a. Framing at 16 inches o.c.: 1/2 inch, or as otherwise indicated on the Drawings.
   b. Framing at 24 inches o.c.: 5/8 inch, or as otherwise indicated on the Drawings.

6. Width: 4 feet.
7. Length: 8 feet minimum.
8. Edges: Square.

D. Sheathing Fasteners:

1. Corrosion-resistant, self-drilling, self-tapping type.
2. Spacing:
   a. 8 inches o.c. along edge of sheathing at joint.
   b. 12 inches o.c. in field area of sheathing.

E. Insulation Board:

1. Molded polystyrene boards as approved by E.I.F.S. manufacturer.
2. Density: 1.0 pcf.
3. Size: 2 feet x 4 feet maximum; 1 inch thick minimum.
4. Flamespread: 25 maximum when tested per ASTM E-84.
5. Smoke Development: 450 maximum when tested per ASTM E-84.
6. Thermal Value: "k" per inch.
   a. .23 BTU/°F/SF at 40°F
   b. .23 BTU/°F/SF at 74°F

F. Insulation Board Adhesive:

1. Acrylic polymer-modified base coat material mixed with Portland cement.
2. Ready-mixed or field-mixed.

G. Standard Reinforcing Mesh:

1. Treated, open weave, glass fiber type. Manufacturer's standard.
2. Use only for areas above 7'-6".

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H. Impact-Resistant Reinforcing Mesh:

1. Treated, open weave, glass fiber type.
2. Acceptable products:
   a. "Dryvit", "Panzer 20".
   b. "STO", "Armour Mat XX".

3. 20 ounce.
4. Use where indicated and all areas less than 7'-6" above grade.
5. Provide and install a layer of impact-resistant reinforcement mesh below a layer of manufacturer's standard reinforcing mesh.

I. Finish:

1. Factory-mixed, 100% pure acrylic base.
2. Integral color and texture.
3. Color and texture to be selected from manufacturer's entire selection. (Match exist building EIFS color)

J. Water:

1. Clean, potable and free and all foreign matter.

K. Sealant:

1. Refer to Section 07900-Joint Sealers.

2.03 MIXING AND PREPARATION

A. Adhesive:

1. No mixing required. Water should not be added.

B. Finish:

1. Thoroughly stirred until a uniform workable consistency is obtained.
2. Small amount of water may be added to adjust workability.
3. No additive, or materials of any kind, such as rapid binders, antifreeze, accelerators, filters, pigments, etc. shall be added under any circumstances.
4. Use finish material immediately after mixing. Container to be kept closed when not in use.

C. Reinforcing Mesh:

1. Reverse roll to remove curling tendencies.

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PART 3 - EXECUTION

3.01 INSPECTION

A. Examination of Substrate:

1. Prior to installation of the E.I.F.S., the Substrate shall be examined by the Applicator as follows:
   a. The Substrate shall be a type approved by E.I.F.S.
   b. The Substrate surface shall be free of foreign materials such as oil, dust, dirt, form-release agents, paint, wax, glazing, water, moisture, frost, etc.
   c. The Substrate shall be examined for compliance with Contract Documents.
   d. The Substrate shall be examined for soundness, such as tightness of connections, crumbling or looseness of surface, voids and projections, etc.
   e. The Substrate shall be examined for dimensional correctness.

2. The Architect and Contractor shall be advised of all discrepancies. Work shall not proceed until unsatisfactory conditions are corrected.

3.02 INSULATION BOARD INSTALLATION

A. Apply insulation boards to substrate beginning from the bottom with joints offset to produce a running bond pattern.

B. Precut board to fit openings, corners, projections, etc.

C. Apply adhesive directly to one surface of the insulation board using a notched trowel over entire board surface.

D. Apply a 2 inch wide x 3/8 inch thick ribbon of adhesive around entire perimeter of board.

E. Install board immediately after application of adhesive. Slide into final position, tight against adjacent boards.

F. Tamp entire area of board to ensure complete contact of adhesive.

G. Allow 24 hours minimum for adhesive to form a positive bond.

3.03 DESIGNS AND SHAPES

A. Grooves and other features are to be routed into the outside surface of the insulation board. The minimum thickness of the board at any point in the routed groove or feature must not be less than 3/4 inch.

B. Apply foam shapes of insulation board directly to the substrate or surface of the insulation board.

C. Follow the E.I.F.S. manufacturer's detailed instructions for these procedures.

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D. All soffits to have routed "drip" reveals, continuous at perimeter.

3.04 BASE COAT

A. Inspect the surface of insulation board for flatness. High areas out-of-plane are to be sanded flat.

B. Repair any damaged board surfaces and remove foreign materials.

C. Apply a 1/16 inch uniform layer of adhesive mixture to the surface of insulation board.

D. Embed reinforcing mesh into adhesive as follows:

1. Use standard mesh above 7'-6" A.F.F.
2. Impact-resistant mesh below 7'-6" A.F.F.

E. Smooth out the adhesive mixture with a trowel until mesh is fully embedded. Mesh pattern should not be visible.

F. Allow 24 hours minimum for base coat to form a positive bond.

G. Protect the base coat from damage and weather while curing.

3.05 FINISH COAT

A. Apply the finish continuously and in one operation to the entire wall surface. Maintain a wet edge at all times.

B. The installer is responsible for providing sufficient manpower, scaffolding and equipment to ensure a continuous operation and uniform appearance.

C. Work shall proceed toward joints and corners.

D. Apply the finish in a tight coat to the base coat. Leveling and texturing are to be one operation.

E. The maximum thickness of finish coat should not be greater than of the largest aggregate.

3.06 FIELD QUALITY CONTROL

A. An authorized representative of the E.I.F.S. must visit the project site during construction to inspect the means, methods and materials being used for the entire E.I.F.S.

3.07 CLEAN-UP

A. All excess materials, scraps, debris, etc. are to be removed from the project site upon completion.

B. Clean all adjacent surfaces and materials and the work area in general of foreign materials resulting from their work.

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SUBMITTAL CHECK LIST

1. Product Data.
2. Shop Drawings.
3. Samples.

END OF SECTION 07 2400

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SECTION 07 3100 - SHINGLES

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials equipment, special tools, supervision and services required to install complete fiberglass roofing shingles and related accessories indicated, noted, detailed and scheduled on the drawings and specified herein.

B. Includes Underlayment beneath finished shingle roof surface.

C. Includes Ridge Vent atop ridges of finished shingle roof surface.

1.02 QUALITY ASSURANCE

A. Provide materials which have been tested and listed by Underwriters Laboratories for class and rating specified.

B. ASTM D3018 or 03161 type I, ASTM D3462.

1.03 SUBMITTALS

A. Submit samples showing manufacturer's full range of standard colors. Submit additional or larger samples of selected colors upon request.

B. Submit copy of manufacturer's product warranty.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in sealed packages with manufacturer's and Underwriter's Laboratories labels intact.

B. Store material on raised platforms, protected with coverings.

C. Do not stack bundles of shingles more than 3 ft. high.

D. Store rolled goods on end.

1.05 PROJECT CONDITIONS

A. Do not install underlayment or shingles on wet surfaces.

B. Do not apply shingles when air temperature is below 32°F.

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1.06 WARRANTY

A. Provide written manufacturer's guarantee against material defects for 30 years, minimum.

B. Guarantee workmanship for 2 years.

C. Shall include an anti-algae / anti-fungal growth guarantee for 10 years, minimum.

D. Shall include a 110 MPH wind warranty for 10 years, minimum.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Provide one of the following approved products:

1. "GAF", Slate Line.
2. "Certainteed", Hatteras.
3. "Elk", Prestique Grande.
4. "Owens Corning", Berkshire.

2.02 MATERIALS

A. Basis of specification: "GAF", Slate Line.

B. Shingles:

1. Material: Fiberglass Asphalt, self-sealing.
2. Type: Fire Resistant Class A.
3. Tabs: 4 or 5.
4. Size: Approx. 17" x 40".
5. Weight: Approx. 235 lb./square minimum.
6. Exposure: Approx. 7-1/2".
7. Self-healing.

C. Ridge Cap:

1. Preformed to match shingles, by same manufacturer.
2. Install atop Ridge Vent and at all lengths of ridges where Ridge Vent is not otherwise located.

D. Underlayment:

1. Provide one of the following approved products:
   a. "Grace Building Products", Ice and Water Shield.
   b. “Soprema”, Lastobond.

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c. “Mid-States Asphalt”, Quik-Stick HT.
d. “InterWrap”, Titanium UDL.

2. Provide beneath entire finished roof surface.

E. Fasteners:

1. Galvanized roofing nails, minimum 3/8" head, 5/8" min. length, 10 gauge annular threaded shank.

F. Plastic Asphalt Cement:

1. Per ASTM D 491.

2.03 RIDGE VENT

A. Basis of specification: "Air Vent, Inc.", Shingle Vent II.

B. Description:

1. Pre-formed, low-profile, shingle-over designRoof mounted static exhaust vent.
2. External wind baffle and internal weather filter for simultaneous ventilation and weather protection.
3. Internal stiffening ribs for strength and stability.
4. Continuous end air slots with 18 square inches net free area per linear foot.
5. Built-in ventilating end plug, self-closing and weathertight.
6. Made to receive installation of ridge cap shingles atop.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Underlayment:

1. Apply starting at eave line.
2. Lap each sheet 4" minimum.
4. Nail at edges 8" o.c. through metal caps. Field nail at 12" o.c.

B. Shingles:

1. Apply shingles with five inches exposure, with not less than 4 nails, following manufacturers published instructions and recommendations.
2. Apply starter strip of roll roofing or inverted shingles, even with flashing lower edge.
3. Control shingle alignment with chalk lines.
4. Align cutouts and butts.
5. Comply with manufacturer's installation instructions and NRCA recommendations and details.

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3.02 MAINTENANCE STOCK

A. See Section 01 7846 – Closeout Maintenance Materials.

SUBMITTAL CHECK LIST

1. Samples.
2. Warranty.

END OF SECTION 07 3100

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SECTION 07 6000 - FLASHING, SHEET METAL AND ROOF ACCESSORIES

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The extent of each type of flashing and sheet metal work is indicated on the drawings and by provisions of this section.

B. The types of work specified in this section include, but are not limited to, the following:

1. Metal edge flashing and coping.
2. Metal wall flashing and expansion joint.
3. Exposed metal trim/fascia units.
4. Miscellaneous sheet metal accessories.
5. Metal gutters.
6. Metal downspouts.
7. Sheet metal flashing at windows and exterior doors.
8. Pre-manufactured metal coping.
9. Roof vents.

C. Gutters and downspouts may be either aluminum or galvanized steel as approved by the Architect.

The intent is that all metal work shall have the same and consistent finish so as to appear as a cohesive installation. Coordinate with coping, fascia, soffits, flashings, trim, etc.

1.02 QUALITY ASSURANCE

A. Sheet metal flashing and trim shall conform with recommended practices contained in "Architectural Sheet Metal Manual", Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA).

1.03 SUBMITTALS

A. Shop Drawings:

Show typical details of formed configuration, seams, joints, thicknesses, dimensions, fastening and anchoring methods.

B. Samples:

1. 6 inch x 6 inch piece of metal and each type fastener.
2. Colors to be selected from manufacturer's entire standard selection. (intent is to match existing building color)

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1.04 JOB CONDITIONS

A. Coordinate work of this section with interfacing and adjoining work for proper sequencing of each installation. Insure best possible weather resistance and durability of the work and protection of materials and finishes.

B. Do not proceed with the installation of flashing and sheet metal work until curb and substrate construction, can't strips, blocking and other construction to receive the work is completed.

1.05 WARRANTY

A. The Project warranty provided by the Contractor shall include agreeing to repair or replace sheet metal and flashing which has failed to fulfill performance requirements of waterproofing due to defective materials, workmanship or improper installation, during the warranty period.

1.06 FINISHES

A. As shown on the Drawings or as selected from manufacturer's entire selection.

B. All colors and finishes are to be as selected by Architect.

C. Custom color may be required to produce a match to that selected or to match existing building materials.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Stainless Steel:

1. ASTM A 167, soft temper, Type 304.
2. 26 gauge (.018 inches) sheet.
3. Finish 2D, dull; ASTM A 480.

B. Galvanized Steel:

1. ASTM A 525, coating G90.
2. Thickness (minimum):
   a. 18 gauge.
   b. 26 gauge flashing.
   c. 24 gauge gutters.
   d. 22 gauge, downspouts.

C. Aluminum:

1. ASTM B 209, Alloy 5005-H134.
2. Thickness (minimum):
   a. .032 inches, or as otherwise indicated on Drawings.

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b. .032 inches, gutters.
c. .032 inches, downspouts.

3. Finish: Fluoropolymer enamel.

D. Copper:

1. ASTM B 370, cold rolled sheet.
2. Weight: 16 oz.

E. Lead Coated Copper:

1. ASTM B 101, Class A, cold rolled sheet.
2. Weight: 16 oz.

F. Solder:

1. ASTM B 32.
2. 50-50 Block tin and pig lead; 40-60 lea and tin for lead coated copper.

G. Fasteners:

1. Stainless Steel nails, flat-head.
2. Galvanized steel, hot dipped, flat head.
3. Hard copper, brass or bronze, flat-head, 12 gauge for copper and lead coated copper.

H. Cleats:

1. 2 inches wide, 3 inches long piece of sheet metal.
2. 16 oz., unless otherwise specified.

I. Flux:

1. Rosin or muriatic acid neutralized with zinc.

J. Bituminous Paint:

1. Asphalt emulsion, ASTM D 1187, Type A.

K. Sealant:

1. One-part butyl rubber sealant, FS TT-S-00657, Type 1.

L. Metal Accessories:

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1. Provide sheet metal clips, straps, anchoring devices and similar accessory units as required for installation of work, matching or compatible with material being installed, non-corrosive, size and gauge required for performance.

M. Coil Stock:

1. “Alcoa Aluminum” with Almalure 2000, 2-coat acrylic topcoat resin.

2.02 FABRICATION

A. Form metal flashing and trim to configurations indicated on the Drawings, free from defects which impair strength or mar appearance.

B. Remove acid flux residue by neutralizing and scrubbing with ammonia or washing with soda solution. Rinse with clean water.

C. Tin edges of plain copper sheets to be soldered for a width of 1-1/2 inches both sides with solder.

D. Seams:

1. Make seam in direction of flow.
2. Seams must be soldered or locked, unless otherwise approved.
3. Gutter and downspout seams may be lapped.
4. Standing seams shall finish not less than 1” high unless otherwise specified.
5. Flat-Lock Seams, Soldered and unsoldered: Finish not less than 3/4” wide.
6. Lap Seams, Soldered: Finish not less than 1” wide.
7. Lap Seams, Unsoldered: Overlap 3" unless otherwise noted.
8. Loose-Lock Seams, Unsoldered: 3” common, or hook, seam, filled with sealant.

E. All exposed edges not seamed shall be hemmed, bent back 1/2 inch to unexposed side.

F. Furnish edge strips where sheet metal extends over edges and where necessary to secure sheet metal work at fascia, gravel stops, etc. Form edge strips of compatible material.

2.03 PRE-MANUFACTURED METAL COPING

A. Provide products, as approved by the Architect, by one of the following approved manufacturers:

1. "Metal-Era".
2. "Hickman".
3. “MM Systems".
4. Architectural Products Company”.

B. Product:

1. Basis of Specification: "Metal-Era", Anchor-Tite Fascia, AF Series.
2. Description: Extruded aluminum fascia, splice plate and galvanized steel cant dam.
3. Style: Extruded Aluminum 6063-T5 Alloy.

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4. Size: To be selected from the manufacturer's standard sizes of 4", 5-1/2", 7" or 8-1/2". See Drawings for sizes. If not indicated, provide 7" height. See details and drawings for special conditions that may require differing sizes.
5. Thickness: .040" minimum, aluminum.
6. Length: 12'-0" lengths.
7. Compression screw and clamp for non-penetrating securing of roof membrane.
8. All corners to be mitered and fully welded, then factory finished.
9. FM I-120 approved.
10. Finish: Kynar 500, 20-year finish warranty.
11. Color: Selected by Architect from manufacturer's entire standard selection.

2.04 ROOF VENTS

A. Provide products, as approved by the Architect, by one of the following approved manufacturers:

1. "Air Vent, Inc.", Roof Louvers, Slant-Back Metal Roof Vent.

B. Product:

1. Heavy-duty aluminum construction.
2. Insect screen.
3. Installation flashing flange at entire perimeter.
4. 50 square inches of net free area per unit.
5. Provide appropriate unit as required for roof pitch condition.
6. Finish: Galvanized.
7. Color: Field-finish paint to match roofing.

PART 3 - EXECUTION

3.01 GENERAL

A. Examine all surfaces to receive the metal flashing and trim. Verify all dimensions of in-place and subsequent construction. Installation of metal flashing and trim constitutes acceptance of the existing conditions.

B. Surfaces to which sheet metal is to be applied shall be smooth, sound, clean, dry and free from defects that might affect the application.

C. Erect all member plumb, level and in line securely anchored and properly related to other parts of the Work.

D. Protect metal surfaces which are to be in contact with dissimilar metals, with wood or other absorptive material, with roofing felt, building paper or a coat of bituminous paint specified to prevent galvanic or corrosive action. Protection shall not extend onto exposed surfaces.

3.02 INSTALLATION

A. Base Flashing:

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1. On roofing where shown, extend flashing up vertical surfaces not less than 8 inches unless otherwise shown, and 4 inches horizontally out on the roof.

B. Insert Flashing:

1. Preform, interlock and bed insert flashing, extend horizontally from face of wall to backing, extend vertically and insert in reglet: Secure as hereinafter specified.

C. Counterflashing:

1. Overlap base flashing 4 inches.

D. Securing Flashing and Reglets:

1. Open Slot Reglets:
   a. Turn sheet metal into open slot reglets and secure with lead or copper plugs at approximately 12 inches o.c.

2. Friction Type Reglets:
   a. Turn sheet metal into friction type reglets and secure by indenting slot 12 inches o.c. with a dull punch or by means of “thumbnail” notches in sheet metal at 12 inches o.c.

E. Cleats:

1. Where required to retain flashing, provide cleats specified, spaced not more than 12 inches o.c. Secure one end with two nails and fold clip back over nail heads. Lock free end of cleat into seam or into folded edge of sheet metal.

F. Roof Penetration Flashing:

1. Base Flashing:
   a. Extend flange onto roof 6 inches minimum away from penetration.
   b. Extent Flange upward around penetration to at least 2 inches above floor line.
   c. Fold back upper an side roof flange edges 1/2 inch minimum.
   d. Solder lap joints.

2. Counterflashing:
   a. Provide sealant around penetrations through flashing.

G. Reglets:
1. Install in accurate location, straight in-line, with leakproof joints.

H. Drip Edge:

1. Extend 4 inches wide up from eave edge full eave length.
2. Set into asphalt flashing cement, full width.
3. Secure with aluminum annular ring nails 12 inches o.c.

I. Base Flashing at shingle roof slope along vertical surface:

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1. Extend up vertical surface 8 inches minimum and onto roofing 4 inches minimum.
2. Solder lap vertical seams; miter and solder lap corners.
3. At sloped roof extend flashing from 2 inches above top edge to base shingle to 1-1/2 inches above butt edge of covering edge of shingle, extending 5 inches up vertical surface.
4. Install flashing under each shingle course.

J. Apron flashing at roof sloping away from vertical surface:

1. Extend up vertical surface to first masonry joint (if applicable), and onto roofing minimum 4 inches.
2. Hem bottom edge 1/2 inch.
3. Lap seam vertical joints minimum 3 inches and apply sealant engaging hemmed edged.
4. Miter and solder joints: extend minimum 3 inches around corners.
5. Install bottom edge tight against roofing.
6. Counter flash top edge.

K. Cricket Flashing:

1. Form to slope away from vertical surface.
2. Extend up vertical surface minimum 4 inches and 8 inches onto roof surface, with edges folded back 1/2 inch.
3. Solder lap joints: cleat to substrate.

L. Rake Flashing:

1. Extend horizontal flange 3 inches under roofing and nail to substrate.
2. Extend vertical face of fascia.
3. Lap seam joint in direction of flow.

M. Gutters:

1. 6", Ogee (K-Style) profile, unless otherwise indicated.
2. Continuous 10’-0” lengths with 6” splice plate to allow thermal movements.
3. Lap joints 1 inch minimum and rivet.
4. Fabricate outer edge 1/2 inch minimum lower than back edge.
5. Stiffen outer edge with hemmed return.
6. Secure end caps with 1 inch minimum width flanges riveted and sealed.
7. Secure gutter with matching metal straps spaced 2 feet apart maximum.
8. Locate and shape outlet thimble to fit downspouts and extend 2 inches below gutter soffit.
9. Rivet and seal thimble flanges to gutter bottom.

N. Downspouts:

1. 5" x 5", plain square profile, unless otherwise indicated.
2. Form with flat sheet material, plain rectangular size indicated.
3. Fabricate longitudinal joints with flat lock seams.
4. Telescope upper sections onto lower sections 1-1/2 inches minimum.
5. Rivet and solder.
6. Attach to wall with 1 inch wide straps matching downspout material, 1 gauge heavier.
7. Locate straps at downspout tops, bottoms, and at 10 feet maximum centers.

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8. Secure straps to wall with fastener heads covered with strap tabs.
9. Fit strainers tightly in each downspout.

O. Gravel Stop:

1. Form 3/4 inch minimum height gravel stop.
2. Lap seam joints maximum 10 feet apart.
3. Fill roof flange joints with bituminous plastic cement.
4. Lock drip edge over continuous cleats secured to substrate.
5. Extend roof flange 4 inches onto roofing, set in plastic cement and secured to substrate with nails approximately 8 inches o.c.
6. Miter and bend corners, extend minimum 12 inches.

P. Scuppers:

1. Locate straps at downspout tops, bottoms and at 10 feet maximum centers.
2. Secure straps to wall with fasteners heads covered with strap tabs.
3. Fit strainers tightly in each downspout.
4. Extend minimum 3 inches into storm drain hub.
5. Grout with Portland cement to close opening and trowel top surface to slope away from downspout.

Q. Coping:

1. Form to profile indicated.
2. Space coverplates seams 10 feet o.c.
3. Miter and joint corners with soldered seams.
4. Lock exterior rounded edge under cleats, continuous.
5. Bend inner edge over counterflashing, lock to substrate at seams.
6. Slope toward roof 3/4 inches.

3.03 CLEANING AND PROTECTION

A. Remove all flux, scraps and dirt as work progresses. Neutralize excess flux with a 5 to 10 percent solution of washing soda and surface drenched with clean water.

B. Protect flashing and sheet metal work during construction to insure that work will be without damage or deterioration, other than natural weathering, at time of substantial completion.

SUBMITTAL CHECK LIST

1. Shop Drawings.
2. Samples.

END OF SECTION 07 6000

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SECTION 07 9200 - JOINT SEALERS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The extent of each form and type of joint sealer as indicated on the Drawings and specified herein.

B. Types of joint sealants specified herein include:

1. Elastomeric Sealants.
2. Non-Elastomeric Sealants and Caulking Compounds.
3. Concrete Tilt-Wall Panel Sealants.
4. Acoustical Sealants.
5. Acoustical Duct Gaskets.
6. Waterstop.

C. In general, all joints are to have joint sealers, including but not limited to the following:

1. Sidewalk Joints.
2. Expansion and control joints.
3. Flashing and coping joints.
4. Interior wall/ceiling/door/window frame joints.
5. Joints between dissimilar materials.
6. Concrete tilt wall panel joints.
7. Acoustical partition walls joints and entire perimeter.
8. Mechanical ducts through acoustical partition walls.
9. Concrete joints and penetrations at elevator pits below grade.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Refer to Division 3 - concrete surfaces.

B. Refer to Division 8 - sections for glazing requirements.

C. Refer to sections of Division 22, 23 and 26 for joint sealers in mechanical and electrical work.

1.03 QUALITY ASSURANCE

A. Except as otherwise indicated, joint sealers are required to establish and maintain airtight and waterproof continuous seals on a permanent basis, within recognized limitations of wear and aging as indicated for each application. Failures of installed sealers to comply with this requirement will be recognized as failures of materials and workmanship.

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1.04 SUBMITTALS

A. Product Data:

1. Submit manufacturer's product specifications, handling/installation/curing instructions and performance tested data sheets for each elastomeric product required.
2. Submit certified test reports for elastomeric sealants on aged performances as specified, including hardness, stain resistance, adhesion, cohesion or tensile strength, elongation, low-temperature flexibility, compression set, modulus of elasticity, water absorption, and resistance (aging, weight loss, deterioration) to heat and exposures to ozone and ultraviolet light.

B. Samples:

1. Submit color charts for selection.
2. Colors to be selected by Architect from manufacturer's entire selection.
3. Multiple colors may be selected for differing substrates and/or conditions throughout the project.

1.05 JOB CONDITIONS

A. Do not proceed with installation of liquid sealants under unfavorable weather conditions. Install elastomeric sealants when temperature is in lower third of temperature range recommended by manufacturer for installation.

1.06 WARRANTY

A. The Contractor shall provide a warranty against failure of sealant materials and workmanship including replacement of other materials damaged as a result of sealant failure for five (5) years from the date of Substantial Completion. Typical for all sealants at all locations and conditions, unless otherwise indicated.

PART 2 - PRODUCTS

2.01 GENERAL

A. General Sealer Requirements:

1. Select materials for compatibility with joint surfaces and other indicated exposures, and except as otherwise indicated, select modulus of elasticity and hardness or grade recommended by manufacturer for each application indicated.
2. Where exposed to foot traffic, select non-tracking materials of sufficient strength and hardness to withstand "stiletto" heel traffic without damage or deterioration of sealer system.
3. Provide colors as selected by Architect from the manufacturer's entire available color selection. Colors are to be selected for each differing material and condition. Various colors of each product are to be expected.

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2.02 ACCEPTABLE MANUFACTURERS

A. Provide products, as approved by the Architect, by one of the following approved manufacturers:

1. Manufacturers of Elastomeric Sealants (Liquid):
   a. "Sonneborn / BASF Building Systems"
   b. "Tremco, Inc."
   c. "Capital Services"
   d. "DOW Corning"

2. Manufacturers of Non-Elastomeric Sealants (Liquid/Tape):
   a. "Sonneborn / BASF Building Systems"
   b. "Tremco, Inc."
   c. "Capital Services"
   d. "DOW Corning"

3. Manufacturers of Joint Fillers/Sealant Backers:
   a. "Sonneborn / BASF Building Systems"
   b. "Backer Rod Mfr. & Supply Co."
   c. "Williams Products, Inc."

2.03 ELASTOMERIC SEALANTS

A. For use at interior/exterior joints subject to movement: control joints, expansion joints, etc.

B. Multi-Component Polyurethane Sealant: Except as otherwise indicated, provide manufacturer's standard, non-modified, 2-or-more-part, polyurethane-base, elastomeric sealant; complying with ASTM C920 Type M Class 25, non-sag grade/type.

C. Modulus and Hardness: Where self-leveling grade/type is required, provide sealant with cured modulus of elasticity at 100% elongation of not more than 150 psi (ASTM D 412 test procedure), and Shore A hardness of not less than 55 (ASTM D 2240). Where non-sag grade/type is required, provide sealant with cured modulus of elasticity at 100% elongation of not more than 75 psi and Shore A hardness of 20 to 30.

D. Tear Resistance: Not less than 50 lb. per inch (ASTM D 624).

E. Acceptable Products:

1. "Sonneborn", Sonolastic NP 1.
2. "Sonneborn", Sonolastic NP 2.
3. "Sonneborn", Sonolastic SL I.
4. "Tremco", Dymeric.

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2.04 NON-ELASTOMERIC SEALANTS AND CAULKING COMPOUNDS

A. For general use as an exposed building construction sealant provide acrylic terpolymer, solvent-based, one-part, thermo-plastic sealant compound; solids not less than 95% acrylic.

B. Performance Standard: Comply with either ASTM C 920 Type S Class 12-1/2 Grade NS or Class B Type Non-Sag.

C. Bond and Cohesion: Comply with ASTM C 910, with less than 0.50 square inches of combined cohesion and bond failure for three (3) samples.

D. Acceptable Products:

1. "Sonneborn", Sonolac.
2. "Tremco", Mono.

2.05 MISCELLANEOUS MATERIALS

A. Joint Primer/Sealer:

Provide type of joint primer/sealer recommended by sealant manufacturer for joint surfaces to be primed or sealed.

B. Bond Breaker Tape:

Provide Polyethylene tape or other plastic tape as recommended by sealant manufacturer; to be applied to sealant-contact surfaces where bond to substrate or joint filler must be avoided for proper performance of sealant. Provide self-adhesive tape where applicable.

C. Sealant Backer Rod:

Provide compressible rod stock of polyethylene foam, polyurethane foam, polyethylene jacketed polyurethane foam, butyl rubber foam, neoprene foam or other flexible, permanent, durable non-absorptive material as recommended by sealant manufacturer for back-up of, and compatibility with sealant.

PART 3 - EXECUTION

3.01 PREPARATION

A. Examine substrates, (joint surfaces) and conditions under which joint sealer work is to be performed. Do not proceed with joint sealer work until unsatisfactory conditions have been corrected.

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3.02 INSTALLATION

A. Clean joint surfaces immediately before installation of sealants. Remove dirt, insecure coating, moisture and other substrates which could interfere with bond of sealant. Etch concrete and masonry joint surfaces as recommended by sealant manufacturer. Roughen vitreous and glazed joint surfaces as recommended by sealant manufacturer.

B. Set joint filler units at depth or position in joint as indicated to coordinate with other work, including installation of bond breakers, backer rods and sealants. Do not leave voids or gaps between ends of joint filler units.

C. Install sealant backer rod for liquid-applied sealants, except where shown to be omitted or recommended to be omitted by sealant manufacturer for application indicated. Install backer rod at all areas required for proper installation of sealant.

D. Install backer rods at any location necessary for proper installation of all sealants, whether shown on drawings or not.

E. Install bond breaker tape where indicated and where required by manufacturer's recommendations to insure that liquid-applied sealants will perform as intended.

F. Employ only proven installation techniques, which will insure that sealants are deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of joint bond surfaces equally on opposite sides. Except as otherwise indicated, fill joints with sealant to a slightly concave surface slightly below adjoining surfaces. Where horizontal joints are between a horizontal surface and vertical surfaces, fill joint to form a slight cove, so that joint will not trap moisture and dirt.

G. Install liquid applied sealant to depths as shown or, if not shown, as recommended by sealant manufacturer but within the following general limitations:

1. 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 inch deep nor less than 1/4 inch deep.
2. For joints sealed with non-elastomeric sealants and caulking compounds, fill joints to a depth in range of 75% to 125% of joint width.

H. Do not allow sealants or compounds to overflow from confines of joints, or to spill onto adjoining work, or to migrate into voids of exposed finishes. Clean adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage.

I. Do not overheat or reheat hot-applied sealants.

3.03 PROTECTION

A. Cure sealant compounds in compliance with manufacturer's instructions and recommendations, to obtain high early bond strength, internal cohesive strength and surface durability.

B. Protect joint sealers during construction period, so that they will be without deterioration or damage (other than normal wear and weathering) at time of substantial completion. Replace or restore sealants which are damaged or deteriorated during construction period.

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SUBMITTAL CHECK LIST

1. Product Data.
2. Warranty.

END OF SECTION 07 9200

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SECTION 08 1113 - STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Hollow metal doors and frames as shown on the Drawings and specified herein, including:

1. Hollow steel doors and frames.
2. Hollow steel frames for wood doors.
3. Hollow steel frames for FRP flush doors.
4. Heavy duty steel traffic doors and frames.
5. Hollow metal window-walls, glazed openings, and other hollow metal frames for glass.
6. Modifying existing hollow metal doors and frames.
7. Rough bucks, frame reinforcing, door reinforcing, door insulation, closer reinforcements, clip angles and anchorage.
8. Factory prime paint finish.
9. Grouting of hollow metal frames with masonry mortar where not covered under other Sections.

1.02 REFERENCES

A. The following standards, tests and publications may be referred to herein and are applicable to this Section:

1. ANSI A250.8-1998/SDI-100 - Recommended Specifications - Standard Steel Doors and, Steel Door Institute, unless herein specified.
2. UL 10C-98 and UBC 7-2 – Positive Pressure Fire Tests of Door Assemblies.
3. NFPA-80-1999 – Standard for Fire Doors and Windows.
4. NFPA-101-1997 – Life Safety Code.
5. NFPA-105 – Standard for Smoke and Draft Control Assemblies.
6. ASTM-A 366-95A – Specification for Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality.
7. ASTM-A 568-95 – Specification for Steel, Sheet, Carbon, and High Strength, Low-Alloy, Hot-Rolled, and Cold-Rolled.
8. ASTM-A 569-91a – Specification for Steel, Carbon, (0.15 maximum percent), Hot-Rolled Sheet and Strip Commercial Quality.
9. ASTM-A 924-95 – General Requirements for Steel Sheet, Metallic Coated by the Hot-Dip Process.
10. SDI-105-92 – Recommended Erection Instructions for Steel Frames.
11. ANSI A115.1-.18 - Specification for Door and Frame Preparation for Hardware.
12. ANSI A156.7 - Standard Template Hinge Dimensions.

1.03 SUBMITTALS

A. Product Data:

1. Manufacturer's specifications for fabrication and installation, including data substantiating products comply with requirements.

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2. Manufacturer's published product data sheets.

B. Shop Drawings:

1. Show type of door and frame for each opening, sections of all typical members, dimensioned elevations, anchors, reinforcements and other required components.
2. Preparation for installing hardware and glazing.

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 herein specified.

B. Wind Load Performance Requirements: Comply with wind load requirements of the applicable State Building Code. Deflection shall not exceed 1/175 of span.

C. Supplier Qualification: Qualified direct distributor of products to be furnished. The distributor shall have in their regular employment an A.H.C./C.D.C. or person of equivalent experience who will be available at reasonable times to consult with the Architect, Contractor and/or Owner regarding any matters affecting the total door and frame openings.

D. Installer Qualification: Experience with installation of similar materials.

E. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated or required, provide fire-rated door and frame assemblies that comply with NFPA 80 "Standard for Fire Doors and Windows", and have been tested, listed, and labeled in accordance with ASTM E152 "Standard Methods of Fire Tests of Door Assemblies" by nationally recognized independent testing and inspection agency acceptable to authorities having jurisdiction.

1. Oversize Fire-Rated Door Assemblies: For door assemblies required to be fire-rated and exceeding sizes of tested assemblies, provide certificate or label from approved independent testing and inspection agency, indicating that door and frame assembly conforms to requirements of design, materials and construction as established by individual listings for tested assemblies.
2. Temperature Rise Rating: At stairwell enclosures, provide doors which have Temperature Rise Rating of 450 degrees F maximum in 30 minutes of fire exposure.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver, handle and store doors and frames at the job site in such a manner as to prevent damage.

B. Remove all damaged or otherwise unsuitable doors and frames.

C. Deliver hollow metal doors in manufacturer's protective covering. Handle hollow metal with care to prevent damage.

D. Door Storage: Store doors in upright position, under cover. Place doors on at least 4 inch high wood sills or on floors in manner that will prevent rust and damage. Do not use non-vented plastic or canvas shelters which create humidity chamber and promote rusting. If corrugated wrapper on door becomes wet, or

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moisture appears, remove wrapping immediately. Provide 1/4-inch space between doors to promote air circulation.

E. Frame Storage: Store frames under cover on 4 inch wood sills on floors in manner that will prevent rust and damage. Do not use non-vented plastic or canvas shelters which create humidity chamber and promote rusting. Store assembled frames in vertical position, 5 units maximum in stack. Provide 1/4-inch space between frames to promote air circulation.

F. Deliver doors and frames to the jobsite in stages or shipments as required for phasing, and in a timely manner so as not to delay progress of other trades.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Provide products, as approved by the Architect, by one of the following acceptable manufacturers:

1. Atlas Companies.
2. CECO Door Products.
3. Curries.
4. Deansteel Manufacturing Company, Inc.
5. Fenestra.
6. Kewanee Corporation.
7. Mesker.
8. Metal Products.
9. Pioneer Industries, Inc.
10. Republic Builders Products.
11. Steelcraft Manufacturing Company.

2.02 MATERIALS

A. Cold-Rolled Steel Sheets:

1. Commercial quality, stretcher leveled flatness, cold-rolled steel, free from scale, pitting or other surface defects.
2. Complying with ASTM A 366 and ASTM A568.

B. Galvanealed Steel Sheets:

1. ASTM A924, A60 zinc coating.
2. Use galvanealed steel sheets at the following locations, whether indicated or not:
    a. All exterior doors and door frames.
    b. All doors and frames in kitchens, locker rooms and restrooms.
    c. All doors and frames in or directly exposed to swimming pool areas.
    d. All doors and frames in any other area that is exposed to moisture for long periods of time.
    e. All door louvers and other components within doors that require galvanealed steel sheets.

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3. Internal reinforcing may be manufactured of hot rolled pickled and oiled steel per ASTM-A569.

C. Supports and Anchors:

1. Fabricate of not less than 16-gauge galvanized sheet steel.
2. Provide all blocking, backings and supports in all horizontal and vertical members as required for reinforcing of all door hardware as specified in Section 08 7100.

D. Inserts, Bolts and Fasteners:

1. Manufacturer's standard units, except hot-dip galvanize items to be built into exterior walls.

E. Drip Cap:

1. On all exterior door bottoms.
2. On all exterior door frame heads.

F. Primer:

1. For steel surfaces, use rust-inhibitive zinc oxide primer suitable as a base for specified finish paints.

2.03 FABRICATION

A. General:

1. Fabricate hollow metal work to be rigid, neat in appearance and free from defects, warp, or buckle.
2. Accurately form metal to required sizes and profiles.
3. Weld exposed joints continuously; grind and dress smooth.
4. Provide doors and frames bearing UL labels as scheduled. Construction similar to specified hollow metal work, modified to meet Underwrites Laboratories, Inc. requirements.

B. Galvanealed Steel Sheets:

1. ASTM A924, A60 zinc coating.
2. Internal reinforcing may be manufactured of hot rolled pickled and oiled steel per ASTM-A569.

C. Minimum Gauges of Hollow Metal:

1. Frames:
   a. 16 gauge: Interior door frames.
   b. 16 gauge: Typical labeled interior frames.
   c. 16 gauge: Interior glazed window and opening frames.
   d. 14 gauge: Exterior door frames.
   e. 14 gauge: Typical labeled exterior frames.
   f. 14 gauge: Exterior glazed window and opening frames.

2. Doors:
   a. 18 gauge: Interior doors.

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b. 18 gauge: Typical labeled interior doors.
c. 16 gauge: Exterior doors.
d. 16 gauge: Typical labeled exterior doors.

3. Accessories:
   a. 20 gauge: Trim members.

4. Provide heavier gauges at doors, frames and accessories as required by fire rating label, details or specific condition.
5. Entire frame, sidelight and transom unit shall be of the same gauge.

D. Doors:

1. Form face sheets in smooth seamless unbroken surface. Construct doors with smooth flush surfaces, without visible joints or seams on exposed faces or stile edges. Interior and exterior door edge seams shall be full height wire welded and ground smooth.
2. Reinforce, stiffen and sound deaden.
3. Stiffen face sheet with 20-gauge steel stiffener reinforced vertically, full height and width, spot welded to both face sheets. Stiffeners welded together top and bottom.
4. Close top and bottom edges of interior and exterior doors with continuous recessed flush steel channel minimum 16 gauge, extending full width of door, and spot welded to both faces. Provide drain holes in bottom closure of exterior doors.
5. Frame openings for glazing and provide cut-outs for glass and louvers with stops as shown. Form beads of 20-gauge steel; locate on inside of opening.
6. Insulate core of all exterior doors, whether indicated or not, and interior doors where indicated:
   a. Insulate with 1 lb minimum density insulation.
   b. Minimum insulation value R-2 minimum.

7. Labeled Doors: Insulate as required by Underwriters Laboratories. Build in special hardware and provide astragals as indicated. At one hour and at 1-1/2 hour doors at enclosures, maximum transmitted temperature end point shall not exceed 450 degrees F above ambient at end of 30 minutes of fire exposure per U.L.
8. Exterior Hollow Metal Door Louvers: Fabricate louver units of 16-gauge galvanized steel sheets with stationary, weatherproof Z-shaped blades and U-shaped frames, not less than 1-3/8 inch thick. Space louver blades not more than 1-1/2 inch o.c. Assemble units by welding. Provide insect screen on interior side of frame, consisting of 14 by 18 wire mesh in rigid, formed metal frame.
9. Interior Hollow Metal Door Louvers: Fabricate of 20-gauge cold-rolled steel sheets with stationary sight proof inverted V-shaped blades and U-shaped frames. Space louver blades not more than 3 inches o.c. Assemble units by welding.
10. Typical Reinforcement: Provide as required for hardware items. For lock reinforcement, provide manufacturer's standard reinforcement. Provide 12-gauge reinforcement for escutcheons or roses. centering clips to hold lock case in alignment. For door checks, provide 14-gauge channel type reinforcements, 3-1/2 inch deep by 14 inches long, or as required. Hinge reinforcement to be one piece 14-gauge continuous channel welded to the door. Reinforce doors for surface items such as surface and semi-concealed closers, brackets, surface holders and door stops. Drilling and tapping installation of these surface items shall be done in field by hardware installer.
11. Provide to design indicated including: Flush panel doors, flush panel with cut-out as indicated, stile and rail type, stile and rail with door louver.

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12. Finish: Provide prime coat finish on doors. Thoroughly clean off rust, grease and other impurities. Grind welds smooth, no marks shall show. Apply metallic filler as required to fill cracks and joints and to level any weld areas or similar imperfections. Sand filler coat smooth.
13. **All exterior metal doors to be Galvanealed Steel Sheets.**

E. Frames:

1. Welded Frames. Knockdown frames not permitted, except where specifically indicated by Architect.
2. Close corner joints tight with trim faces mitered and continuously welded, ground smooth.
3. Provide dust cover boxes for hinge and strike plate cutouts and at all other hardware mortises.
4. Weld temporary steel spreader to feet of both jambs, or strap pairs with heads inverted, as bracing during shipping and handling.
5. Rated frames where indicated on drawings and at all rated door openings.
6. At masonry, provide wire or masonry “T” anchors approximately 24 inches on center.
7. Provide and secure galvanized steel drip cap at all exterior doors, field painted to match frame.
8. Silencers: Provide specified silencers, except where stop does not occur and at smoke gasketed openings, 3 per jamb at single door and one for each door at double doors.
9. Extensions: Reinforce transom bars or mullions as necessary to provide rigid installation. Where required (as at multiple openings) to stabilize large frames, provide frame or mullion extensions to anchor to structure above, proper size to fit within overhead construction. Provide angle clips to fasten to structure.
10. Mullions: Provide mullions, straight and without twist, of tubular design. No visible seams will be accepted. For removable mullions provide reinforcing at frame head.
11. Clearances: Provide and be responsible for proper clearances at metal frames, including for weatherstripping, soundstripping and smoke gasketing. Glass clearance shall be thickness of glass plus clearance each side (1/8 inch minimum exterior - 1/16-inch minimum interior), adjust for installation, glass thickness to allow for glazing and sealant. Where sealed double glazing is indicated, provide rebates minimum of 3/4 inch and provide 1/4-inch clearance at glass edges. Where units fit around concrete blocks (blocks built into frames) obtain actual dimensions of blocks being used to establish minimum clearances.
12. Stops: Set with countersunk or Jackson head screws.
13. Labeled Frames: Construct in accordance with requirements for labeled work. Attach proper U.L. label, Warnok Hersey. "B" labeled frames shall be 1-1/2 hour construction.
14. Joinings: Furnish frames mitered, or coped, and continuously face welded. Grind smooth, and conceal joints for a seamless appearance. Touch up welded surfaces with manufacturer’s standard prime paint.
15. Workmanship: Fabricate so no grind marks, hollow or other out-of-plane areas are visible. At joints of intermediate members (such as mullions and transom bars), provide tight joining, neatly accomplished without holes, burned out spots, weld build up or other defacing work. Fill to close cracks and to preserve shapes. Tightly fit loose stops, to hairline joints.
16. Finish: Clean frames by degreasing process and apply thorough coating of baked-on primer, covering inside as well as outside surfaces. At galvanealed frames, coat welds and other disrupted surface with zinc-rich paint containing not less than 90 percent zinc dust by weight.
17. **All exterior metal frames to be Galvanealed Steel Sheets.**

F. Hardware Preparation:

1. Mortise, reinforce, drill and tap doors and frames for mortised hardware.
2. Prepare strike jamb for 3 silencers on door side.

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3. Typical Reinforcing: Provide minimum hinge reinforcement 3/16 inch by 1-1/2 inch by 10 inch. Provide similar reinforcement for hardware items as required to adequately withstand stresses, minimum 12 gauge, including channel reinforcement for door closers and closer arms, door holders and similar items. Provide reinforcement and clearances for concealed in-head door closers and for mortise locks, where applicable.
4. Anchorage: Provide standard and special anchorage items as required.
5. Cover Plates: For hinge and strike plate cutouts, provide fully enclosed pressed steel cover boxes spot welded to frames behind mortises.

G. Finish:

1. Chemically treat and apply manufacturer's standard rust inhibitive primer coat conforming to ANSI A224.1-1990.
2. Coat interior of frame with bituminous paint, minimum 1.5 mils.
3. Prep surfaces to receive finish painting in the field.

H. Fastenings:

1. Provide fastenings, anchors and clips as required to secure hollow metal work in place.
2. Provide Jackson head screws, or flatter.
3. Dimple metal work to receive screw heads.
4. Set stops and other non-structural fastenings with #6 Jackson head self-tapping screws.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine supporting structure and conditions under which hollow metal is to be installed.

B. Verify that frame opening corresponds to dimensions of frames furnished.

C. Check that surfaces to contact frames are free of debris.

D. Do not proceed with installation until unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. General:

1. Install in accordance with reviewed shop drawings and manufacturer's printed instructions.
2. Set hollow metal plumb, level, square to proper elevations, true to line and eye.
3. Units and trim shall be fastened tightly together, with neat, uniform and tight joints.

B. Anchorage:

1. Attach anchors to opening.
2. Minimum number of anchors: 3 per jamb.

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3. Securely fasten and anchor work in place without twists, warps, bulges or other unsatisfactory or defacing workmanship.
4. Set clips and other anchors with Ramset "shot" anchors or drill in anchors as approved.

C. Frames:

1. Attach frames true to line with adjacent construction.
2. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set.
3. After wall construction is complete, remove temporary braces and spreaders leaving surfaces smooth and undamaged.
4. At cast-in-place concrete or masonry construction, set frames and secure in place using countersunk bolts and expansion shields, with bolt heads neatly filled with metallic putty, ground smooth and primed.

D. Doors:

1. Hang doors square to opening.
2. Minimum Clearances:
   a. At head and jambs: 1/8".
   b. Between meetings edges of pairs of doors: 1/8".
   c. With Floor: 3/4", except 3/8" undercut at handicap accessible doors.
   d. At Threshold: 1/4".
   e. At Handicap Threshold: As required to coordinate with threshold height.

3. Fit hollow metal doors accurately in their respective frames, within following clearances:
   a. Jambs and head 3/32 inch.
   b. Meeting edges pair of doors 1/8 inch.
   c. Sill where no threshold or carpet 1/4 inch above finished floor.
   d. Sill at threshold 3/4 inch maximum above finished floor.
   e. Sill at carpet 1/4 inch above carpet.

E. Labeled Doors and Frames:

1. Install in conformance with NFPA Standard 80.
2. Provide clearances in conformance with NFPA Standard 80.

3.03 ADJUST AND CLEAN

A. Remove dirt and excess sealants from metal surfaces.

B. Touch up marred or abraded surfaces.

C. Lubricate hardware and adjust moving parts to operate smoothly.

D. Remove debris from work area.

E. Prime Coat Touch-Up: Modify existing doors and frames to receive new door hardware. Cut, patch, weld, bondo, and sand smooth, modified areas.

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Modifications will be seamless and not noticeable. Use compatible air-drying primer.

F. Protection Removal: Immediately before final inspection, remove protective wrappings from doors and frames.

SUBMITTAL CHECKLIST

1. Product Data.
2. Shop Drawings.

END OF SECTION 08 1113

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SECTION 08 1416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Interior flush pre-fit, pre-machined standard and fire rated type wood doors as shown on the Drawings and specified herein.

B. Modifications to existing doors receiving new door hardware, where applicable.

1.02 REFERENCES

A. WDMA - Window and Door Manufacturers Association: IS 1-A 1997 Industry Standard for Architectural Flush Wood Doors.

B. NFPA-80: Standards for Fire Doors 1999 Edition.

C. Uniform Building Code: UBC 7-2 1997 or UL10C, Positive Pressure Fire Door Assemblies.

Category “B” for single swing doors and Category “A” for pairs of swinging doors.

D. NFPA-105: Recommended Practice for Installation of Smoke-Control Door Assemblies, 1999 Edition.

E. NFPA-252: Standard Method of Fire Tests for Door Assemblies.

F. UL: Building Materials Directory.

G. WHI: Directory of Listed Products.

H. ICC/ANSI-A117.1-2003: Accessible and Usable Buildings and Facilities.

I. State and Local Building Codes including the Authority Having Jurisdiction.

1.03 QUALITY ASSURANCE

A. Except as otherwise specified herein, wood doors shall conform with Architectural Woodwork Institute (AWI) Quality Standards and National Woodwork Manufacturer's Association (NWMA) I.S. 1 and I.S. 2.

B. Fire-Rated Wood Doors: Provide wood doors which are identical in materials and construction to units tested in door and frame assemblies in accordance with UBC 7-2 1997 or UL10c, Positive Pressure Fire Door Test Method, and which are labeled and listed for ratings indicated by ITS - Warnock Hersey, UL or other testing and inspection agency acceptable to authorities having jurisdiction.

1. Doors: Comply with UBC 7-2 1997 or UL10C where required.
2. Provide smoke gaskets or fire seals as required by manufacturers' individual authorities in compliance with UBC 7-2 1997 or UL-10C-1998.

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3. Maintain one copy of each compliance document on the project site.
4. Fabrication of doors shall permit installation in accordance with NFPA Standard No. 80.
5. Fire doors to be rated UL10C Positive Pressure Category A.

C. WDMA I.S. 1-A 2004 Quality Standard: Window and Door Manufacturers Association Quality Standards for grade of door, core, construction, finish, and other requirements.

D. Temperature Rise Rating: At stairway enclosures, provide doors which have Temperature Rise Rating of 250 degrees F maximum in 30 minutes of fire exposure.

E. Manufacturer must have qualifications specializing in the manufacturing of the products specified in this Section for a period of not less than 10 years.

1.04 SUBMITTALS

A. Manufacturer's Literature:

1. Manufacturer's published catalog data, product data sheets and cutsheets.
2. Certificate of compliance with NWMA I.S. 1.
3. Indicate general construction, jointing methods, hardware and louver locations, locations of cut-outs for glass, thickness of veneers, materials, door swings, special blocking, stile and rail dimensions, undercuts, and storage and installation details. Do not proceed with any fabrication until all details are approved.

B. Shop Drawings:

1. Show elevations, dimensions, construction details, glazing, cut-outs and label.

C. Samples:

1. Actual samples of wood veneer and finish.
2. Stain colors and finishes to be selected from manufacturer's entire standard selection.
3. If stains are required to be custom matched, submit samples of actual finished product, along with sample of item door was to be matched to.

D. Warranty:

1. Manufacturer's standard warranty for materials.
2. Special Warranty as specified herein.

E. Certification:

1. Submit any information necessary to indicate compliance to all of these specifications.
2. All labeled fire door assemblies to be of a type which have been classified and listed in accordance with the latest edition of NFPA 80 and tested in compliance with NFPA-252, and UL-10B, and UBC-7-2.
3. A metal label is to be permanently affixed to the fire door at an authorized facility. Furthermore, all, 45, 60, and 90 minute labeled fire doors, are to have manufacturer’s standard laminated stiles for improved screw holding and split resistance capabilities.

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1.05 DELIVERY, STORAGE AND HANDLING

A. Do not deliver doors to the site until building has been closed in and is thoroughly dry.

B. Deliver pre-finished wood doors to jobsite after all door frames have been painted, and all “wet” construction has been completed.

C. Plastic wrap and protect wood doors during transit, storage and handling, to prevent damage, soiling or deterioration. Follow the Care and Installation guidelines as described in WDMA I.S. 1-A 2004.

D. Store doors flat and protect from damage.

E. Do not walk or stack any materials on top of any wood doors delivered to the jobsite, and do not drag any wood doors across each other during delivery or installation.

F. Remove damaged or otherwise unsuitable doors from the job site.

1.06 SPECIAL WARRANTY

A. The Contractor shall warrant the wood doors to be free of faults and defects for the life of the installation.

B. Faults and Defects:

1. Delamination in any degree.
2. Warp or twist of 1/4” or more, in any 7’-0” plane, in any direction.
3. Telegraphing of stile, rail, or core, through the face of the door to cause surface variation in excess of 1/100” in any 3” span.
4. Any other defect that shall affect the operation of the door, shall be considered a defect under the provision of the warranty.

C. Warranty to include refinishing and reinstallation that may be required due to repair or replacement of any defective doors.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Provide products, as approved by the Architect, by one of the following acceptable manufacturers:

1. Algoma Hardwoods.
2. Chappell.
3. Eggers Industries.
4. Graham Manufacturing.
5. Ideal Wood Products.
6. Marshfield Door Systems.
7. Mohawk Flush Doors.
8. Ohio Valley.

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9. Oshkosh.
10. VT Industries.

2.02 FABRICATION

A. Typical Doors, Non-Fire Rated:

1. Thickness: 1-3/4 inches.
2. Interior flush, bonded, solid core, hardwood veneered.
3. Door construction shall conform to WDMA I.S. 1-A 2004 Premium Grade and AWI Quality Standards Premium Grade.
4. Core: bonded particle core (PC).
    a. Solid particleboard bonded to the stiles and rails.
    b. Comply with ANSI-A208-1 Grade 1-LD-2.

5. Vertical Stiles: Hardwood to match face veneer, 1-3/8” minimum before trimming, over structural composite lumber (SCL), glued to core.
6. Rails: Mill option hardwood or SCL. Top and bottom: 2 inches before trimming.
7. Facing: Wood veneer cut and species as specified shall conform to WDMA I.S. 1-A 2004 "A" grade for Premium Grade Door Construction requirements.
8. Crossbands: Hardwood, 1/16 inches thick, extending full width of door.
9. Edge Bands: Same species as face veneer, matched for color.

B. Fire Rated Doors (20 Minute Rating):

1. Thickness: 1-3/4 inches.
2. Interior flush, bonded, solid core, hardwood veneered.
3. Door construction shall conform to WDMA I.S. 1-A 2004 Premium Grade and AWI Quality Standards Premium Grade.
4. Core: bonded particle core (PC).
    a. Solid particleboard bonded to the stiles and rails.
    b. Comply with ANSI-A208-1 Grade 1-LD-2.

5. Vertical Stiles: Hardwood to match face veneer, 1-3/8” minimum before trimming, over structural composite lumber (SCL), glued to core.
6. Rails: Mill option hardwood or SCL. Top and bottom: 2 inches before trimming.
7. Facing: Wood veneer cut and species as specified shall conform to WDMA I.S. 1-A 2004 "A" grade for Premium Grade Door Construction requirements.
8. Crossbands: Hardwood, 1/16 inches thick, extending full width of door.
9. Edge Bands: Same species as face veneer, matched for color.

C. Fire Rated Doors (45 Minute Rating and Higher):

1. Thickness: 1-3/4 inches.
2. Interior flush, bonded, solid core, hardwood veneered.
3. Door construction shall conform to WDMA I.S. 1-A 2004 Premium Grade and AWI Quality Standards Premium Grade.
4. Core: bonded mineral core (FD).
    a. Non-combustible mineral core containing no asbestos.

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5. Vertical Stiles: Laminated hardwood to match face veneer over mineral composite, glued to core, and laminated prior to field fitting.
6. Rails: Fire-rated mineral composite materials (Firestop), as required by fire door authorities. Top and bottom: thickness before trimming as required by manufacturer's fire door authorities. Meet requirements and testing for labeled rating.
7. Facing: Wood veneer cut and species as specified shall conform to WDMA I.S. 1-A 2004 "A" grade for Premium Grade Door Construction requirements.
8. Crossbands: Hardwood, 1/16 inches thick, extending full width of door.
9. Edge Bands: Same species as face veneer, matched for color.

D. Wood Transom Panels:

1. Provide continuous sequence of veneer between transom panel and adjoining door using same width of veneer pieces on adjoining requirements for veneer quality and matching.
2. Label doors and transoms to show door assembly match relationships specified.

E. Provide all blocking, backings and supports in all horizontal and vertical members as required for reinforcing of all door hardware as specified in Section 08 7100.

2.03 WOOD VENEER

A. Face Veneer:

1. Shall meet quality standards conforming to WDMA I.S. 1-A 2004 "A" grade for transparent finish.
2. Minimum face veneer thickness shall be 1/50" after finish sanding.
3. Wood Species: Natural Birch.
4. Face Cut: Plain Sliced.
5. Face Assembly: Book Match.
6. Face Symmetry: Running Match.

2.04 VISION FRAMES

A. Non-Rated Doors:

1. Flush bead wood frames, 1/2" thickness.
2. Hardwood of same species as face veneer, matched for color.

B. Fire Rated Doors:

1. Provide UL rated frame. Match color of door face veneer.
2. Equal to: "Air Louvers", "Slimline" lite kits with glazing.
3. Factory glaze doors using compatible veneered metal lite kits.

C. Glass:

1. Refer to drawings for type and thickness.
2. See Section 08 8100 - Glass and Glazing.

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2.05 FITTING AND FINISHING

A. Fitting:

1. Doors may be fitted for hardware at job site or pre-fitted and pre-machined at factory.

B. Factory Finish:

1. Generally, all doors shall be prefinished at the factory, unless indicated as field stained or a custom stain match is required.
2. Selected finish color must be able to be matched.
3. Transparent Finish shall match finish requirements indicated in AWI-“TR6”.
4. Comply with referenced AWI “Factory Finishing” for Premium Grade factory finish systems.
5. Finish wood doors using three coats of water-clear, 100% solids, modified acrylic urethane, cured immediately with ultra-violet light. Factory seal all doors on all 6 sides.

C. Field Stained Finish:

1. Field stained doors on site shall be per requirements of Section 09900 - Painting.
2. Where matching to existing doors is required, supplier shall field verify all requirements so as to match existing door type, wood species, face cut, graining, and stain color, including custom stain matching as required.

D. Coordination:

1. Finish or stain doors before hanging.
2. Variations in finish due to body oils on doors, planer marks or other irregularities not attributable to natural wood grain variations will be cause for rejection.

2.06 ADHESIVES

A. Adhesives:

1. Face to core adhesives shall be Type I or Type II as appropriate for location in building.
2. All adhesives must be classified Type I or Type II per WDMA TM-6 “Adhesive Bond Test Method.”
3. Use Type I adhesives for doors in exterior applications.
4. Use Type II adhesives for doors in interior applications.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine door frames and verify that frames are correct type and have been installed as required for proper hanging of corresponding doors. Do not proceed with installation until unsatisfactory conditions have been corrected.

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B. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with plumb, square, and level jambs and heads.

C. Modify existing wood doors to receive new door hardware, where applicable. Drill, Cut, patch, and sand smooth, modified areas. Modifications shall be seamless and not noticeable. Use touch up stain provided by custom stain manufacturer. Clear coat with Polyurethane after custom stain has dried.

3.02 INSTALLATION

A. Condition doors to average prevailing humidity in installation area prior to hanging.
Install doors after building humidity is at an acceptable level.

B. Handle doors in accordance with recommendations of WDMA I.S. 1-A, “Care and Installation at Job Site”.

C. Install wood doors in strict accordance with manufacturer's published instructions and as shown.

D. Install accurately in frame. Install within the clearances specified in the manufacturer’s written instructions. Install plumb, level, square and true.

E. Install to operate freely, but not loosely, free from hinge and strike binding conditions. All doors shall be free from rattling when in the latched position.

F. Pilot holes to be drilled for screws attaching hinges, locksets, and all other hardware to be installed on the doors. Pilot holes shall not exceed 90% of the diameter of the screw.

G. Remove and replace all doors found to be warped, twisted, bowed, or otherwise damaged. Do not install doors which cannot be properly fitted to frames.

H. Adjust pre-finished doors and hardware and other moving or operating parts to function smoothly and correctly.

I. Ensure that smoke gaskets are in-place before pre-finished door installation.

J. Bevel non-fire rated doors 1/8 inch in 2 inches lock and hinge edges.

K. Fit to frames and machine for hardware to whatever extent not previously worked at factory as required for proper fit and uniform clearance at each edge.

L. For non-rated doors provide the following clearances:

1. 1/8 inch at jambs and heads.
2. 1/2 inch at floor finish or covering.

M. For installation of hardware, See Division 08710 - Finish Hardware.

3.03 ADJUST AND CLEAN

A. Rehang or replace doors which do not swing or operate freely.

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B. Refinish or replace doors damaged during installation.

C. Protect installed wood doors from damage or deterioration until Substantial Completion.

D. Adjust doors for a smooth, balanced, fully functional opening.

E. Clean pre-finished doors and hardware.

SUBMITTAL CHECKLIST

1. Manufacturer's Literature.
2. Shop Drawings.
3. Samples.
4. Warranty.
5. Certification.

END OF SECTION 08 1416

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SECTION 08 3113.01 - ACCESS DOORS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Metal access doors as shown on the Drawings and specified herein, including:

1. Access doors in walls.
2. Access doors in ceilings.

1.02 QUALITY ASSURANCE

A. Fire Resistive Ratings:

1. Where access doors are shown in rated assemblies, provide panel door, frame, hinge and latch from manufacturer listed by Underwriters Laboratories for ratings indicated.

B. Use manufacturer's standard size units for nominal sizes indicated. Field coordinate actual unit sizes with rough openings and built-in anchors and inserts.

1.03 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to job in manufacturer's unopened packages with labels intact.

B. Store and handle products so as to prevent damage. Remove all damaged items from the job site.

1.04 SUBMITTALS

A. Product Data:

1. Manufacturer's published catalog information, product data sheets and cutsheets.
2. UL fire rated test data stating achieved rating.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Provide products, as approved by the Architect, from one of the following acceptable manufacturers:

1. Babcock-Davis.
2. Bilco.
3. Dayton.
4. J.L. Industries.

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5. Karp Associates, Inc.
6. Milcor Incorporated.
7. Vestal Manufacturing Co.

2.02 MATERIALS

A. Access Doors:

1. Door: 14 gage steel.
2. Frame: 16 gage steel with 1 inch flange.
3. Hinge: Concealed spring type, 175 degree opening.
4. Lock: Screwdriver activated cam lock.
5. Finish: Gray baked enamel prime coat. Prepped for finish field coats.
6. Sizes: 20 inches x 40 inches minimum at attic access, unless otherwise indicated on Drawings.
   24 inches x 24 inches all other locations, unless otherwise indicated on Drawings.

B. Fire-Rated Access Doors:

1. Door: 20 gage steel, insulated sandwich panel construction.
2. Frame: 15 gage steel with 1 inch flange.
3. Hinge: Concealed pin type.
4. Lock: Recessed turn ring with interior latch release.
5. Closer: Spring type closer, adjust to assure positive latching.
6. Finish: Gray baked enamel prime coat. Prepped for finish field coats.
7. Sizes: 20 inches x 40 inches minimum at attic access, unless otherwise indicated on Drawings.
   24 inches x 24 inches all other locations, unless otherwise indicated on Drawings.
8. Label: 1-1/2 hour - "B" label, unless otherwise indicated on Drawings.

2.03 FABRICATION

A. Fabricate units of continuous welded construction.

B. Neatly fit all joints, and grind welds smooth and flush with adjacent surfaces.

C. Furnish each access door as a complete unit with all parts ready for installation.

PART 3 - EXECUTION

3.01 PREPARATION

A. Field verify all rough opening dimensions.

B. Assure that sufficient inserts, blocking and built-in anchors are provided for secure installation of doors.

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3.02 INSTALLATION

A. Install per manufacturer's recommendations.

B. Painting of doors is specified in Section 09 9000.

3.03 ADJUSTING AND CLEANING

A. Adjust hardware so that all doors operate smoothly and freely.

B. Remove and replace panels or frames which are bowed, warped or damaged.

3.04 PROTECTION

A. Protect doors from damage until Substantial Completion.

SUBMITTAL CHECKLIST

1. Product Data.

END OF SECTION 08 3113.01

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SECTION 08 4113 - ALUMINUM ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment, special tools, supervision and services required to complete the aluminum thermal-type and non-thermal type Entrances and Storefronts as shown on the Drawings and specified herein.

1.02 QUALITY ASSURANCE

A. Comply with all Federal, State and Local building codes and regulations.

B. Thermal Performance:

1. AAMA Test Procedure 1502.7.
2. Condensation Resistance Factor (CRF) of 43 (min.) at equivalent of 15 MPH wind velocity.

C. Air Infiltration:

1. ASTM E283.
2. Maximum infiltration .06 CFM/ft. crack length under static pressure of 6.24 PSF (equivalent of 50 MPH wind velocity).

D. Water Infiltration:

1. ASTM E331.
2. No water penetration for 15 minutes with 5 gal./hr./s.f. at 10.0 PSF pressure.

E. Uniform Loading:

1. ASTM E-330.
2. Max. 1/175 deflection, no permanent deformation under a load of 25 PSF.

1.03 SUBMITTALS

A. Shop Drawings:

1. Submit complete shop drawings prior to fabrication.
2. Indicate metal thickness, construction, installation and anchorage details.

B. Samples:

1. Section of window wall assembly with glass.
2. If finish is selected, submit sample of finish indicated.

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If not indicated, submit color and finish samples for selection by the Architect, from manufacturer's entire standard selection.

C. Test Reports:

1. Submit test reports certified by the mullion manufacturer's testing laboratory.
2. Show compliance with performance requirements.

D. Warranty:

1. Submit warranty as specified herein.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver, handle and store doors and frames at the job site in such a manner as to prevent damage.

B. Remove all damaged or otherwise unsuitable doors and frames from the job site.

1.05 WARRANTY

A. Provide written manufacturer's guarantee against defective workmanship and materials for a period of two (2) years.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Provide thermal barrier type mullion window and door system, to be approved by the Architect, as manufactured by one of the following approved manufacturers:

1. "EFCO"
2. "Kawneer"
3. "Tubelite"
4. "Vistawall"
5. “United States Aluminum”
6. “Traco”
7. “Wausau Window and Wall Systems”
8. “Arch Aluminum and Glass”
9. “YKK AP”
10. “Manko Window Systems”
11. “Graham Architectural Products”

B. Clarification that any/all aluminum window, curtain walls and entrances and storefronts in the scope of work are to all be provided by a single source manufacturer for the entire project.

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C. Basis of Specification:

1. Window Wall Systems:
   a. "EFCO", Series 403 (T), Thermal Storefront Framing.
      Provide at all locations exposed directly to the exterior.
   b. "EFCO", Series 402 (NT), Non-Thermal Storefront Framing.
      Provide at all locations interior to the building, including interior unit of vestibules, unless otherwise indicated.

2. Door Systems:
   a. Narrow Stile: “EFCO”, Series D200 Narrow Stile Doors, 1-3/4” Standard Doors.
   b. Medium Stile: “EFCO”, Series D300 Medium Stile Doors, 1-3/4” Standard Doors.
   c. Wide Stile: “EFCO”, Series D500 Wide Stile Doors, 1-3/4” Standard Doors.
   d. Custom modified to provide for widths and depths of stiles and rails as indicated on the Drawings, Door Elevations, and as specified herein.

2.02 MATERIALS

A. Aluminum Extrusions:

1. ASTM B 221.
2. Alloy 6063-T5.
3. Finish: Class 1 Anodic Coating with integral color, AA-M12-C22.
   Color to be selected from manufacturer's entire standard selection. Color to be dark bronze to match existing building window/storefront.

B. Aluminum Sheets:

1. ASTM B209.
2. Alloy 5005 where exposed, 3003 where concealed.
3. Finish: Match extrusions.

C. Fasteners and Anchors:

1. Stainless steel or aluminum, finish to match extrusions at exposed fasteners.

D. Glass:

1. 1 inch insulating glass for all exterior glass applications.
2. 1/4 inch glass for all interior applications and all door units.
3. See Section 08 8100 for glass specifications.
4. See drawings for window, door and frame elevations.

E. Thermal Break:

1. Poured polyurethane or PVC, standard with manufacturer.
2. 3/8 inch minimum thickness.

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F. Setting Blocks:

1. As specified in Section 08 8100.

G. Glazing Gaskets:

1. Elastomeric gaskets of type recommended by window manufacturer.

H. Glazing Tape:

1. Shimmed polymer type recommended by window manufacturer.

I. Perimeter Joint Sealer:

1. As specified in Section 07 9200.

J. Backup Joint Filler:

1. Closed-cell expanded polyethylene, as specified in Section 07 9200.

K. Joint Cleaner:

1. Cleaner recommended by sealant manufacturer for the specified joint surface condition.

L. Joint Primer and Sealer:

1. Compounds recommended by sealant manufacturer for the specific joint surface conditions.

M. Bond Breaker:

1. Polyethylene tape.

N. Weatherstripping:

1. Neoprene, hypalon, vinyl, PVC, as standard with manufacturer, double row, continuous with vulcanized corners.

O. Subsill:

1. High Performance extruded aluminum with thermal break, and integral weep hole system.

P. Provide all blocking, backings and supports in all horizontal and vertical members as required for reinforcing of all door hardware as specified herein or in Section 08 7100.

2.03 FABRICATION

A. Window Wall Members:

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1. Main extruded members: Minimum thickness .075 inches minimum.
2. Vertical and horizontal framing members: 2 inches nominal face dimension.
3. Perimeter members: 2 inches nominal face dimension.
4. Overall depth: 4-1/2 inches nominal.

B. Door Members:

1. Minimum Thickness: .075" minimum.
2. Overall Depth: 1-3/4 inches nominal.
3. Vertical Stiles: Provide as indicated on Drawings or Door Elevations (modified medium stile).
   If not indicated, provide 3-1/2 inches nominal width (medium stile).
   Reinforce for continuous hinges specified herein or in Section 08 7100.
4. Top Rail: Provide as indicated on Drawings or Door Elevations (modified medium stile).
   If not indicated, provide 3-1/2 inches nominal width (medium stile).
   Reinforce for closers or holders specified herein or in Section 08 7100.
5. Intermediate Panic Rail: Provide as indicated on Drawings or Door Elevations (modified medium stile).
   If not indicated, provide 6 inches nominal width.
   Location to be centered on panic device with dimension as required by Code and ADA.
   Reinforce for panic devices specified herein or in Section 08 7100.
6. Bottom Rail: 10 inches nominal width (modified). Accessory line as required for extra tall rail.

C. Thermal Break:

1. Provide thermal break on all window members.
2. Poured in place, self-adhering elastomer.
3. Do not violate or bridge the thermal break with hardware or fasteners.

D. Preassemble all units to the greatest extent possible to minimize field jointing and assembly at the site. Disassemble units only to the extent necessary to comply with shipping limitations.

E. Fabricate all units to produce uniform sight lines and to be level, plumb, and in same plane as adjacent panels.

F. Accurately fabricate all joints for proper fit and weld all corners.

G. Provide slotted holes or other acceptable means for erection adjustment.

H. Protect exposed surfaces against damage from scratches and discoloration.

I. Provide fully resilient settings for glass panels by use of neoprene gaskets on both sides of glass.

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PART 3 – EXECUTION

3.01 PREPARATION

A. Examine all surfaces of opening and verify dimensions. Installation of frames constitutes acceptance of the existing conditions.

3.02 INSTALLATION

A. Install window walls, doors and hardware in accordance with manufacturer's instructions.

B. Assemble and anchor the various components to allow for expansion and contraction, maintaining a watertight condition.

C. In general, for field assembly, conform to welding and joining requirements specified for shop fabrication.

D. Install items plumb, straight, square, level and in their proper elevation, plane and location, and in proper alignment with other work. Employ only skilled workmen and erection.

E. Install doors plumb and in alignment with frames. Apply hardware in accordance with hardware manufacturer's instructions. Drill and tap for machine screws. Adjust door installation for free and easy movement with uniform clearances and contact at stops.

F. Use shims as required.

G. Caulk perimeter after all lime, mortar, plaster and other corrosive materials have been removed from aluminum surface with solvents not harmful to finish. Provide backer rods as required.

H. Install glass in window walls in accordance with recommendations of the mullion system manufacturer and requirements specified in Section 08 8100.

SUBMITTAL CHECKLIST

1. Shop Drawings.
2. Samples.
3. Test Reports.
4. Warranty.

END OF SECTION 08 4113

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SECTION 08 7100 - FINISH HARDWARE

PART 1 – GENERAL

1.01 WORK INCLUDED

Furnish labor, materials, equipment, special tools, supervision and services required to complete all Finish Hardware work as indicated, noted, detailed, and scheduled on the Drawings and specified herein.

1.02 OWNER VERIFICATION AND REVIEW MEETING

Contractor and hardware supplier are required to meet with the Owner to review and verify the hardware schedule and sets per door. Contractor and supplier shall be responsible for verifying door and hardware handings, lockset operations, and keying required. All information, except for keying, shall be included in the submittals prior to being forwarded to the Architect.

1.03 KEYING MEETING

Contractor and hardware supplier are required to meet with the Owner to review and verify all requirements for keys and keying per door. Incorporate and coordinate all locking hardware in the Project to provide for a complete and unified system of keying. A complete keying schedule shall be submitted to the Architect and Owner, for approval, within seven days after the meeting. Determine cylinders and cores required to match or be compatible with any existing building master keying systems in place as per the Owner's requirements.

1.04 QUALITY ASSURANCE

A. Hardware Supplier:

1. An established firm dealing in architectural commercial door hardware, with an office, sample room, warehousing facilities and an adequate inventory.
2. Has demonstrated a record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project.
3. Supplier must have, as an employee, an experienced and certified Architectural Hardware Consultant (AHC), who is available to Owner, Architect, and Contractor, for consultation throughout the course of the Work.
4. Provide a competent technician to service the hardware on the job as may be required.
5. A regular franchised distributor for all materials required for this project.
6. Shall replace damaged or defective materials prior to shipment to the site. Repairs not acceptable.
7. Shall meet with the Owner to review and verify all requirements and keying required.
8. Shall conduct a comprehensive training class for the Owner's maintenance personnel prior to date of acceptance on all special application mechanical hardware provided under this Section.

B. All work to comply with the latest requirements of ADA, ICC/ANSI A117.1, and the accessibility chapter of the Building Code.

C. All work to comply with the latest requirements of NFPA 80, NFPA 101 and NFPA 252 in providing hardware for all fire rated openings.

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1.05 REFERENCES

A. American National Standards Institute (ANSI):

1. ANSI A117.1, Providing Accessibility and Usability for Physically Handicapped People.
2. ANSI/BHMA A156.1, Butts and Hinges.
3. ANSI/BHMA A156.3, Exit Devices.
4. ANSI/BHMA A156.4, Door Controls-Closers.
5. ANSI/BHMA A156.6, Architectural Door Trim.
6. ANSI/BHMA A156.7, Template Hinge Dimensions.
7. ANSI/BHMA A156.13, Locks & Latches, Mortise.
8. ANSI/BHMA A156.16, Auxiliary Hardware.
9. ANSI/BHMA A156.18, Materials and Finishes.

B. American Society for Testing and Materials (ASTM):

1. ASTM-E2074-2001 Standard Test Method for Fire Tests of Door Assemblies, Including Positive Pressure Testing of Side-Hinged and Pivoted Swinging Door Assemblies.

C. Code of Federal Regulations (CFR) Americans with Disabilities Act (ADA):

1. Latest version as adopted, approved and accepted by the State.

D. Door and Hardware Institute (DHI):

1. Keying Systems and Nomenclature.
2. Hardware for Labeled Fire Doors.
3. Sequence and Format for the Hardware Schedule.
4. Abbreviations and Symbols.

E. National Fire Protection Association (NFPA):

1. NFPA 80 Standard for Fire Doors and Windows.
2. NFPA 101 Life Safety Code.
3. NFPA 105 Recommended Practice for the Installation of Smoke-Control Door Assemblies.
4. NFPA 252 Standard Methods of Fire Tests of Door Assemblies.

F. Steel Door Institute (SDI):

1. SDI 100 Recommended Specifications for Standard Steel Doors and Frames.

G. Underwriter's Laboratories, Inc. (UL) - UL Standards for Safety:

1. UL 10C-97 Positive Pressure Fire Tests of Door Assemblies.
2. UL 228 Door Closer-Holders, With or Without Integral Smoke Detectors.
3. UL 305 Panic Hardware.

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1.06 SUBMITTALS

A. Hardware Schedule:

1. Submit a completely detailed schedule of finish hardware in “Vertical Format” per the Door and Hardware Institute’s Sequence and Format. Include a complete typewritten schedule indicating every item required for each door or opening. Schedules include, but are not limited to; the manufacturers, model numbers, materials, types, styles, sizes, handings, finishes, etc.
2. Numbering of hardware sets is to match those as indicated in the Specifications and as noted on the Door Schedule on the Drawings. Cross reference plans and schedules.
3. Include all prep of doors and frames required for hardware, including mounting heights, locations and dimensions.
4. Clearly indicate door sets altered from that specified.

B. Owner Verification and Review Meeting:

1. Submit with submittals, confirmation that the meeting was conducted with the Owner.
2. Include list of those present at the meeting.
3. Itemize all items resulting from discussions of the meeting in a "meeting minutes" format.
4. Review of set functions shall be done on a "per door" basis, and not merely by sets. Sets included herein is for the convenience of review by grouping like conditions and not intended to necessarily be representative of same function for all doors in the set. Verify with Owner.

C. Manufacturer's Product Information:

1. Furnish catalog cutsheets, drawings, and other descriptive data on all hardware items.
2. After final approval of the hardware by the Architect, furnish copies of submittals to door and frame suppliers and any other subcontractors and suppliers necessary for coordination and installation of door hardware complete.

D. Samples:

1. If requested by the Architect, submit one (1) sample of each different item of hardware for approval, accompanied by an itemized list showing where the different items are to be used, the manufacturer's number, the finish, sizes applicable, and the number required.
2. Submit a full sample ring of hardware finishes for all manufacturers included.
3. After review, the samples will be returned to the supplier.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver hardware or templates, or both to factory or to building as required by those furnishing items to which hardware is to be applied.

B. Plainly mark packages or hardware so locations of use may be ascertained without breaking the packages.

C. Deliver work so all work will progress without delay or interruption.

D. The Contractor is responsible for providing adequate locked storage space for the scheduled quantities of hardware when delivered to the job.

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1.08 PROJECT CONDITIONS

A. The hardware supplier is responsible to examine the door and frame drawings and elevations to determine the suitability of hardware specified.

B. It will be this supplier's responsibility to furnish the correct hardware to fit the door and frame conditions as indicated for correct and proper operation.

1.09 Warranty

A. Furnish manufacturer's limited warranty covering defects in materials and workmanship for periods indicated as follows:

1.	Door Closers:	Minimum Ten (10) years.
2.	Locksets:	Minimum Ten (10) years.
3.	Exit Devices:	Minimum Five (5) years.
4.	Hinges:	Lifetime.
5.	All Other Hardware:	Minimum One (1) year.

PART 2 - PRODUCTS

2.01 KEYING AND KEYS

A. Key system must be a patented keyway. Keyway shall match existing building.

B. Key, master key and grandmaster key to Owner's requirements. The key schedule will be developed by hardware supplier in cooperation with Owner's representative.

C. Provide six (6) grandmaster keys, six (6) master keys per group, and two (2) keys per lock.

D. Engrave all keys with the words **UNLAWFUL TO DUPLICATE THIS KEY**.

2.02 LOCKS, LATCHES AND CYLINDERS

A. Cylinders may be keyed by local locksmith of Owner’s choice.

B. All cylinders to have removable cores.

C. Provide construction cores on all doors as required.

D. Hardware supplier must be an authorized stocking distributor of the lock they propose to furnish.

E. Provide a cylinder for every lock requiring one, whether specifically specified or not.

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F. Unless specifically indicated otherwise, all cylinders supplied throughout the entire project are to be capable of being keyed from the same master keying system. Key cylinders in dogged panic devices, keyed removable mullions, coiling doors, overhead doors, etc. to match building master keying system.

2.03 FINISHES

A. All finishes, typical, are to be:
Satin Chrome US26D (652 Plated Steel, 626 Plated Brass) unless otherwise indicated.
Materials unable to have this finish applied are to have a finish to closely match and compliment (aluminum, dulled chrome, clear satin anodized, satin stainless steel, mil, painted, etc.).

B. All finishes at dark bronze anodized doors to be:
Dark Bronze USL2 (695 Powder Steel, 695 Powder Brass) unless otherwise indicated.
Materials unable to have this finish applied are to have a finish to closely match and compliment
(Satin Bronze, Oil-Rubbed US10B/613, Duranodic Dark Bronze 313, dark brown patina, weathered/aged oiled bronze, weathered/aged antique bronze, painted, etc.).

C. All hardware for painted or other aluminum storefront doors to have finish to match doors and frames.
Contact Architect during bidding for any clarifications or concerns in providing finishes to match.

D. Contact Architect during bidding for any clarifications or concerns for finishes to be provided.

2.04 HARDWARE SETS

A. Verification:

1. The following schedule is intended to describe, in general, the types and quantities of hardware required for the various types of doors and for the other parts of the building which will require hardware. Do not consider this schedule as entirely inclusive.
2. Hardware supplier is responsible for visiting the jobsite and reviewing the requirements for each installation. The supplier shall be responsible for providing all hardware as required to serve the door's intended purpose and intent and include all costs for such in their bid.
3. Hardware supplier is responsible for coordination of all hardware items used together in conjunction with one another, mounting as required to coordinate with all doors and frames as designed, and include all costs for such in their bid.
4. Hardware supplier is responsible for conducting the Owner Verification and Review Meeting, incorporating all items into submittals, and include all costs for such in their bid.
5. Hardware supplier is responsible for conducting the Owner Keying Meeting, determining cylinders and cores required to match any existing building master keying system, provide and install compatible items and key per Owner's requirements.

B. General Requirements:

1. Provide all fire and smoke seals and gaskets as required per Code for all rated door assemblies and for all smoke partition assemblies; full perimeter at head, jambs and bottom.
2. Provide glass and materials as required to meet and maintain fire ratings for all assemblies.
3. All items as listed in hardware sets are “per door”, unless otherwise indicated.
4. All hardware to be mounted per ADA and ICC/ANSI A117.1.

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2.05 HARDWARE PRODUCTS

A. Acceptable Manufacturers:

Hardware Item	Manufacturer
Hinges:	Ives, Hager, McKinney, Stanley, Bommer
Locksets (Cylindrical):	Schlage, Falcon, Best, Sargent, Hager, Dorma, Yale
Cylinders:	Schlage, Falcon, Best, Sargent, Hager, Dorma
Keyway Cores:	*Match existing building.*
Panic Devices:	Von Duprin, Precision (PHI), Hager, Falcon, Sargent, Dorma, Yale
Push/Pulls:	Ives, Glynn-Johnson, Hager, Rockwood, Trimco
Surface Closers:	LCN, Sargent, Hager, Falcon, Norton, Stanley, Dorma, Yale
Wall/Floor Stops:	Ives, Glynn-Johnson, Hager, Rockwood, Trimco
Wall/Floor Holders:	Ives, Glynn-Johnson, Hager, Rockwood, Trimco
Removable Mullions:	Von Duprin, Falcon, Detex, Sargent, Dorma, Stanley, Yale, Precision (PHI)
Thresholds:	Hager, NGP, Pemko, Reese, Zero
Seals/Gaskets/Sweeps/Bottoms:	Hager, NGP, Pemko, Reese, Zero
Flushbolts/Dustproof Strikes:	Ives, Hager, Rockwood, Trimco
Plates:	Ives, Hager, Rockwood, Trimco
Silencers:	Ives, Hager, Rockwood, Trimco
Automatic Door Bottoms:	Hager, NGP, Pemko, Reese

B. Hinges:

1. All interior standard hinges shall be one of the following:
   a. Ives, 5BB1WT, steel hinge and pin.
   b. Hager, BB1168, steel hinge and pin.

2. All exterior standard hinges shall be one of the following:
   a. Ives, 5BB1HW, brass hinge and stainless steel pin.
   b. Hager, BB1199, brass hinge and stainless steel pin.

3. All continuous hinges shall be one of the following:
   a. Ives, 700, stainless steel.
   b. Hager Roton, 790-900, stainless steel.

4. All continuous hinges shall be one of the following
   (where finish other than clear is desired or to match painted or anodized aluminum storefronts):
   a. Ives, 112HD, aluminum geared.
   b. Hager Roton, 780-112, aluminum geared.

5. Interior and exterior standard hinges shall be 5 knuckle, ball bearing, heavy weight, full mortise, wide throw template type hinges with flush barrel and non-removable pins.
6. All exterior hinges shall be of non-corrosive metals, stainless steel, brass, or aluminum as specified, and appropriate for finishes required. Painted or galvanized steel is not permitted. Hinges on all exterior entry doors and all doors receiving panic hardware shall be continuous hinge type and configuration, full height of door.

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7. All interior standard hinges shall be capable of 180 degree throw.
   Use wide throw hinges where necessary to clear jamb trim. Provide same material and finish as standard hinges such that all hinges match for like use and applications.
8. All continuous hinges at access control doors are to be provided with electric power transfer prep, located and sized as required to coordinate with devices, equipment, and wiring needs.
9. Except where label provisions require larger or heavier hinges or where specified otherwise:
   a. Provide 1-1/2 pairs of hinges for each door up to 7'-6".
   b. Provide 2 pairs of hinges for doors over 7'-6".
   c. Use 4-1/2" hinges on doors up to 3'-4" wide.
   d. Use 5" hinges on doors over 3'-4" wide.

C. Locksets (Cylindrical):

1. All heavy-duty Grade 1 cylindrical locksets shall be one of the following:
   a. Schlage, ND Series, "Rhodes" lever and escutcheon.
   b. Falcon, T Series, “Dane” lever and escutcheon.
   c. Best, 9K Series, "15" lever and "D" escutcheon.
   d. Sargent, 11 Line TZONE Series, "L" lever and escutcheon.
   e. Sargent, 10 Line Series, "L" lever and escutcheon.
   f. Hager, 3400 Series, “Withnell” lever and escutcheon.
   g. Dorma, CL800 Series, “LR” lever and escutcheon.
   h. Yale, 4700(LN) Series, “Augusta AU” lever and escutcheon.
   i. Stanley, QCL 100 Series, “Sierra E” lever and escutcheon.

2. All locksets shall have 2-3/4" backset with appropriate standard strike package.
3. All other conditions, function and operation as selected by Owner from all manufacturer's available.

D. Panic Devices (Rim Type):

1. All panics shall be one of the following:
   a. Von Duprin, 99 Series, “06” lever design.
   b. Von Duprin, 35A Series, “06” lever design.
   c. Stanley (PHI), Apex 2100 Series, “A” lever design.
   d. Hager, 4500 Series, “Withnell” lever design.
   e. Falcon, 25 Series, “Dane” lever design.
   f. Sargent, 80 Series, “L” lever design.
   g. Dorma, 9000 Series, “LR” lever design.
   h. Yale, 7000 Series, “Augusta AU” lever design.

2. Only compression springs shall be used in devices, latches and outside trim and/or controls.
3. All exterior doors to receive locking cylinders with night latch function, unless indicated otherwise.
4. Provide Cylinder Dogging on all devices, unless specifically indicated otherwise.
5. Provide cylinders for all panic devices to be compatible for brand of locksets provided and/or for building’s master keying system.
6. Provide fire rated devices for all rated door assemblies.
7. Exit devices shall be tested to ANSI/BHMA A156.3 test requirements by a BHMA certified laboratory. A written certification showing successful completion of a minimum of 1,000,000 cycles shall be provided upon request.
8. Touch pad shall extend a minimum of one half of the door width. Maximum unlatching force shall not exceed 15 pounds. End cap will have three-point attachment to the door.

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9. Provide roller strikes for all rim and surface-mounted vertical rod devices, ASA strikes for mortise devices, and manufacturer's standard strikes for concealed vertical rod devices.
10. All devices to incorporate a security dead-latching feature.
11. Provide removable mullion for any pair of doors where panic devices are used, whether scheduled or not, and whether frame is existing or new. Prep frames as required.

E. Electrified Panic Devices:

1. All electrified panics shall be one of the following (to match series of all others specified):
   a. Von Duprin, 99 Series, "06" lever design.
   b. Stanley (PHI), Apex 2100 Series, "A" lever design.

2. Provide Night Latch function on all exterior door trim.
3. Provide equal to Von Duprin QEL Quiet Electric Latch Retraction option to allow for a control station actuator (key switch, credential reader, etc.) to remotely unlatch and retract the latch bolt.
4. Provide SD-EL Special Center Case Dogging for cylinder dogging capability.
5. Provide cylinders for all panic devices to be compatible for brand of locksets provided and/or for building's master keying system.
6. Provide equal to Von Duprin EPT-2 Power Transfer.
7. Provide equal to Von Duprin PS914 Power Supply.
   Provide equal to Von Duprin 900-2RS option for 2 relay EL panic device control board.
   Provide equal to Von Duprin 900-BB option for battery backup.
8. Field convertible between Fail-Safe and Fail-Secure.
9. Upon loss of power, the panic device and trim shall fail to Fail Secure condition so that the door remains in a locked position to maintain security to the building and spaces.

F. Push/Pulls:

1. All push plates shall be Hager, A40R, size: 6"x16", brass.
2. All pulls shall be Hager, 9G, brass.

G. Surface Closers:

1. Push side condition (with parallel arm) shall be one of the following:
   a. LCN, 4110 Series.
   b. Sargent 351 Series.
   c. Hager, 5200 Series.
   d. Falcon, SC70 Series.
   e. Norton 7570 Series.
   f. Stanley D4550 Series.
   g. Dorma 8916 Series.
   h. Yale 4400 Series.

2. Pull side condition (with non-parallel arm) shall be one of the following:
   a. LCN, 4010 Series.
   b. Sargent 351 Series.
   c. Hager, 5200 Series.
   d. Falcon, SC70 Series.
   e. Norton 7570 Series.
   f. Stanley D4550 Series.

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g. Dorma 8916 Series.
h. Yale 4400 Series.

3. Provide reduced force ADA cylinder.
4. Door closers shall be hydraulic, full rack and pinion action with a high strength cast iron or aluminum alloy cylinder. Cylinder body shall be 1-1/2" diameter, and double heat-treated pinion.
5. All closers shall have forged steel main arms and forearms.
6. Mounting shall be on the inside face of the door, interior to the room. Closers shall not be seen on the corridor, hallway or public side of the door.
7. All covers shall be high impact plastic.
8. All finishes shall be powder coat aluminum.
9. Provide hold open functions where specified. All hold opens to be adjustable set up to 180 degrees.
10. Provide concealed closer in lieu of surface closer where a closer is used in conjunction with overhead stops/holders.
11. In all cases, the manufacturer's recommended table of sizes is to govern the size of closers to be furnished.
12. Use through-bolts to fasten surface closers to mineral core wood and hollow metal doors.
13. Furnish special overhead closers where shown or specified.
14. Provide arms, corner brackets, mounting brackets, or drop plates as required.
15. Provide 180° door swing wherever possible.
16. Reduced force opening of less than 5 lbs. of force for interior hinged doors per ADA.
17. Closing speed of sweep period shall be adjusted so that from an open position of 70 degrees the door will take at least 3 seconds to move to a point 3 inches from the latch per ADA.

H. Wall/Floor Stops:

1. All wall stops shall be one of the following:
   a. Ives, WS401CCV, brass.
   b. Hager, 236W, brass.

2. All floor stops shall be one of the following:
   a. Ives, FS436; FS438 if high stop condition is required, brass.
   b. Hager, 241F; 243F if high stop condition is required, brass.

3. All heavy-duty floor stops shall be one of the following:
   a. Ives, FS18S, steel stud grouted in concrete.
   b. Hager, 269F, steel stud grouted in concrete.

4. Provide stops or bumpers wherever an opened door strikes any part of building construction, whether indicated or not. In general, provide wall mounted stops for all doors.
5. Furnish floor dome type where wall type cannot be used.
6. Furnish heavy-duty floor stops at all exterior entry and panic doors, whether indicated or not.

I. Wall/Floor Holders:

1. All wall holders shall be one of the following:
   a. Ives, WS40.
   b. Hager, 327W.

2. All floor holders shall be one of the following:

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a. Ives, FS40.
b. Hager, 326F.

J. Removable Mullions:

1. All removable mullions shall be one of the following:
   a. Von Duprin, 4954.
   b. Falcon, 4023.
   c. Detex, 90KR.
   d. Sargent, L980.
   e. Hager, 4900.

2. Rim cylinders compatible with those for locksets.
3. Strikes compatible with panic devices and locksets.
4. Finish painted to match frame.
5. Provide removable mullion for any pair of doors where panic devices are used, whether scheduled or not, and whether frame is existing or new.
6. Provide fire rated devices in all fire rated openings.

K. Thresholds:

1. Aluminum, saddle-type.
2. Fully ADA compliant.
3. Span entire width and depth of opening.
4. 1/2" maximum height.
5. 1:2 ratio bevel slope.
6. Finish to match all other hardware specified for opening, and storefront units where applicable.

L. Seals/Gaskets/Sweeps/Bottoms (used for Weatherstripping):

1. All bottoms for doors with recessed bottom channels shall be one of the following:
   a. Hager, 750SN.

2. All bottoms for doors without recessed bottom channels shall be one of the following:
   a. Hager, 772S.

3. All bottoms to be mil finish aluminum.
4. Provide bottoms on all exterior doors, whether scheduled or not.
5. Weatherstripping to be Vinyl, Neoprene, EPDM, TPE (thermoplastic elastomer), or Silicone.
6. Full length and width of opening at each condition.
7. All weatherstripping sets shall be determined by the door hardware supplier as appropriate to the application and able to provide a weather-tight and weather-proof seal, while allowing proper operation of the door and all other hardware.
8. Provide weatherstripping seal sets at entire perimeter jambs and head of all exterior doors, whether scheduled or not.

M. Seals/Gaskets (used for Sound Seals):

1. All sound seals shall be one of the following:
   a. Pemko, S88 Series.

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2. Silicone, adhesive-backed, with compression bulb and stabilizer flange.
3. Full length and width of opening at each condition.
4. Provide sound seal sets at entire perimeter jambs and head.

N. Flushbolts/Dustproof Strikes:

1. All flushbolts shall be one of the following:
   a. Ives, 262.
   b. Hager, 281D.

2. Provide at top and bottom of doors.
3. Provide dust proof strike for bottom flushbolts, provide as deep as possible.

O. Plates:

1. All kick plates shall be height=8", length=2" less than door, unless otherwise indicated, and one of the following:
   a. Ives, 8400.
   b. Hager, 194S.

2. All armor plates shall be height=36", length=1" less than door, unless otherwise indicated, and one of the following:
   a. Ives, 8400.
   b. Hager, 194S.

3. All plates to be .050” thick minimum, brass, stainless steel, or aluminum.
4. All plates to have beveled edges on all 4 sides.
5. All plates to have countersunk screws.
6. Screw-fasten solid to door.
7. Provide kick plates on the interior side of all doors in a restroom, custodial or janitorial room, mechanical or electrical room, laundry room or other such utility space, whether scheduled or not.
8. Provide armor plates on both sides of all crash or impact doors, whether scheduled or not.

P. Automatic Door Bottoms:

1. All automatic door bottoms shall be one of the following:
   a. Hager, 730S.
   b. NGP, 422.
   c. Pemko, 411ARL.
   d. Reese 521C.

2. Non-handed, reversible, full mortise, flush mounting.
3. Comprised of an aluminum case surrounding a movable drop-bar seal. The drop-bar seal is actuated by a plunger which contacts the jamb as the door closes, forcing the drop-bar seal down against the floor or threshold surface.
4. Mill aluminum finish with black sponge neoprene insert.
5. Provide appropriate type of unit applicable to each door material and thickness.

Q. Silencers:

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1. All door silencers in metal frames shall be one of the following:
   a. Ives, SR64.
   b. Hager, 307D.

2. All door silencers in wood frames shall be one of the following:
   a. Ives, SR65.
   b. Hager, 308D.

3. Furnish silencers for all interior single and pairs of doors, whether scheduled or not.
4. Omit silencers at doors where they may interfere with other types of seals already required, such as fire rated doors, smoke doors, sound proof doors, or light proof doors.
11. Stainless steel material. Finish on stainless steel to match all other hardware at opening.
12. Hardware supplier is responsible to coordinate the model required with the condition of installation so as to assure proper fit. Verify condition and dimensions of door frames, mullions, removable mullions, and abutting walls where strikes are to be installed.

R. Access Control Door Controllers:

1. Specified in Section 17920 - Access Control System.

S. Access Control Credential Readers:

1. Specified in Section 17920 - Access Control System.

2.06 HARDWARE SCHEDULE

Hardware Set #1 *(Exterior, Pair, Access Control)*
Continuous Hinge w/ electronic power transfer prep (right leaf)
Continuous Hinge (left leaf)
Electrified Rim Panic Device (right leaf)
Rim Panic Device (left leaf)
Surface Closer w/ Cush-n-stop arm (each leaf)
Threshold
Weatherstripping (each leaf by 08 41 13)
Door Bottom (each leaf by 08 41 13)
Removeable Mullion

Components provided by Owner's separate vendor:
Access Control Credential Reader
Access Control Door Controllers

Hardware Set #2 *(Interior, Single, RR)*
Hinges
Push/Pull
Surface Closer
Wall Stop

Hardware Set #3 *(Interior, Single, Mech.)*
Hinges

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Cylindrical Lockset (Storage function)
Surface Closer
Kickplate
Wall Stop

Hardware Set #4 *(Interior, Single)*
Hinges
Cylindrical Lockset (Classroom function)
Surface Closer w/ Cush-n-stop arm

Hardware Set #5 *(Interior, Single)*
Hinges
Cylindrical Lockset (Classroom function)
Wall Stop

Hardware Set #6 *(Interior, Pair)*
Hinges, 180 degrees (each leaf)
Cylindrical Lockset (Classroom function) (active leaf)
Flushbolts/Dustproof Strike (inactive leaf)
Wall Holder (each leaf)
Sound Seals (each leaf)
Automatic Door Bottom (each leaf)

Hardware Set #7 *(Interior, Single, Conf.)*
Hinges
Cylindrical Lockset (Classroom function)
Wall Stop
Sound Seals (each leaf)
Automatic Door Bottom (each leaf)

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install finishing hardware as recommended by the National Builders Hardware Association.

B. Only use fasteners supplied by the manufacturer. Provide fasteners of suitable size, quantity, type and finish to secure hardware in position for heavy use and long life.

C. Hardware for application on metal surfaces:

1. Made to standard templates.
2. Fastening harmonized with hardware as to material and finish.
3. Fastenings with approved type anchors according to the manufacturer.
4. In general, ends of through-bolts shall be countersunk.

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D. Mount hardware in accordance with current state and federal accessibility standards and guidelines.

E. Install hardware per manufacturers instructions and in compliance with:

1. NFPA-80.
2. NFPA-101.
3. NFPA-105.
4. NFPA-252.
5. ANSI A117.1.

F. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Where cutting and fitting is required to install hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation or application of surface protection with finishing work specified in the Division 9 Sections. Do not install surface-mounted items until finishes have been completed on the substrates involved.

G. Set units level, plumb, and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

H. Drill and countersink units that are not factory prepared for anchorage fasteners.
Space fasteners and anchors in accordance with industry standards.

I. Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements specified in Division 7 Section “Joint Sealers”.

J. Weatherstripping and Seals: Comply with manufacturer's instructions and recommendations to the extent installation requirements are not otherwise indicated.

3.02 FIELD QUALITY CONTROL

A. Material supplier to inspect hardware after installation and before final acceptance in order to ensure that hardware has been properly installed. If there are any discrepancies the material supplier is to provide the Architect, General Contractor and Installer with a written report detailing any and all discrepancies. All discrepancies are to be corrected prior to final acceptance unless otherwise directed by the Owner.

3.03 ADJUSTING AND CLEANING

A. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit.

B. Immediately prior to Substantial Completion replace all construction cores.

C. Tag all keys.

D. Check each key and each lockset to verify proper working order.

E. Lubricate and adjust all hardware to provide smooth operation.

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F. Clean all hardware per manufacturer's instructions after installer makes final adjustments and prior to final acceptance, remove all mortar, drywall mud, paint overspray, foreign materials, labels, markings, soil, oils, etc. Polish all locksets, plates, and other hardware.

G. Clean adjacent surfaces soiled by hardware installation

H. Replace, at no cost to Owner, items that cannot be cleaned to manufacturer's level of new finish quality or that cannot be adjusted to operate freely and smoothly or as intended for the application made.

I. Where door hardware is installed more than one month prior to acceptance or occupancy of a space or area, return to the installation during the week prior to acceptance or occupancy and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to function properly with final operation of heating and ventilating equipment.

SUBMITTAL CHECKLIST

1. Hardware Schedule.
2. Owner Verification and Review Meeting.
3. Manufacturer's Product Information.
4. Samples.

END OF SECTION 08 7100

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SECTION 08 8100 - GLASS AND GLAZING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Glass and glazing as shown on the Drawings and specified herein.

1.02 QUALITY ASSURANCE

A. Comply with the following:

1. Glazing Material:
   a. ANSI Z97.1.
   b. ASTM 1036, Standard Specifications for Flat Glass.

2. Safety Glazing:
   a. Federal Standard CPSC 16 CFR 1201.
   b. ANSI Z97.1.
   c. ANSI Z97.1q.
   d. U.S. Consumer Product Safely Commission Standard 16 CFR 1201 CI and CII.
   e. ASTM C1172, Standard Specification for Laminated Architectural Flat Glass.

3. Insulating Glass:
   a. Manufacturing: ASTM E 6 P03, Class CBA.
   b. Installation: SIGMA A-3000.

B. Unless otherwise shown or governed by other reference standards specified, conform with details and procedures of FGMA Glazing Manual.

C. The level of acceptability for glass and glazing products may be more strict than the basic standards referenced herein. The Owner and/or Architect reserve the right to determine whether a product is acceptable for its intended use, in its intended application, for its intended clarity of visibility, and as required for its intended aesthetic effect.

1.03 SUBMITTALS

A. Manufacturer's Literature:

1. Materials description and installation instructions for glazing compounds.

B. Samples:

1. Submit 6" x 6" actual sample of each glass type, color, tint, etc.
2. Submit 12" x 12" actual sample of insulated units or spandrel units.

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C. Warranty:

1. Submit specified warranty for review.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver glazing materials to project site in manufacturer's unopened containers, fully identified with trade name, color, size, hardness, type, class and grade. Store each item in accordance with manufacturer's instructions. Remove all damaged, or otherwise unsuitable material immediately from the job site.

1.05 JOB CONDITIONS

A. Do not perform work under adverse weather or job conditions. Install liquid sealants when temperatures are within lower or middle third of temperature range recommended by manufacturer.

1.06 WARRANTY

A. Provide manufacturer's warranty for insulated glass units against material obstruction of vision resulting from moisture infiltration or dust collection between interior glass surfaces for ten (10) years.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Provide products, as approved by the Architect, from one of the following, or as otherwise specifically listed:

1. "AGC Glass Company North America".
2. "Guardian Industries".
3. "Oldcastle Building Envelope".
4. "Pilkington North America, Inc.".
5. "Vitro/PPG Industries, Inc.".

2.02 GLASS TYPES

A. Tempered Safety Glass:

1. Thickness as shown on Drawings or specified herein.
2. Single thickness of clear or tinted float glass.
3. Reheated to just below melting point and suddenly cooled for tempering.
4. Upon major impact, the glass surface shall shatter into small pieces free of sharp points or slivers.

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5. See Tinted Float Glass for tint color, where tinted glass is required.

B. 1” Insulating Glass:

1. Manufacturer’s standard units comprised of (1) 1/4” outdoor lite and (1) 1/4" indoor lite with an overall nominal thickness of 1”.
2. Complete units tested and approved in accordance with requirements of the Sealed Insulating Glass Manufacturer’s Association (SIGMA).
3. Outdoor Lite:
   a. 1/4" Low-E glass, tinted
   b. Tempered safety glass.
   c. All requirements of Low-E glass apply as specified above.
   d. See Tinted Float Glass for tint color.

4. Indoor Lite:
   a. 1/4" clear float glass,
   b. Laminated safety glass.
   c. All requirements of laminated or tempered safety glass apply as specified above.

5. Separate outdoor and indoor lites by 1/2” desiccant spacer bar.

2.03 MISCELLANEOUS MATERIALS

A. Glazing Sealant for Exterior Glazing:

1. One Part Silicone, FS TT-S-00230C, Type II, Class A.
2. Provide one of the following approved products:
   a. “General Electric Company”, 1200 Series.
   b. “Dow Corning Corporation”, Dow Corning Silicone Rubber Sealant.
   c. “Tremco”, Proglaze Silicone Construction Sealant.
   d. “Pecora Chemical Corporation”, 863.
   e. “DAP, Inc.”, Dap Flexiglaze 1231 Glazing Compound.

B. Glazing Tape:

1. Polyisobutylene / butyl.
2. Provide one of the following approved products:
   a. “Tremco”, Tremco 440 Tape.
   b. “Pecora Chemical Corporation”, G-66.
   c. “Pecora Chemical Corporation”, BB-50.
   d. “DAP, Inc.”, Butyl Rubber Tape.

C. Setting Blocks:

1. Neoprene blocks, 80 to 90 Type A durometer hardness.

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D. Spacers:

1. Neoprene blocks, 40 to 50 Type A durometer hardness, 3" long, self-adhesive on one face only.

2.04 FABRICATION

A. Sealed Edge Construction for Insulated Units:

1. Fabricate units with a permanent, hermetically sealed, dry air or gas filled space of the width indicated, between sheets of glass as indicated.
2. Except as otherwise indicated, fabricate units with 1/2" wide air spaces.
3. Label each unit to show compliances with required standards and regulations.
4. Indicate which face of unit is for exposure to exterior of weather.
5. Provide removable label except where regulations require a permanent label.

PART 3 – EXECUTION

3.01 PREPARATION

A. Examine all surfaces to receive the parts of the Work specified herein.

B. Verify all dimensions of in-place and subsequent construction.

C. Application or installation of materials constitutes acceptance of the related construction.

3.02 INSTALLATION

A. Employ only experienced glaziers who have had previous experience with the materials and systems being applied. Use tools and equipment recommended by the glass manufacturer.

B. Maintain a minimum temperature of 40°F during glazing unless the manufacturer of the glazing materials specifically agrees to application of his materials at lower temperatures.

C. Clean glazing stops and rabbets to receive glazing materials of all obstructions and deleterious substances which might impair the work. Remove protective coatings which might fail in adhesion of interfere with bond of sealants. Comply with manufacturer's instructions for final wiping of surfaces immediately before application of primer and glazing compounds or tapes.

D. Inspect each piece of glass immediately before installation.
Do not install pieces which are defective or damaged in any way.

E. Set glass on setting blocks or shims. Use blocks of proper size and spacing to support the glass in accordance with manufacturer's recommendations.

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F. Provide spacers for all glass to separate glass from stops, except where continuous gaskets or tape are required.

G. Set glass in a manner which produces greatest possible degree of uniformity in appearance.

H. Install glass according to manufacturer's recommendations and in accordance with the Flat Glass Marketing Association Glazing Manual.

I. Clean excess sealant or compound from glass and framing members immediately after application, using solvents or cleaners recommended by manufacturers.

3.03 CURING, PROTECTION AND CLEANING

A. Cure sealants in accordance with the manufacturer's instructions to attain maximum durability and adhesion to glass and framing as soon as possible.

B. Remove and replace any glass which has become broken, cracked, chipped, or damaged, in any way and from any source, including weather, vandalism, construction, handling, accidents during the construction period, etc.

C. Maintain glass in a reasonably clean condition during construction so that it will not become stained and will not contribute to the deterioration of glazing materials.

D. Remove labels, clean and polish glass on both faces prior to final inspection. Comply with instructions and recommendations of the glass manufacturer and glazing materials manufacturer for cleaning in each case.

3.04 TESTING OF EXTERIOR GLAZING SYSTEMS

A. After completion of exterior glazing and nominal curing of sealants, perpendicularly from a 3/4" hose at normal domestic water pressure, test each exterior glazing unit. Repair leaks and other defects, and retest as directed. Repair or replace other work damaged by such leaks.

SUBMITTAL CHECKLIST

1. Manufacturer's Literature.
2. Samples.
3. Warranty.

END OF SECTION 08 8100

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SECTION 08 5 13 - ALUMINUM SOFFIT VENT

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish all labor, materials and equipment necessary for a complete installation of continuous aluminum soffit vent and related accessories.

PART 2 - PRODUCTS

2.01 SOFFIT VENT

A. Approved Products:

1. "Fry Reglet Corporation", E.I.F.S. Soffit Vent, #PCS-75-V-600.

B. Description:

1. Continuous soffit vent.
2. Size: 3/4” deep x lengths as required on Drawings.
   If not indicated, provide continuous across entire length of soffit area.
3. 6” reveal width.

C. Material:

1. Extruded aluminum, 6063-T5.

2.02 SUBMITTALS

A. Product Data:

1. Manufacturer's specifications and installation instructions.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General:

1. Prior to installation, verify all dimensions and existing conditions. Examine, clean and repair, if necessary any adjoining work to assure proper installation of soffit and vent.

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2. Dissimilar Materials:
    a. Care must be exercised in placing aluminum in contact with metals or materials not compatible with aluminum.
    b. Dissimilar materials shall be painted or otherwise protected when they are in contact with aluminum or when drainage from them passes over aluminum.

B. Install soffit vent and accessories in accordance with manufacturer's instructions.

C. Sealant at entire perimeter of soffit vent.

SUBMITTAL CHECKLIST

1. Product Data.

END OF SECTION 08 9513

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SECTION 09 3000 - TILE

PART 1 - GENERAL

1.1 SUMMARY

A. Related Documents: General and Supplementary Conditions of the Contract, Division 1 General Requirements, and Drawings are applicable to this Section.

B. Section Includes:

1. Porcelain wall tile where shown on Drawings.

1.2 SUBMITTALS

A. Shop Drawings:

1. Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control joints, thresholds, and setting details.
2. Locate and detail expansion and control joints.

B. Product Data:

1. Manufacturer's product data sheets, cutsheets, specifications and instructions for using mortars, adhesives, and grouts.

C. Samples:

1. Tile: Submit color samples as specified on Drawings or manufacturer's entire color selection.
2. Grout: Submit color samples as specified on Drawings or manufacturer's entire color selection.

1.3 QUALITY ASSURANCE

A. Single Source Responsibility:

1. Obtain each type and color tile material required from single source.
2. Obtain setting and grouting materials from one manufacturer to ensure compatibility.
3. Furnish a 10-year guarantee from installation material manufacturer. The guarantee is inclusive of installation materials, finish product, and labor.

B. Manufacturer Qualifications:

1. Tile: Minimum 5 years' experience in manufacture of tile products.
2. Setting Materials: Minimum 10 years experience in manufacture of setting and grout materials specified.
3. Membrane: Minimum 5 years' experience in manufacture of membrane materials specified.

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C. Installer Qualifications:

1. Specializing in tile work, having a minimum of 5 years successful documented experience with work comparable to that required for this Project.

D. Certifications:

1. Submit "Master Grade Certificate" for each type of ceramic, quarry, and paver tile in accordance with requirements of ANSI A137.1.
2. Submit manufacturer's certifications that mortars, adhesives, and grouts are suitable for intended and specified use.

E. Conform to ANSI- Recommended Standard Specifications for Ceramic Tile - A137.1

F. Conform to TCA Ceramic Tile: The Installation Handbook.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of Section 01 6500.

B. Labeling: Comply with ANSI A137.1.

C. Deliver materials in manufacturer's unopened containers, fully identified with name, brand, type, and grade.

D. Protect materials from contamination, dampness, freezing, or overheating in accordance with manufacturer's instructions.

E. Broken, cracked, chipped, stained, or damaged tile will be rejected, whether built-in or not.

F. Protect mortar and grout materials against moisture, soiling, or staining.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Comply with requirements of referenced standards and recommendations of material manufacturers for environmental conditions before, during, and after installation.

B. Do not begin installation until building is completely enclosed and HVAC system is operating and maintaining temperature and humidity conditions consistent with "after occupancy" conditions for a minimum of 2 weeks.

C. Maintain continuous and uniform building temperatures of not less than 50 degrees F during installation nor more than 100 degrees F.

D. Ventilate spaces receiving tile in accordance with material manufacturers' instructions.

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1.6 MAINTENANCE MATERIALS AND DATA

A. See Specification Section 01 7846 - Closeout Maintenance Materials.

B. Submit maintenance data under provisions of Section 01 7800 - Closeout Submittals.

C. Include cleaning and maintenance methods, cleaning solutions recommended, stain removal methods, and polishes and waxes recommended.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. “Daltile."

B. “Portobello”.

2.2 GENERAL

A. ANSI Standards:

1. Comply with ANSI A137.1 "American National Standard Specifications for Ceramic Tile" for types, compositions, and grades of tile indicated.
2. Furnish tile complying with "Standard Grade" requirements unless otherwise indicated.

B. ANSI Standard for Tile Installation Materials:

1. Comply with ANSI standard referenced with products and materials indicated for setting and grouting.

C. Factory Blending:

1. For tile exhibiting color variations within the ranges selected during sample submittals, blend tile in factory and package accordingly so that tile units taken from one package show the same range in colors as those taken from other packages and match approved samples.

D. Mounting:

1. Where factory-mounted tile is required, provide back-face or edge-mounted tile assemblies as standard with manufacturer unless another mounting method is indicated.
2. Where tile is indicated for installation in swimming pools, on exteriors or in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies that this type of mounting is suitable for these kinds of uses and has been successfully used on other projects.

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2.3 PORCELAIN TILE

A. Porcelain Wall Tile:

1. Type: To be selected during construction.
2. Size: To be selected during construction.
3. Pattern: To be selected during construction.
4. Color: To be selected during construction.

2.4 THRESHOLDS

A. Metal Edge Strip:

1. General:
   a. Provide metal edge strip at the transition between the tile flooring to the adjacent flooring.
   b. Equal to: “Schluter Systems” transition and edge strips.

2. Size and Profile:
   a. Bent angle profile with smooth finished edges.
   b. Configuration as required to provide proper transition between finished surface of tile and that of the adjacent finished flooring.
   c. Height to match the thickness of the tile, with top surface smooth and flush with the tile.

3. Finish:
   a. White zinc, aluminum or stainless steel.
   b. Finish as selected from all manufacturer’s standard selection.

2.5 TRIMMERS

A. Provide necessary caps, stops, returns, trimmers and other shapes to complete installation.

2.6 MORTAR MATERIALS - THIN SET BEDS

A. Lightweight Portland Cement; Thin-Set (for use with large format 18” x 18” or larger floor tile):

1. Provide one of the following acceptable products:
   a. "Custom Building Products", ProLite Tile & Stone Mortar or approved equal.

2. Description:
   a. Lightweight formula for use with large format tile and stone.
   b. Complying with ANSI A118.4TE, A118.15TE and A118.11.

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2.7 MEMBRANES, PRIMERS AND SEALERS

A. Crack Isolation and Waterproofing Membrane:

1. Provide one of the following acceptable products:
   a. "Mapei", Mapelastic 315.
   b. “Custom Building Products”, Red Gard.

2. Description:
   a. Trowel applied elastomeric compound.

3. Accessories:
   a. Preformed fiberglass mesh coving, inside and outside corners, and drain fittings.
   b. Preformed expansion joint flashing.

B. Concrete Slab Primers and Sealers:

1. Where existing substrate is unacceptable for adhesion or bonding of new materials: Provide primers and sealers as required by flooring manufacturer to achieve the proper substrate conditions for installation of flooring.
2. Scarify, shot-blast, or sand-blast floor as required at no change in bid price.

2.8 GROUT

A. Polymer- Modified Portland Cement

1. Provide one of the following acceptable products:
   a. “Custom Building Products”, Prism Color Consistent Grout.

2. A lightweight, polymer-modified, cement-based grout that offers consistent color without mottling or shading. Composition is a blend of specialty cements, recycled aggregates and chemicals.
3. Comply with ANSI A118.7
4. Color: As indicated or to be selected by Architect from manufacturer’s entire selection.
5. Location: Provide for all floor and wall surfaces, unless indicated otherwise. Non-sanded grout must be used with glass tile and glazed ceramic wall tile.

2.9 TILE AND GROUT SEALER:

A. Sealer:

1. Provide one of the following acceptable products:
   a. "Custom Building Products", Tile Lab Surfacegard Penetrating Sealer.

2. Description:
   a. Water-based, clear.

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b. Compatible with surfaces comprised of marble, stone, porcelain, ceramic, quarry, grout, concrete, brick, masonry and unglazed tile.
c. Compatible with tile manufacturer's warranty requirements.
d. Repel dirt, oils and stains. Resists mold and mildew.
e. Low odor, pH neutral and non-abrasive.
f. Allow moisture vapor transmission.
g. Rated for interior and exterior use.

B. Stripper:

1. Provide one of the following acceptable products:
   a. "Custom Building Products", Tile Lab Heavy-Duty Cleaner and Stripper.

2. To clean surfaces and strip wax and acrylic finishes.
3. Apply to all surfaces in strict accordance with the manufacturer's instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that areas to receive tile installed by thin bed method have wood float finish and pitched to drains. Substrates are to be true within 1/8 inch in 10'-0" (for all tiles 18" and larger). Substrates are to be true within 1/4 inch in 10'-0" (for all tiles smaller than 18").

B. Condition of Surfaces to Receive Tile:

1. Firm, dry, clean and free of oily or waxy films, mortar and soil.
2. Grounds, anchors, plugs, hangers, bucks, electrical and mechanical work in or behind tile installed.

C. Air Temperature and Surfaces in Rooms to Receive Flooring:

1. Between 60 degrees to 90 degrees F, unless otherwise recommended by manufacturers of materials being installed.

3.2 PREPARATION

A. Clean substrates.

B. Wet down or wash dry, dusty surfaces and remove excess water immediately prior to application of tiles.

C. Prepare surfaces in strict accordance with instructions of manufacturer whose setting materials or additives are being used.

D. Acid Based Cleaners: Use not permitted.

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E. Scarify concrete substrates with blast track equipment if necessary to completely remove curing compounds or other substances that would interfere with proper bond of setting materials. Clean and maintain substrate in condition required by setting material manufacturer.

F. Do not seal substrate unless required by manufacturer.

G. Prime substrate when required by manufacturer.

H. Blending:

1. For tile exhibiting color variations within the ranges selected during sample submittals, verify that tile has been blended in factory and packaged accordingly so that tile units taken from one package show the same range in colors as those taken from other packages and match approved samples.
2. If not factory blended, either return to manufacturer or blend tiles at project site before installing.

3.3 INSTALLATION

A. Concrete Slab Primers and Sealers:

1. Install primers and sealers in accordance with manufacturers recommended installation guidelines and details.
2. Apply all concrete slab primers and sealers as required to achieve an acceptable substrate for installation of flooring per flooring manufacturer's requirements. Apply when areas are ready or scheduled to receive flooring without delays to the project or schedule, and without any additional costs or change in time. If floor is required to be sandblasted, shot-blasted, scarified, or otherwise prepared, perform this work at no additional cost or change in time.

B. Crack Isolation and Waterproofing Membrane:

1. Install membrane in accordance with manufacturers recommended installation guidelines and details.
2. Install membrane over cracks of up to 1/8 inch or greater in substrates.
   Apply a 12 inch wide strip centered on crack as crack isolation membrane.
3. Install membrane with products or methods approved in writing by membrane manufacturer when joining, sealing, fastening, or adhering sheet membranes.
4. Once all cracks have been addressed, install membrane to entire floor substrate as waterproofing membrane.
5. Flash waterproofing up adjacent walls and surfaces in accordance to manufacturer's details, full height of base.
6. Use preformed cove, corners, and expansion joint flashing.
7. Allow membrane to cure as prior to setting tile.
8. Do not allow construction traffic on membrane.
9. Flood test waterproof membranes after fully cured.
10. Field Quality Control water test when required.

C. Tile Installation, General:

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1. Install tile materials in accordance with ANSI A137.1, other referenced ANSI and TCNA specifications, and TCNA "Handbook for Ceramic Tile Installation", except for more stringent requirements of manufacturer or these Specifications.
2. Cut and fit tile tight to protrusions and vertical interruptions and treat with a compatible sealant as required. Form corners and bases neatly.
3. Work tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joint watertight, without voids, cracks, excess mortar, or grout.
4. Prepare surface, fit, set, bond, grout and clean in accordance with applicable requirements of ANSI standards and Tile Council of North America.

D. Layout:

1. Lay out work to pattern indicated so that full tile or joint is centered on each wall and no tile of less than half width need be used. Do not interrupt pattern through openings. Lay out tile to minimize cutting and to avoid tile less than half size.
2. For heights stated in feet and inches, use courses of full tile to produce nearest attainable heights without cutting tile.
3. No staggered joints will be permitted.
4. Align joints in tile in both directions.
5. Align joints between floor and base tile.
6. Make joints between sheets of tile exactly same width as joints within sheet.
7. File edges of cut tile smooth and even.
8. Cut and fit tile at penetrations through tile. Do not damage visible surfaces. Carefully grind edges of tile abutting built-in items. Fit tile at outlets, piping and other penetrations so that plates, collars, or covers overlap tile.
9. Extend tile work into recesses and under or behind equipment and fixtures, to form complete covering without interruptions, except as otherwise indicated. Terminate work neatly at obstructions, edges and corners without disrupting pattern or joint alignments.
10. Accurately form intersections and returns.

E. Thin Set Method, Floors and Walls, ANSI-108.4, 108.5, 108.14, 108.15, 108.16:

1. Apply mortar or adhesive with notched trowel using scraping motion to work material into good contact with surface to be covered. Maintain 90 percent coverage on back of tile and fully bed all corners.
2. Apply only as much mortar or adhesive as can be covered within allowable windows as recommended by mortar or adhesive manufacturer or while surface is still tacky.
3. When installing large tiles, ceramics or mosaics, trowel small quantity of mortar or adhesive onto back of each tile or sheet of tiles.
4. Set tiles in place and rub or beat with small beating block.
5. Beat or rap tile to ensure proper bond and also to level surface of tile.
6. Align tile to show uniform joints and allow to set until firm.
7. Clean excess mortar or adhesive from surface of tile with wet cheese cloth (not a sponge) while mortar is fresh.
8. Allow face mounted tile to set until firm before removing paper and before grouting.
9. Sound tile after setting. Replace hollow sounding tiles.

F. Grouting, ANSI A108.9- 108.10:

1. Allow tiles to set a minimum of 48 hours before grouting.

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2. If bonding materials are rapid setting, follow manufacturer's recommendations.
3. Install in accordance with grout manufacturer's recommendations and ANSI A108.10.
4. Pack joints full and free before mortar takes initial set.
5. Clean excess grout from surface with wet cheesecloth as work progresses. Do not use hydrosponges.
6. Cure after grouting by covering with kraft or construction paper for 72 hours.
7. Install sealant in vertical wall joints at interior corners.

G. Sealing:

1. Allow grout to fully cure, 48 hours minimum.
2. Thoroughly clean and prepare all surfaces of all grout and tile with manufacturer's cleaner and stripper product. Do not use cleaners containing ammonia, acids or bleach.
3. Protect from any foot or equipment traffic prior to sealing.
4. Apply first coat of clear sealer to all surfaces of all grout and tile, per manufacturer's recommendations.
5. Once dried, apply a second coat of clear sealer to all surfaces of all grout and tile, per manufacturer's recommendations.
6. Allow sealer to fully cure between coats and after final coat prior to any foot or equipment traffic atop.
7. All grout and tile surfaces to receive sealer, unless specifically indicated otherwise.

H. Control Joints and Other Sealant Usage, ANSI-A108.1:

1. Install control joints where tile abuts any/all retaining surfaces such as perimeter walls, curbs, columns, wall corners and directly over cold joints and control joints in structural surfaces conforming to architectural details.
2. Install control joint in floors at spacings as indicated in TCNA Installation Handbook, unless noted otherwise.
3. Rake or cut control joints through setting bed to supporting slab or structure. Keep joints free of mortar.
4. Install in full accordance with TCNA Installation Handbook.
5. Fill joints with self-leveling polyurethane sealant and backing material as required.
6. Fill joints around toilet fixtures with white silicone sanitary sealant.

I. Expansion Joints:

1. Keep expansion joints free of mortar and grout.
2. Use manufacturer's expansion joint flashing when covering expansion joints with waterproof or crack isolation membranes.
3. Provide expansion joints directly over changes in material, over control and expansion joints in substrate, at juncture of floors and walls, at other restraining surfaces such as curbs, columns, bases, and wall corners, and where recommended by TCNA EJ171 Expansion Joint requirements.
4. Install sealant in expansion joints.
5. Provide sealant material at items penetrating tile work, unless otherwise indicated.
6. Provide sealants and related materials in accordance with cited ANSI A108.1 and TCNA requirements.

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3.4 ADJUSTING

A. Sound tile after setting. Replace hollow sounding units.

3.5 CLEANING

A. Clean excess mortar from surface with water as work progresses. Perform cleaning while mortar is fresh and before it hardens on surfaces.

B. Sponge and wash tile diagonally across joints. Polish with clean dry cloth

C. Remove grout haze following recommendation of mortar additive manufacturer. Do not use acids for cleaning.

D. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

E. Wipe all sealer from glazed surfaces or any other surface that will not accept sealer. Clean tile surfaces to remove any residue and do not allow to dry on surface.

3.6 PROTECTION

A. Prohibit traffic from floor finish for 72 hours after installation.

B. Where temporary use of new floors is unavoidable, supply large, flat boards or plywood panels for walkways over kraft paper.

C. Protect work so that it will be without any evidence of damage or use at time of acceptance.

SUBMITTAL CHECKLIST

1. Shop Drawings.
2. Samples.
3. Manufacturer's Product Data.

END OF SECTION 09 3000

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SECTION 09 5113 - ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Extent of acoustical ceilings as shown and scheduled on the Drawings.

B. Types of acoustical ceilings specified in this Section include the following:

1. Acoustical panel ceilings, exposed grid suspension.

1.02 QUALITY ASSURANCE

A. UL Fire Hazard Classification:

1. Where acoustical ceilings are indicated to comply with fire hazard classification provide acoustical materials which have been tested, rated and labeled by UL for indicated ratings.
2. Classification: Maximum of 25 for flame spread.

B. Sound and Noise Classification:

1. Provide systems with NRC ratings in accordance with ASTM C423 and STC ratings in accordance with AMA1-II, as tested by an independent agency.

1.03 SUBMITTALS

A. Product Data:

1. Manufacturer's product data sheets, cutsheets, specifications and installation instructions.

B. Samples:

1. Where colors are specified, submit one sample of each type of acoustical unit and suspension system member.
2. Where colors are not specified, or are specified as "to be selected", submit samples showing manufacturer's full range of standard colors for each type acoustical unit and suspension system.
3. Submit additional or larger samples of selected colors upon request.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the site in manufacturers original, unopened packages, with labels intact. Store and handle to avoid damage and exposure to elements. Remove damaged or otherwise unsuitable material from job site.

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1.05 MAINTENANCE MATERIALS AND DATA

A. See Specification Section 01 7846 - Closeout Maintenance Materials.

B. Submit maintenance data under provisions of Section 01 7800 - Closeout Submittals.

1.06 PROJECT CONDITIONS

A. Do not install acoustical ceilings until space is enclosed and weatherproof, and until wet-work in space is completed, and until temperature and humidity will be continuously maintained at values near those indicated for final occupancy.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Provide ceiling panels, as approved by the Architect, by one of the following manufacturers:

1. "Armstrong"

B. Provide suspension systems from same manufacturer as the ceiling panel, as approved by the Architect, or by one of the following manufacturers:

1. “Armstrong”

2.02 CEILING SYSTEMS

A. Provide the following acoustical ceiling systems as indicated on the Drawings:

1. Panel and Suspension System Type “ACP-1”:
(Lay-in, 2’x2’, Drop Edge)
   a. Panel:
      1. Model: “Armstrong”, Ultima #1912.
      2. Size: 2’ x 2’ x 3/4”.
      3. Edge: Beveled Tegular.
      4. NRC: 0.75.
      5. Light Reflect: 0.88.
      6. Color: White.
   b. Suspension System:
      1. Model: “Armstrong”, Suprafine XL.
      2. Profile: 2’ x 2’ grid, 9/16”’ flange.
      3. Material: Hot dipped galvanized
      4. Color: White.

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2.03 CEILING SUSPENSION MATERIALS

A. Comply with ASTM C 635, as applicable to type of suspension system required for type of ceiling units indicated. Coordinate with other work supported by or penetrating through ceilings, including light fixtures, and HVAC equipment.

B. Structural Class:

1. Intermediate-duty system.

C. Attachment Devices:

1. Size for 5 times design load indicated in ASTM C 635, Table 1, Direct Hung.

D. Hanger Wires:

1. Galvanized carbon steel, ASTM A 641, soft temper, pre-stretched, yield-stress load of at least 3 times design load, but not less than 12 gauge (0.106 inch).

E. Type of System:

1. Either direct-hung or indirect hung suspension system, as required to meet performance requirements.

F. Carrying Channels:

1. 1-1/2 inch steel channels, hot-rolled or cold-rolled, not less than 0.475 lbs. per lineal ft.

G. Edge Moldings:

1. Manufacturer's standard channel molding for edges and penetrations of ceiling, with single flange of molding exposed.
2. 9/16 inch minimum exposed leg, finish to match grid finish.

H. Exposed Suspension System:

1. Manufacturer's standard exposed runners, cross-runners and accessories, of double web types and profiles indicated, with exposed cross runners coped to lay flush with main runners.
2. Provide uniform factory-applied finish on exposed surfaces of ceiling suspension systems, including moldings, trim and accessories.
3. Manufacturer's standard baked polyester finish, low gloss, color as selected.

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PART 3 - EXECUTION

3.01 PREPARATION

A. Furnish layouts for inserts, clips or other supports required to be installed by other trades for support of acoustical ceilings.

B. Establish layout of acoustical units in compliance with reflected ceiling plan. Balance border widths at opposite edges of each ceiling. Avoid use of less-than-half width units at borders.

3.02 INSTALLATION

A. Install materials in accordance with manufacturer's printed instructions, and to comply with governing regulations, fire resistance rating requirements as indicated, and industry standards applicable to work.

B. Install all acoustical units with grain in one plane and direction.

C. Install suspension systems to comply with ASTM C 636, with hangers supported only from building structural members. Locate hangers near each end and spaced 4'-0" along each carrying channel or direct-hung runner, unless otherwise indicated, leveling to tolerance of 1/8 inch in 12'-0".

D. Install edge moldings of type indicated at perimeter of acoustical ceiling area and at locations where necessary to conceal edges of acoustical units.

1. Sealant Bed: Apply continuous ribbon of acoustical sealant, concealed on back of vertical leg before installing moldings.
2. Screw-attach moldings to substrate at intervals not over 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to tolerance of 1/8 inch in 12'-0". Miter corners accurately and connect securely.

E. Install panels in coordination with suspension system, with edges concealed by support of suspension members. Scribe and cut panels to fit accurately at borders and at penetrations.

F. Install hold-down clips in areas indicated, and in areas where required by governing regulations or for fire resistance ratings; space as recommended by panel manufacturer, unless otherwise indicated or required.

3.03 ADJUST AND CLEAN

A. Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members; comply with manufacturer's instructions for cleaning and touch-up of minor finish damage.

B. Remove and replace work which cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

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SUBMITTAL CHECKLIST

1. Product Data.
2. Samples.

END OF SECTION 09 5113

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SECTION 09 6519 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Section Includes:

1. Rubber Base.
2. Resilient flooring accessories.

B. Furnish labor, materials, equipment, special tools, supervision and services required for floor preparation for tile installation.

C. Furnish labor, materials, equipment, special tools, supervision and services required to install the products and systems complete as shown on the Drawings and/or specified herein.

1.2 SUBMITTALS

A. Manufacturer’s Literature:

1. Manufacturer's product data and descriptive literature.
2. Manufacturer's installation instructions.
3. Manufacturer's maintenance instructions.
4. Material safety data sheets.

B. Samples:

1. Base:
   a. Full size sections of colors as specified on drawings. Color charts alone are not acceptable.
   b. If color is not specified, submit samples of manufacturer's entire selection.

1.3 DELIVERY, STORAGE AND HANDLING

A. Receive all products and materials as packaged by the manufacturer with manufacturer's seals and labels intact. Store materials at the job site within the building and in a dry place at least 48 hours before installing flooring materials.

B. Store in space with temperature maintained between 65 degrees F and 90 degrees F.

1.4 MAINTENANCE MATERIALS AND DATA

A. See Specification Section 01 7846 - Closeout Maintenance Materials.

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B. Submit maintenance data under provisions of Section 01 7800 - Closeout Submittals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide products, as approved by the Architect, from one of the following approved manufacturers:

1. Rubber Base:
   a. “Tarkett".

2. Resilient Accessories
   a. “Tarkett”

2.2 MATERIALS

A. Rubber Base:

1. FS SS-W-40A, Type I, TP rubber.
2. Meets ASTM F-1860, Group 1.
3. 1/8" thickness, 120' rolls, coved, set-on type.
4. 4" high unless otherwise shown.
5. Color: as shown on Drawings.

B. Rubber Base Adhesive:

1. Comply with recommendations of rubber base manufacturer.

C. Concrete Slab Primers and Sealers:

1. Where existing substrate is unacceptable for adhesion or bonding of new materials: Provide primers and sealers as required by flooring manufacturer to achieve the proper substrate conditions for installation of flooring.
2. Scarify, shot-blast, or sand-blast floor as required at no change in bid price.

D. Leveling Compound:

1. Latex type as recommended by flooring manufacturer.

E. Subfloor Leveler System:

1. Equal to: “Tarkett”, Subfloor Leveler System.
2. Resilient PVC gradual sloping ramped wedged materials.
3. Provide slope, profile, and lengths as required for specific condition.

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PART 3 - EXECUTION

3.1 PREPARATION

A. Spaces shall be at a minimum temperature of 70 degrees F. Temperature shall be maintained during and 48 hours after installation.

B. Surfaces shall meet the minimum requirements of the manufacturer of the flooring. Do not install directly over plywood. Provide luan underlayment over all plywood decks. Commencement of installation of materials constitutes acceptance of the substrates.

C. Work shall not be started until all items penetrating the flooring have been installed.

D. No flooring shall be installed until the installer has ascertained that the chemical treatment of substrates will not interfere with the successful application of the flooring materials.

E. Spaces in which resilient flooring is being installed shall be closed to traffic or other work.

F. When solvent-based adhesives are used, the space shall be ventilated; use spark proof fans if natural ventilation is inadequate. Prohibit all smoking.

G. Before installing flooring, test concrete floor for excessive moisture by taping an 18" x 18" mat of rubber or vinyl sheet material to floor at edges with masking tape. If condensation is apparent on the underside of the sheet after 24 hours, do not install flooring.

H. Before installing flooring, fill all cracks and holes and level depressions with underlayment compound. Surfaces shall not vary more than 1/8" in 10' in any dimension.

I. Before installing flooring, test concrete floor for acceptable adhesion and bonding of new materials atop substrate. If proper adhesion and bonding are not apparent, do not install flooring until sealer and primer are applied. Scarify, shot-blast, or sandblast floor if required to install sealer/primer.

3.2 INSTALLATION

A. Install flooring and products in accordance with the manufacturer's recommendations.

B. Apply all concrete slab primers and sealers as required to achieve an acceptable substrate for installation of flooring per flooring manufacturer's requirements. Apply when areas are ready or scheduled to receive flooring without delays to the project or schedule, and without any additional costs or change in time. If floor is required to be sandblasted, shot-blasted, scarified, or otherwise prepared, perform this work at no additional cost or change in time. This includes, but is not limited to, floor slabs which are not acceptable due to excessive moisture content.

C. Install subfloor leveler at all doors and openings as required so as to maintain a smooth, flat, and true transition between these flooring materials and adjacent flooring materials.

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D. Mix and apply adhesive as recommended by the manufacturer. Lay flooring so that fields or patterns center on areas. Adjust pattern so that edge pieces shall not be less than 1/2 size. Lay flooring true to line, level, and with tight joints. Cut flooring to and around all permanent cabinets and bases. Roll flooring to assure contact and proper adhesion to substrate.

E. Apply wall base to walls, columns, pilasters, casework, and other permanent fixtures in rooms or areas where base is required. Install base in lengths as long as practicable with continuous wrapping outside corners, and miter cut inside corners. Do not use preformed corner pieces.

F. Remove excessive adhesive in accordance with flooring manufacturer's instructions.

G. Install edge strips at termination of flooring where substrate is exposed and extends beyond.

H. Install edge strips at doors, openings, and any and all other junctions of this flooring and adjacent flooring materials. Firmly anchor strips to subfloor with adhesive. Make transition in floor finish at centerline of door bottom or opening through wall.

I. After installation, maintain a minimum space temperature of 55 degrees F.

3.3 RUBBER BASE CLEANING

A. Not less than 4 days after flooring installation, clean all rubber base. Wash thoroughly, with a cleaner recommended by the flooring manufacturer, in accordance with flooring manufacturer's recommendations.

END OF SECTION 09 6519

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SECTION 09 6716 – DECORATIVE EPOXY FLAKE FLOOR COATING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Resinous flooring: Abrasion, impact and chemical resistant, decorative aggregate-filled epoxy-resin-based monolithic floor surfacing designed to produce a seamless floor.

B. Extent of decorative epoxy flake floor coating is indicated on Drawings and specified herein.

1.2 QUALITY ASSURANCE

A. Installer: A firm familiar with work with not less than five years of experience in installing products similar to those required for this project.

B. Deliver materials to project site in original packages or containers clearly labeled to identify manufacturer, brand name, quality or grade and fire hazard classification.

C. Store materials in original undamaged packages or containers. Maintain temperature in storage area above 40°F. Store per manufacturer’s recommendations.

D. Illuminate areas of installation using building's permanent lighting system; temporary lighting alone will not be acceptable.

1.3 SUBMITTALS

A. Product Data:

1. Manufacturer's product data sheets, cutsheets, specifications, materials description, installation and maintenance instructions.
2. Materials Safety and Data Sheets (MSDS).

B. Samples:

1. Actual samples of all colors and finishes.
2. Colors and finishes to be selected by Architect from manufacturer's entire selection.

C. Mock-Up Panel:

1. Construct on site, sample panels, 4 foot x 4 foot minimum in size.
2. Concrete shall be cured at least 28 days prior to application of the stain, so multiple panel slabs should be cast at the same time to allow for multiple samples opportunities in timeframe required.
3. Panel to be a concrete slab apart from any concrete areas associated within the project.

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4. Show proposed color, range, texture, and workmanship of floor coating application, including sealer, to demonstrate the finished product.
5. Do not proceed with floor coating work until sample panel has been approved by the Architect.
6. If deemed unacceptable by the Architect, create another panel to correct items of unacceptability. Continue process until and approved panel has been achieved.
7. Once an approved panel has been achieved, use panel as standard of comparison for all stain work.
8. Do not destroy or remove panel until all stain work is complete and accepted.

PART 2 - PRODUCTS

2.1 Decorative Epoxy Coating

A. Basis of Specification:

1. “Sherwin-Williams/General Polymers”; Resuflor Deco Flake BC Coating System.
   a. Primer: "Sherwin-Williams", Resuprime “3579”, Epoxy Primer and Binder Parts A & B. Color to be selected by Architect. Rate of Application: 200-300 SF/ gallon.
   b. Base Coat: "Sherwin-Williams", “3746” Resuflor High Performance Epoxy base coat.* Blastrac pattern shall be completely hidden by second coat. Additional coats as required by Architect to achieve desired and intended result to hide below. Rate of Application: 200-300 SF/ gallon.
   c. Broadcast: Decorative Flakes 6750 or 6755 to excess at 100-200 lbs.per 1,000 square feet. * Apply decorative broadcast paint flake over second coat while still tacky and not completely cured.
   d. Grout Coat: "Sherwin-Williams", “3746” Resuflor High Performance Epoxy grout coat. Rate of Application: 160-250 SF/ gallon. Seal Coat: “Sherwin Williams”, “4686” Resutile seal coat. Rate of Application: 250-400 SF/ gallon.

B. Color:

1. Coating and decorative flake colors as selected by Architect from manufacturer’s entire selection.

C. Finish:

1. High-Gloss finish.
2. Withstand heavy industrial traffic, abrasion, and general chemical attack.

D. Additives, Primers and Sealers:

1. None permitted.
2. Concrete Kure-N-Seal product not permitted in areas to receive concrete floor coating.
3. The use of Quick-Kick Epoxy Accelerator is not permitted in areas to receive concrete floor coating.

E. Concrete Slab Primers and Sealers:

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1. Where existing substrate is unacceptable for adhesion or bonding of new materials: Provide primers and sealers as required by flooring manufacturer to achieve the proper substrate conditions for installation of flooring.
2. Scarify, shot-blast, or sand-blast floor as required within the bid price scope of work.

F. Slip-Resistant Additive:

1. "Sherwin-Williams"; "General Polymers 5190, Fine finish".
2. "Sherwin-Williams"; "General Polymers 5191, Coarse finish".
3. Small granular particles for addition to finish coats and topcoats during the mixing process and applied with the coating material, encapsulated by the resin system.
4. Results in increased slip resistance, skid-inhibiting surface profile, granulized surface texturing, and gloss reduction.
5. Rate of mixture and application is to be in strict accordance with the manufacturer's published instructions and recommendations.

PART 3 - EXECUTION

3.1 PREPARATION

A. Ensure floor surfaces are clean, dry, sound, and fully cured. Remove all form release agents, curing compounds, salts, efflorescence, laitance, oil, dust, grease, dirt, loose rust, and other foreign material to ensure adequate adhesion.

B. Consult manufacturer's recommendation for substrate prep and cleaning.

C. Test floor for vapor drive in accordance with ASTM D 4263 and per manufacturer's recommendations.

D. Blastrac entire floor surface to receive specified floor coatings. Required finished profile of CSP1-3 prior to any coating taking place.

E. Repair concrete imperfections, apply crack fillers, and install joint sealants as required and as compatible with floor coating products.

F. Clean all surfaces of oil, grease, or other bond-inhibiting materials per manufacturer's recommendations.

G. Surfaces must be clean, dry, sound and offer sufficient profile to achieve adequate adhesion. Remove all form release agents, curing compounds, salts, efflorescence, laitance, and other foreign matter by sandblasting, shotblasting, mechanical scarification. Perform this work at no additional cost or change in time. Rinse thoroughly to achieve a final pH as specified by the manufacturer and allow to dry thoroughly prior to coating.

3.2 INSTALLATION

A. Install according to manufacturer's instructions and recommendations.

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B. Apply first finish coat at rate specified above. Apply second finish coat at rate specified above when first coat is dry, no sooner than 12 hours after completing first coat, but no more than 48 hours.

C. Utilize spike shoes to apply decorative broadcast flakes over concrete coating. Apply flakes as double broadcast to achieve complete coverage of Epoxy Floor Coating.

D. Remain off of floor surface until completely dried.

E. Approval required by Architect of Finish coats of epoxy floor coating prior to applying Urethane Top Coat.

3.3 ADJUST AND CLEAN

A. Assure finish is uniform and consistent.

B. Replace removed plates and covers on floors.

C. Remove surplus materials, rubbish, and debris resulting from installation upon completion of work, and leave areas of installation in neat, clean condition.

D. Clean surface of all debris. Sweep and mop to a smooth, clean appearance.

E. Improper installation or improper use of products will result in the final floor coating to have an undesirable result. If the final surfacing is deemed unacceptable by the Architect, the entire system is to be removed completely, and the substrate properly re-prepped. The system is to be reapplied to an acceptable final result. All costs associated with this procedure are to be at the expense of the contractor with no additional costs to the Owner. The level of acceptability is at the sole discretion of the Architect.

SUBMITTAL CHECK LIST

1. Material Samples.
2. Manufacturer’s Literature.
3. Material Safety and Data Sheets.
4. Mock-up panel.

END OF SECTION 09 6716

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SECTION 09 6800 - CARPETING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish labor, materials, equipment, special tools, supervision and services required for floor preparation for carpet installation.

B. Furnish labor, materials, equipment, special tools, supervision and services required to manufacture, deliver and install all carpet indicated, noted and detailed on the Drawings and as specified herein.

1.2 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer who can demonstrate successful experience with installations on projects of similar size and scope to this project.

B. Requirements and Regulatory Agencies:

1. Provide carpet and padding which meets the following requirements.
   a. Flame Spread: ASTM E84, 75 or less.
   b. Radiant Panel Test: ASTM E648, .45 watts/CM2, or more.
   c. Smoke Density Test: ASTM E662, 450 or less.
   d. Pill Test: DOC FF-1-70, pass.
   e. Meet local Fire Marshal's requirements.

1.3 SUBMITTALS

A. Samples:

1. Where colors are specified, submit one full size sample of each color specified.
2. Where colors are not specified or are specified as "to be selected", submit samples showing manufacturer's full range of standard colors for each type of carpet. Submit additional or larger samples of selected colors upon request.

B. Shop Drawings and Manufacturer's Literature:

1. Seaming diagram indicating:
   a. Pattern direction.
   b. Location of seams.
   c. Location of edge strips.
   d. Dimensions of carpeted areas.

C. Independent Testing Laboratory Test Reports:

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1. Fire hazard classifications.
2. Static control.
3. Construction.

D. Certificates:

1. Manufacturer's certification that rolls furnished were manufactured in accordance with specification requirements, stating yarn and weight, backing and weight and average tuft bind.
2. Installer's list of comparable installations

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver:

1. Deliver carpet in original mill wrappings with register number tabs attached or stenciled on bale.
2. Do not deliver materials until installation is ready to begin.

B. Storage:

1. Store materials in dry, well ventilated space.
2. Do not store carpet rolls on end.

C. Handling:

1. Handle to protect from dirt and stains.

1.5 GUARANTEE / WARRANTY

A. Warrant the following items for the lifetime of the carpet face:

1. Wear: Not abrasively wear more than 10% face yarn weight under normal use.
2. Static Electricity: Maintain specified levels of static electricity generation.
3. Edge ravel: Will not occur under normal use.
4. Delamination: Will not occur under normal use.
5. Tuft Bind: Average face year tuft bind of 20 lbs.; will not zipper, wet or dry.

B. Adjustment:

1. During project guarantee period and within 15 days written notice from Owner or Architect, repair seams, edges and any other irregularity.

1.6 MAINTENANCE MATERIALS AND DATA

A. See Specification Section 01 7846 - Closeout Maintenance Materials.

B. Submit maintenance data under provisions of Section 01 7800 - Closeout Submittals.

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PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide products, as approved by the Architect, from one of the following approved manufacturers:

1. "Interface."
2. “Tarkett.”
3. “J&J Flooring.”

2.2 CARPET

A. Type:

1. Modular Carpet Tile products as indicated on the Drawings.
2. Colors and patterns as indicated on the Drawings. If not indicated, colors and patterns are to be selected by Architect from manufacturer's entire selection for the specific carpet family specified.

B. Static Electricity Generation (all carpet):

1. Control Fiber: Stainless steel, aluminum, copper, or other metal, blended with carpet fiber, or by specific fiber blend.
2. Maximum 3,000 volts at 20% relative humidity and 70°F temperature, AATCC-134-75.

2.3 INSTALLATION MATERIALS

A. Adhesive:

1. Carpet Adhesive:
   a. Per carpet manufacturer for substrate and warranty requirements.
   b. Nonflammable.

2. Seam Adhesive:
   a. Latex base per carpet manufacturer.

B. Concrete Slab Primers and Sealers:

1. Where existing substrate is unacceptable for adhesion or bonding of new materials: Provide primers and sealers as required by flooring manufacturer to achieve the proper substrate conditions for installation of flooring.

C. Subfloor Leveler System:

1. Equal to: “Johnsonite”, Subfloor Leveler System.
2. Resilient PVC gradual sloping ramped wedged materials.
3. Provide slope, profile, and lengths as required for specific condition.

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D. Edge Strips (direct glue-down installation):

1. Extruded, anodized aluminum bar reducer at exposed edges.
2. Undercut, flanged.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examination: Examine surfaces scheduled to receive carpeting for:

1. Defects that will adversely affect the execution and quality of work.
2. Deviation beyond allowable tolerances for carpet installation over concrete as indicated in Section 03 3000.

B. Conditions of Surfaces:

1. Do not install carpet over concrete substrate until concrete has cured minimum of 30 days.
2. Check floor moisture content. Seal inverted glass tumbler to floor with putty. If condensation forms in 48 hours, do not install carpet.
3. Do not start until unsatisfactory conditions are corrected.
4. Install carpeting prior to installation of movable partitions and electrical floor outlets.

C. Prime floor slab as recommended by manufacturer.

D. Apply all concrete slab primers and sealers as required to achieve an acceptable substrate for installation of flooring per flooring manufacturer's requirements. Apply when areas are ready or scheduled to receive flooring without delays to the project or schedule, and without any additional costs or change in time. If floor is required to be sandblasted, shot-blasted, scarified, or otherwise prepared, perform this work at no additional cost or change in time. This includes, but is not limited to, floor slabs which are not acceptable due to excessive moisture content.

3.2 INSTALLATION OF DIRECT GLUE DOWN CARPET

A. Install carpet in accordance with submitted seam diagram, and manufacturer’s instructions.

B. Fit carpet neatly into breaks and recesses, against bases, around pipes and penetrations, under saddles and thresholds, and around permanent cabinets and equipment.

C. Seaming (seams shall be invisible):

1. Cement seams.
2. Trim length seams.
3. Coat cut edges with seam adhesive.
4. Layout length of rolls so cross seams do not occur at conspicuous locations, near doors or pivot points.

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5. Do not place seams perpendicular to doors or entries.
6. Center seams at doors directly under door.
7. Where seams occur at corridor change of direction, follow wall parallel to carpet direction.
8. Bond all seams at warp line.

D. Application of Adhesive:

1. Mix and apply adhesives in accord with manufacturer's instructions.
2. Do not soil walls, bases, or adjacent areas with adhesive.
3. Promptly remove any spillage.
4. Apply contact or seam adhesive 6 inches wide along carpet edges abutting walls and at cross-seams.

E. Roll carpet to remove air bubbles and insure bond.

F. Install carpeting wall to wall, under all moveable casework and cabinets, under all open counter areas, and up to fixed equipment and casework.

3.3 ADJUST AND CLEAN

A. Cleaning:

1. Remove spots and smears of cement from carpet immediately with solvent or adhesive remover.
2. Remove rubbish, wrapping paper, salvages and scraps less than 2 square feet or less than 8 inches in any dimensions.
3. Upon completion, vacuum with a commercial beater bar type vacuum cleaner.

B. Protection:

1. After each area of carpet has been installed, protect from soiling and damage.
2. The use of tape to hold down floor protection is prohibited.
3. The use of adhesive film floor protection is prohibited.

SUBMITTAL CHECKLIST

1. Samples.
2. Seaming Diagram.
3. Testing Laboratory Reports.
4. Certificate of Manufacturer's Compliance.

END OF SECTION 09 6800

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SECTION 09 9000 - PAINTING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Extent of painting work as indicated on the Drawings and specified herein including, but not limited to:

1. Surface Inspection and Preparation.
2. Paint System Schedule - Exterior Paint Systems.
3. Paint System Schedule - Interior Paint Systems.

B. Additional requirements of the work are to include:

1. Painting and finishing of all interior and exterior items and surfaces throughout the project, except as otherwise indicated. Surface preparation, priming and costs of paint specified are in addition to shop-priming and surface treatment specified under other sections of work.
2. Field painting of exposed steel and ironwork, and primed metal surfaces of equipment installed under mechanical and electrical, except as otherwise indicated.
3. Field painting of all exposed interior and exterior structural steel components, whether indicated or not on the Drawings. Includes painting of galvanized components unless noted otherwise.
4. Painting of exposed mechanical, electrical equipment items as indicated on the Drawings.
5. Paint exposed surfaces except where natural finish of material is specifically noted as a surface not to be painted. Where items or surfaces are not specifically mentioned, paint same as adjacent similar materials or areas.
6. "Paint" as used herein generally refers to all coating systems material, including primers, emulsions, enamels, stains, sealers, fillers, and other applied materials whether used as prime, intermediate or finish coat.
7. Painting and finishing of all EXISTING interior and exterior items and surfaces throughout the project, whether they are or are not currently finished, except as otherwise indicated.

1.2 RELATED WORK

A. Following categories of work are NOT included as part of field-applied finish work specified herein, or are included in other sections of the specifications:

1. Shop Priming:
   a. Unless otherwise specified, shop priming of ferrous metal items is included under various sections for structural steel, miscellaneous metal, and shop-fabricated or factory-built mechanical and electrical equipment or accessories.

2. Pre-Finished Items:
   a. Unless otherwise indicated, do not include painting when factory-finishing or installer finishing is specified for such items including, but not limited to, pre-finished aluminum panels, finished mechanical and electrical equipment, light fixtures, switchgear, distribution cabinets, etc.

3. Concealed Surfaces:

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a. Unless otherwise indicated, painting is not required on surfaces in concealed areas and generally inaccessible areas, such as interstitial spaces; however, doors and door frames in these spaces shall be painted.

4. 4. Finished Metal Surfaces:
   a. Metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze and similar finished materials will not require finish painting, unless otherwise indicated.

B. Following areas are to be included as special considerations of areas to NOT receive paint:

1. Operating parts and labels, moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, unless otherwise indicated.
2. Any code-required labels, such as Underwriter's Laboratories and Factory Mutual, or any equipment identification, performance rating, name or nomenclature plates.

1.3 SUBMITTALS

A. Product Data:

1. Manufacturer's published product data sheets, specifications, materials description and technical information.
2. Manufacturer's published installation and application instructions.
3. Materials Safety and Data Sheets (MSDS).

B. Samples and Draw Downs:

1. If colors and finishes are indicated, submit samples boards (draw downs) for each as selected.
2. If colors are not indicated, they will be selected by the Architect from manufacturer's entire selection. Submit complete range of available paint colors, either in the form of a fan set or individual color chips box set.
3. If finishes are not indicated, they will be selected by the Architect from manufacturer's entire selection.
4. Once colors and finishes have been chosen, submit samples boards for each color selected.
5. Sample boards to be 8-1/2 inch x 11 inch cardstock, painted with actual product of color and finish as selected by the Architect. Submit three (3) of each color as selected.
   Stain samples to be 6 inch x 6 inch minimum on wood specifies and cut as specified. Submit three (3) of each color as selected.

C. Mock-Ups:

1. Paint on site, a test sample area of wall, 2 foot x 2 foot minimum in size. Complete test area for each color selected, for each paint system specified, and per each substrate material included, as directed by the Architect.
2. Paint one (1) hollow metal door and frame complete, as directed by Architect.
3. Stain one (1) wood door complete, as directed by Architect.
4. Mock-ups shall indicate color, texture and finish.
5. Do not proceed with paint work until mock-ups have been approved by the Architect.
6. If deemed unacceptable by the Architect, create another mock-up to correct items of unacceptability. Continue process until an approved mock-up has been achieved.

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7. Once an approved mock-up has been achieved, use as a standard of comparison for all work.
8. Do not destroy or remove mock-up until all paint work is complete and accepted.
9. Accepted mock-ups may remain as part of the work or discarded, at the discretion of the Architect.

D. Compatibility Tests:

1. Paint on site, (2) 2 foot x 2 foot minimum test sample areas of each existing and/or previously painted surface to receive new painted finish atop. Complete test area for each color selected, for each paint system specified, per each existing color of existing surface, and per each substrate material included, as directed by the Architect.
2. Check for compatibility by applying the test sample of the recommended coating system as stated. Allow to dry for one week prior to testing adhesion per procedures of ASTM D3359.
3. Test sample areas are to be completed by the installing contractor, reviewed and checked on site by the paint manufacturer's representative. If non-compatibility issues exist, the paint manufacturer shall provide recommendations and solutions to compatibility and/or alterations to the paint system specified.
4. Submit all test results and manufacturer's approval in writing to the Architect. Painting manufacturer must certify that they approve the test results and will include the longevity and performance of the paint system in their warranty and guarantees of the paint system.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to job site in original, new, sealed and unopened packages and containers bearing manufacturer's name and product label.

B. Store and protect products in strict accordance with manufacturer's recommendations and requirements.

C. Provide physical properties of each product to be used on the project, including:

1. Weight per gallon.
2. Solids by weight.
3. Solids by volume.
4. V.O.C. as supplied.

D. Container labeling to include:

1. Date of manufacture.
2. Manufacturer's name.
3. Product name, type and stock number.
4. Color and finish.
5. Rate of coverage.
6. Application instructions for surface preparation, drying time, cleanup, mixing and reducing.

E. Store paint materials at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in well ventilated area, unless required otherwise by manufacturer's instructions.

F. Take precautionary measures to prevent fire hazards and spontaneous combustion.

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1.5 ENVIRONMENTAL REQUIREMENTS

A. Provide continuous ventilation and heating facilities to maintain surface and ambient temperatures above 50 degrees F for twenty-four (24) hours before, during and forty-eight (48) hours after application of finishes, unless required otherwise by manufacturer's instructions.

B. Do not apply exterior coatings during rain or snow, or when relative humidity is above 50 percent, unless required otherwise by manufacturer's instructions.

C. Minimum Application Temperatures for Latex Paint: 50 degrees F for exterior, unless required otherwise by manufacturer's instructions.

D. Minimum Application Temperatures for Varnish Finishes: 65 degrees F for interior and exterior, unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 foot candles measured mid-height at substrate surface.

1.6 PROJECT CONDITIONS

A. Apply water-base paints only when temperature of surfaces to be painted and surrounding ambient air temperatures are between 60 degrees F and 85 degrees F, for at least 72 hours prior to beginning of installation, unless otherwise permitted by paint manufacturer's printed instructions.

B. Apply solvent-thinned paints only when temperature of surfaces to be painted and surrounding ambient air temperatures are between 45 degrees F and 95 degrees F, for at least 72 hours prior to beginning of installation, unless otherwise permitted by paint manufacturer's printed instructions.

C. Maintain proper ambient air temperatures throughout entire timeframe of installation and cure period.

D. Do not install until space is enclosed, weathertight, and ambient conditions are controlled and stabilized.

E. Do not apply in snow, rain, fog or mist; or when relative humidity exceeds 85%; or on damp or wet surfaces.

F. Provide adequate ventilation at all times for proper drying.

1.7 MAINTENANCE MATERIALS AND DATA

A. See Specification Section 01 7846 - Closeout Maintenance Materials.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide products, as approved by the Architect, from one of the following approved manufacturers:

1. "The Sherwin-Williams Company" (S-W).

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2.2 MATERIALS

A. Quality:

1. Provide best quality grade of various types of coatings as regularly manufactured by acceptable paint materials manufacturers.
2. Materials not displaying manufacturer's identification as a standard, "top-of-the-line" product will not be acceptable.

B. Compatibility:

1. Provide finish coats which are compatible with prime paints used.
2. Review other sections of these specifications in which prime paints or factory coats are to be provided to insure compatibility of total coatings systems for various substrates.
3. Upon request from other trades, furnish information on characteristics of finish materials proposed for use, to insure compatible prime coats are used.
4. Provide barrier coats over incompatible primers or remove and re-prime as required.
5. Provide undercoat paint produced by same manufacturer as finish coats. Where undercoats specified are not considered by the paint manufacturer to be fully compatible with the finish coat, submit recommended undercoat substitution to Architect for acceptance. No additional cost to the Owner will be considered for such a change.
6. Use only thinners approved by the paint manufacturer, and use only within recommended limits.
7. Notify the Architect in writing of any anticipated problems during bidding with the use of specified coating systems with substrates primed by others.

C. Coatings and Pigments:

1. To be pure, non-fading, applicable types to suit substrates and service expectations indicated.
2. Ready mixed, except field catalyzed coating.
3. Pigments processed to a soft paste consistency, capable of being readily and uniformly dispersed to as a homogeneous coating.
4. Good flow and brushing properties; capable of drying or curing free of streaks or sags.

D. Accessory Materials:

1. All materials, such as linseed oil, shellac, turpentine, paint thinners, and other materials not specifically indicated but required to achieve the finishes specified.
2. All of commercial quality.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine surfaces scheduled to be finished prior to commencement of work.

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1. Report any conditions that may potentially affect proper application.
2. Verify that surfaces and substrate conditions are ready to receive work as instructed by the product manufacturer.
3. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of a durable paint film or proper adhesion required.

C. Beginning of installation equates to acceptance of the substrate by the contractor.

3.2 PREPARATION - GENERAL

A. Perform preparation and cleaning procedures in accordance with paint manufacturer's instructions and as herein specified, for each particular substrate condition.

1. Clean surfaces to be painted before applying paint or surface treatments.
2. Remove oil and grease prior to mechanical cleaning.
3. Program cleaning and painting so that contaminants from cleaning process will not fall onto wet, newly painted surfaces.

B. Provide all scaffolding and staging required for work in this Section.

1. Coordinate locations to eliminate interference with work of others.

C. Remove hardware, hardware accessories, machined surfaces, electrical plates, lighting fixtures, trim, clocks, speakers, devices, fittings and similar items which are not to be finish-painted, prior to preparing surfaces or finishing.

D. Provide surface-applied protection prior to surface preparation and painting operations for all adjacent areas, surfaces, or items to remain.

E. Correct minor defects and clean surfaces which affect work of this Section.

F. Shellac and seal marks which may bleed through surface finishes.

3.3 MATERIALS PREPARATION

A. Mix and prepare painting materials in accordance with manufacturer's directions.

B. Store materials not in actual use in tightly covered containers. Maintain containers used in storage, mixing and application of paint in a clean condition, free of foreign materials and residue.

3.4 SURFACE PREPARATION

A. Uncoated Steel and Iron Surfaces:

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1. Clean ferrous surfaces, which are not galvanized or shop coated, of oil, grease, dirt, loose mill scale and other foreign substances by solvent or mechanical cleaning.
2. Where heaving coatings of scale are evident, remove by wire brushing or sandblasting; clean by washing with solvent.
3. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned.

B. Shop Primed Steel Surfaces:

1. Sand and scrape to remove loose primer and rust.
2. Feather edges to make touch-up patches inconspicuous.
3. Clean surfaces with solvent.
4. Prime bare steel surfaces.
5. Touch-up shop-applied prime coats wherever damaged or bare, and where required by other sections of these specifications. Clean and touch-up with same type shop primer.

C. Gypsum Board Surfaces:

1. Latex fill minor defects.

D. Wood Doors, Metal Doors and Metal Frames:

1. Apply one coat of paint to glazing stops and rabbets prior to glazing.

E. Previously Coated Surfaces:

1. Maintenance painting will frequently not permit or require complete removal of all old coatings prior to repainting. However, all surface contamination such as oil, grease, loose paint, mill scale, dirt, foreign matter, rust, mold, mildew, mortar, efflorescence and sealers must be removed to assure sound bonding to the tightly adhering old paint.
2. Feather edges of existing coating to make touch-up patches inconspicuous.
3. Glossy surfaces of old paint films must be clean and dull before repainting. Accomplish by sanding or thoroughly washing with an abrasive cleanser.
4. Spot prime any bare areas with an appropriate primer.
5. Provide compatibility tests per submittal requirements herein.
6. If the coating proves incompatible, complete removal is required.

F. Hand Tool Cleaning:

1. Hand tool cleaning removes all loose mill scale, loose rust, and other detrimental foreign matter. It is not intended that adherent mill scale, rust and paint be removed by this process.
2. Mill scale, rust and paint are considered adherent if they cannot be removed by lifting with a dull putty knife.
3. Prior to hand tool cleaning, remove visible oil, grease, soluble residues and salts by the methods outlined in the “Steel Structures Paint Council Surface Preparation Specification No. 2 (SSPC-SP1 and SSPC-SP2).

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3.5 PROTECTION

A. Protect elements surrounding the work of this Section from damage or disfiguration.

B. Repair damage to other surfaces caused by work of this Section.

C. Furnish drop cloths, shields, and protective methods to prevent spray or droppings from disfiguring other surfaces.

D. Remove empty paint containers from site.

3.6 APPLICATION

A. General:

1. Apply paint and coatings in strict accordance with manufacturer's published directions.
2. Apply all coatings at manufacturer’s recommended spreading rates per coat to provide finished wet mil and dry mil coverage per coat between the minimum and maximum microns indicated.
3. Apply additional coats when undercoats, stains or other conditions show through final coat of paint, until paint film is of uniform finish, color and appearance. Give special attention to insure that surfaces, including edges, corners, crevices, welds and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces. Paint surfaces behind movable equipment same as similar exposed surfaces.
4. Paint back sides of access panels, and removable or hinged covers to match exposed surfaces.
5. Sand lightly between each succeeding enamel or varnish coat.
6. Omit first coat (primer) on metal surfaces which have been shop-primed and touch-up painted, unless otherwise indicated.

B. Scheduling Painting:

1. Apply first-coat material to surfaces that have been cleaned, pretreated or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
2. Allow sufficient time between successive coatings to permit proper drying.
3. Do not apply finishes to surfaces that are not dry.

C. Technique:

1. Apply each coat to uniform finish.
2. Apply each coat of paint slightly darker than preceding coat, unless otherwise approved.
3. Sand lightly between coats to achieve required finish.
4. Allow applied coat to dry before next coat is applied.

D. Apply paint as recommended by the manufacturer and as approved by the Architect:

1. Apply final coat to concrete, masonry and smooth finished wall and ceiling surfaces with roller.
2. Apply paint to exposed ceiling surfaces and in inaccessible areas by spraying.
3. Do not use spray application on other areas without written approval of Architect.
4. Apply materials at not less than manufacturer's recommended spreading rate, to establish a total dry film thickness as indicated or if not indicated, as recommended by coating manufacturer.

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E. Draw lines of demarcation between different shades or colors to eliminate blurred edges.

F. Back-prime all surfaces of interior and exterior wood blocking and woodwork, except pressure treated wood, with one coat of aluminum paint.

G. Prime back surfaces of interior woodwork scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with mineral spirits.

H. Where clear finishes are required, tint fillers to match wood.

1. Work fillers into the grain before set.
2. Wipe excess from surface.

I. Coat steel items that come in contact with aluminum items with a field coat of bituminous paint.

J. Mechanical and Electrical Work:

1. Painting of mechanical and electrical work is limited to those items exposed in finished occupied spaces.
2. Mechanical items to be painted include, but are not limited to, ducts, diffusers, piping, pipe hangers, supports and accessory items.
3. Electrical items to be painted include, but are not limited to, the following:
    a. Conduit and fittings (In finished areas only, unless otherwise indicated).
    b. Switchgear (In Finished areas only, unless otherwise indicated).

K. Paint all exposed ceiling construction, including joists, structural members, metal deck and all exposed conduit, pipes, pipe covering and ductwork in these ceiling areas.

L. Seal, stain and varnish concealed and semi-concealed surfaces of millwork items.

1. Seal internal surfaces of millwork items with two coats of shellac.
2. Brush apply only.

M. Prime Coats:

1. Apply prime coat of material which is required to be painted or finished, and which has not been prime coated by others.
2. Re-coat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.

N. Pigmented (Opaque) Finishes:

1. Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance and coverage.
2. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness or other surface imperfections will not be acceptable.

O. Completed Work:

1. Match approved samples for color, texture and coverage.

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2. Remove, refinish or repaint work not in compliance with specified requirements.

P. Renovation and Patching Areas:

1. Prepare and prime new construction portions of surfaces per specifications
2. Prepare existing surfaces located in the same plane as renovation or patching per specifications.
3. Paint area of renovation and patching entire surface full height, from “floor-to-ceiling” and from "corner-to-corner".

3.7 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

A. Paint shop primed equipment.

B. Touch up marred or damaged shop prefinished items.

C. Remove unfinished louvers, grilles, covers and access panels on mechanical and electrical components and paint separately.

D. Replace identification markings on mechanical or electrical equipment when painted accidentally.

E. Paint interior surfaces of air ducts and convector and heating cabinets that are visible through grilles and louvers with one coat of flat black paint, to limit sight line.

1. Paint dampers exposed behind louvers, grilles, and convector and heating to match face panels.

F. Paint exposed conduit and electrical equipment occurring in finished areas.

G. Paint both sides and all edges of plywood backboards for electrical and telephone equipment with one coat of light to medium gray paint before installation of equipment.

H. Reinstall electrical plates, hardware, light fixture trim, clocks, speakers and fittings removed prior to finishing.

I. Paint all equipment located on roofs, including aluminum exhaust fans, gravity relief vents, appliance exhausts and all equipment unless factory finish is acceptable to Architect.

J. Refer to Division 23 and Division 26 for schedule of color coding and identification banding of equipment, ductwork, piping and conduit.

3.8 CLEANING AND PROTECTION

A. As work proceeds, promptly remove paint where spilled, splashed or spattered.

B. During progress of work maintain premises free of unnecessary accumulation of tools, equipment, surplus material and debris.

C. Collect cotton waste, cloths and material which may constitute a fire hazard, place in closed metal containers and remove daily from site.

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D. During progress of work remove from site discarded paint materials, rubbish, cans and rags at end of each work day. **DISPOSE OF ALL MATERIALS IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL REGULATIONS.**

E. Upon completion of painting work, clean window glass and other paint-spattered surfaces.

F. Protection:

1. Protect work of other trades, whether to be painted or not, against damage by painting and finishing work. Correct any damage by cleaning, repairing or replacing, and repainting.
2. Provide "Wet Paint" signs as required to protect newly-painted finishes. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations.
3. At the completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces.

3.9 PAINT SYSTEM SCHEDULE - EXTERIOR PAINT SYSTEMS

A. STEEL, UNPRIMED (exterior, new construction, painted finish):

1. 1st Coat - Rust-Inhibitive Metal Primer
   a. "S-W, Kem Bond HS, Universal Metal Primer"
   b. *Color selected as most appropriate beneath finish topcoats.

2. 2nd Coat - Urethane Alkyd Topcoat
   a. "S-W, Industrial Urethane Alkyd Enamel, B54-150 Series, Gloss"

3. 3rd Coat - Urethane Alkyd Topcoat
   a. "S-W, Industrial Urethane Alkyd Enamel, B54-150 Series, Gloss"
   b. *Not less than 3.0 mils dry film thickness.

B. STEEL, SHOP PRIMED (exterior, new construction, painted finish):

1. Touch-Up - Rust-Inhibitive Metal Primer
   a. "S-W, Kem Bond HS, Universal Metal Primer"
   b. *May use original primer if available.
   c. *Color selected as most appropriate to match primer.

2. 2nd Coat - Urethane Alkyd Topcoat
   a. "S-W, Industrial Urethane Alkyd Enamel, B54-150 Series, Gloss"

3. 3rd Coat - Urethane Alkyd Topcoat
   a. "S-W, Industrial Urethane Alkyd Enamel, B54-150 Series, Gloss"
   b. *Not less than 3.0 mils dry film thickness.

C. PVC / PLASTIC / FIBERGLASS (exterior, new construction, painted finish):

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1. 1st Coat - Latex Primer
   a. "S-W, PrepRite ProBlock Latex Primer, B51 Series"
   b. *White

2. 2nd Coat - Latex Topcoat
   a. "S-W, A-100 Exterior Latex Satin, A82 Series"

3. 3rd Coat - Latex Topcoat
   a. "S-W, A-100 Exterior Latex Satin, A82 Series"

3.10 PAINT SYSTEM SCHEDULE - INTERIOR PAINT SYSTEMS

A. METAL DOORS AND FRAMES (interior, new construction, painted finish):

1. Touch-Up - Rust-Inhibitive Metal Primer
   a. "S-W, Kem Bond HS, Universal Metal Primer"
   b. *May use original primer if available.
   c. *Color selected as most appropriate to match primer.

2. 2nd Coat - Urethane Alkyd Topcoat
   a. "S-W, Industrial Urethane Alkyd Enamel, B54-150 Series, Gloss"

3. 3rd Coat - Urethane Alkyd Topcoat
   a. "S-W, Industrial Urethane Alkyd Enamel, B54-150 Series, Gloss"
   b. *Not less than 3.0 mils dry film thickness.
   c. *Additional coats as required by Architect to achieve desired and intended result.

B. GYPSUM DRYWALL / PLASTER WALL SURFACES (interior, new construction, painted finish):

1. 1st Coat - Latex Primer
   a. "S-W, ProMar 200 Zero VOC, Interior Latex Primer, B28W02600"
   b. *Tinted toward final color.

2. 2nd Coat - Interior Latex Topcoat
   a. "S-W, ProMar 200 Zero VOC, Interior Latex, Eg-Shel"

3. 3rd Coat - Interior Latex Topcoat
   a. "S-W, ProMar 200 Zero VOC, Interior Latex, Eg-Shel"

C. GYPSUM DRYWALL / PLASTER WALL SURFACES (interior, existing and/or previously painted, painted finish):

1. 1st Coat - Latex Primer
   a. "S-W, ProMar 200 Zero VOC, Interior Latex Primer, B28W02600"
   b. *Painter responsible to visit site and field verify surface prep required.
   c. *Additional coats as required to cover existing color and texture.

2. 2nd Coat - Interior Latex Topcoat

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a. "S-W, ProMar 200 Zero VOC, Interior Latex, Eg-Shel"

3. 3rd Coat - Interior Latex Topcoat
   a. "S-W, ProMar 200 Zero VOC, Interior Latex, Eg-Shel"

D. GYPSUM DRYWALL / PLASTER CEILING AND SOFFIT SURFACES (interior, existing and/or previously painted, painted finish):

1. 1st Coat - Latex Primer
   a. "S-W, PrepRite ProBloc, Interior/Exterior Latex Primer/Sealer, B28W02600"
   b. *Painter responsible to visit site and field verify surface prep required.
   c. *Additional coats as required to cover existing color and texture.

2. 2nd Coat - Interior Latex Topcoat
   a. "S-W, ProMar 200 Zero VOC, Interior Latex, Flat "

3. 3rd Coat - Interior Latex Topcoat
   a. "S-W, ProMar 200 Zero VOC, Interior Latex, Flat "

SUBMITTAL CHECKLIST

1. Product Data.
2. Samples and Draw Downs.
3. Mock-Ups.
4. Compatibility Tests.

END OF SECTION 09 9000

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SECTION 10 1300.02 - INTERIOR SIGNS

PART 1 - GENERAL

1.01 WORK INCLUDED

1. Interior signage as indicated on the Drawings and specified herein, including:
   a. Non-illuminated room identification signs.

1.02 SUBMITTALS

A. Product Data:
   1. Submit manufacturer's product data, cutsheets, specifications and installation details to illustrate conformance with the specifications and for selection and/or verification of all sign layout and construction items.

B. Signage Layout:
   1. Provide initial layout of signage and lettering, including the actual spacing and layout required for the surface to be installed on.
   2. Draw and indicate layout to scale, with field verified measurements included.

C. Mounting Template:
   1. Once a final layout has been approved, supplier shall provide the Contractor with a full-scale mounting template for proper positioning of studs and fasteners.

D. Samples:
   1. Submit full size samples of actual sign for each type specified.
   2. Submit full size paper template of dimensional lettering signs.
   3. Submit color charts for color selections.
   4. Submit actual color and finish samples as requested for selection of verification.

1.03 DELIVERY, STORAGE AND HANDLING

A. Deliver signs in manufacturer's unopened packages, with labels intact.
B. Store and handle letters so as to prevent damage or deterioration.

PART 2 - PRODUCTS

2.01 ROOM IDENTIFICATION SIGNS

A. Typical Flat Wall Signs:
   1. Basis of Specifications: “ASI Sign Systems”, InTouch.

B. Type of Graphics:
   1. .080” thick matt acrylic faceplate laminated to a .080” thick acrylic back.
   2. Raised etched tactile letters welded to front surface of plaque.
   3. Letters and numerals shall also be included in raised braille, color same as background.

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4. Copy to be centered, unless indicated otherwise.
5. Signs are to be unframed.
6. Typeface: Uppercase 3/4" high.
7. Font: As selected from manufacturer's entire standard selection.
8. Square corners.
9. Size: as shown on Drawings.

2.02 COORDINATION

A. Colors shall be selected from manufacturer's entire standard selection, panel and type.
B. Room numbers to be determined during shop drawing submittals, unless otherwise indicated.
C. Blank Back Plate:
   1. Flat and smooth panel.
   2. Material and color to match plaque.
   3. Size to match plaque.
   4. Provide for any sign where plaques need to be installed on a glass sidelight, transom or window, or where backside and/or mounting is otherwise exposed to view. Provide when and where directed by Architect, whether indicated or not, for location of sign installation designated.
D. Field verify all locations of signs with Architect prior to mounting. Relocate as required.

2.03 TYPES OF SIGNS

A. The following signs shall be provided throughout the project, whether indicated or not:
   1. All restrooms shall be identified by room name, pictogram, and universal symbol of accessibility.
   2. All mechanical and utility rooms shall be identified by "Mechanical", unless otherwise indicated.
   3. All fire extinguishers shall be identified by universal symbol for extinguisher.
   4. Typical sign elevations may be indicated on Drawings. See code compliance sheet.

2.09 SIGN SCHEDULE (ROOM IDENTIFICATION SIGNS)

1. Sign Type: A
   Location: Women 103
   Text: Women
   Quantity: 1

2. Sign Type: B
   Location: Men 102
   Text: Men
   Quantity: 1

3. Sign Type: C
   Location: Meeting Room 100 and Service Area 101
   Text: Exit
   Quantity: 2

4. Sign Type: D
   Location: Meeting Room 100

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Text: Maximum Occupancy: xxx (Number to be determined)
Quantity: 1

5. Sign Type: E
Location: Service Area 101
Text: Fire Extinguisher
Quantity: 1

6. Sign Type: F
Location: Mechanical 104
Text: Mechanical
Quantity: 1

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install all signs square, plumb, level, and true.
B. Adhesive Attachment:
1. Install using manufacturer's standard double-click foam tape, or combination of tape and adhesive.
2. Use for typical installations on gypsum board or like surfaces.

C. Fastener Attachment:
1. In addition to the adhesive method above, install one screw fastener through face of sign and into the substrate at all corners. Finish paint screw heads to match face of sign.
2. Use for installations on masonry walls, exterior mounting, epoxy paint or areas prone to either wet or vandal conditions.
3. Mount sign on wall adjacent to latch side of door, unless otherwise indicated. If wall space does not permit this location, consult Architect for mounting desired.
4. Mounting height shall be 60" above finish floor to centerline of the sign, unless otherwise indicated.
5. Install blank back plate on opposite side of plaque where applicable.

SUBMITTAL CHECK LIST

1. Manufacturer's Literature.
2. Signage Layout.
3. Mounting Template.
4. Samples.

END OF SECTION 10 1300.02

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SECTION 10 2113.13 - METAL TOILET PARTITIONS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment, special tools, supervision and services required to furnish and install all toilet partitions indicated, noted and detailed on the drawings and specified herein.

1.02 SUBMITTALS

A. Shop Drawings: Complete shop and erection drawings showing plan layout, all fabrication and erection details, anchorage, hardware and accessories.

B. Data Sheets: Finish sample, installation instructions.

1.03 DELIVERY, STORAGE AND HANDLING

A. Delivery:

1. Deliver material in original unopened, undamaged packages.
2. Identify by contents and color.

B. Store materials in original protective packaging to prevent soiling, damage or wetting.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Provide materials manufactured by one of the following, or an approved equivalent.

1. “Global”
2. “Metpar”
3. “Mills Company”
4. “Knickerboker”
5. “Sanymetal”
6. “Flush Metal Partitions”

2.02 MATERIALS

A. Facing Materials: 22 gauge galvanized - bonderized steel, roll formed with concealed lock seam.

B. Edges: 20 gauge continuous molding, internally welded with corner reinforcement. Mitered at corners.

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C. Core: Honeycomb.

D. Hardware and Fittings:

1. Chrome plated.
2. Emergency outside access feature on latch.
3. Hinges: Operable parts concealed in door, to remain open, maximum 15° when not in use.
4. Latch, hinges, strikes, keepers, combination coat hooks and bumpers, and brackets.
5. Fasteners: Theft-resistant, finish to match hardware.
6. Provide one coat hook on inside of each toilet partition stall door: surface mounted, stainless steel, satin finish, with concealed mounting. Mount at ADA height at all ADA stalls.

E. Finish: Electrostatically applied thermo-setting acrylic enamel. Color as selected from manufacturer's standards.

F. Provide reinforcement for partition mounted grab bars.

2.03 FABRICATION

A. Design: Floor Mounted, Overhead Braced

B. Panels:

1. Sandwich construction of steel enclosing honeycomb core.
2. Seal edges and all sides, against moisture, mitered, welded and finished.
3. Pre-pierce panels for fittings and hardware.
4. Seal exposed core at notches and cut-outs.
5. Conceal reinforcement for hardware.

C. Thickness:

1. Partitions: 1” thick.
2. Doors: 1” thick.
3. Pilasters: 1-1/4” thick.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Anchor pilasters to steel supports.
B. Anchor to wall stirrup brackets, with 1@ clearance, 3 brackets per panel.
C. Set plumb and true to line and level, in a rigid substantial manner.
D. Conceal drilling, cutting and fitting in walls and ceiling.
E. Clearance at vertical edge of doors shall be uniform top to bottom and not exceed 3/16@.

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3.02 CLEANING

A. Upon completion, remove all materials, equipment and debris from the premises.

B. Wash thoroughly with cleaner recommended by manufacturer.

SUBMITTAL CHECK LIST

1. Shop Drawings.
2. Manufacturers Literature.

END OF SECTION 10 2113.13

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SECTION 10 2613 – WALL AND CORNER GUARDS

PART 1 – GENERAL

1.01 WORK INCLUDED

A. Extent of wall and corner guards as indicated on Drawings and specified herein.

1.02 QUALITY ASSURANCE

A. Deliver materials to project site in original packages or containers clearly labeled to identify manufacturer, brand name, quality or grade and fire hazard classification.

B. Store materials in original undamaged packages or containers. Store materials in a clean, dry location protected against damage of any kind.

C. Illuminate areas of installation using building's permanent lighting system; temporary lighting alone will not be acceptable.

1.03 SUBMITTALS

A. Product Data:

1. Manufacturer's product data sheets, cutsheets, specifications and installation instructions.
2. Include data on physical characteristics, durability, fade resistance and flame resistance characteristics.

B. Samples:

1. Submit actual samples of corner guards selected. If color not selected, submit samples for selection by the Architect from manufacturer's entire selection of type indicated. Printed color chart alone is not acceptable.

1.04 WARRANTY

A. Provide manufacturer's standard 5-year warranty.

PART 2 – PRODUCTS

2.01 MATERIAL

A. Surface-mounted Corner Guards (Mounted to continuous aluminum retainer- 2" wing size):

"Pawling"; Pro-tek NXT Impact Protection Systems, CG-20P.

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"Construction Specialties;" Acrovyn Corner Guard, SSM-20AN

"In Pro Architectural Products"; 160 High Impact Corner Guard

a. Description:
   1. Snap-on extruded vinyl corner guards with continuous aluminum retainer.
   2. Dimensions: Leg length: 2", Angle: 90 degrees w/ 1/4" radius.
   3. Height: 4'-0".
   4. Profile: High-impact vinyl acrylic extrusion with rounded corners.
   5. Thickness: nominal .080".
   6. Flame Resistance: Class A fire rating (ASTM E 84).
   7. Texture: Pebble.
   8. Provide injection-molded top and bottom caps.

PART 3 – EXECUTION

3.01 PREPARATION

A. Verify that wall surfaces are acceptable to receive the specified guard systems. Do not begin installation until acceptable conditions have been corrected.

3.02 INSTALLATION

A. Install Corner Guards securely to wall according to manufacturer's instructions and recommendations.

B. Install Corner Guards accurately in location, alignment, and elevation.

C. Remove excess adhesive along edges.

3.03 ADJUST AND CLEAN

A. Remove surplus materials, rubbish, and debris resulting from corner guard installation upon completion of work, and leave areas of installation in neat, clean condition.

B. Clean corner guards and adjacent wall surfaces of all stains, marks and adhesives.

SUBMITTAL CHECK LIST

1. Product Data.
2. Samples.

END OF SECTION 10 2613

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SECTION 10 2623.16 - FIBER REINFORCED PANELS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Fiberglass reinforced plastic coated panels as shown on drawings and specified herein.

1. Wall Panels.

1.02 QUALITY ASSURANCE

A. USDA accepted.

B. FM Approved and UL Classified.

PART 2 - PRODUCTS

2.01 WALLS PANELS

A. “Crane Composites” glassboard panels.

1. 4’ wide x length as required to extend from floor to ceiling without seams.
2. Class A (1) Flame Spread (max. 25 per ASTM E-84).
3. Color: as selected from manufacturer’s complete range of color selections.
4. Texture: to be selected by architect.
4. Fasteners and accessories as required for a complete installation.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install per manufacturer’s recommendations.

B. Install over gypsum wall board using Crane Advanced Polymer adhesive.

C. Install moldings at all joints, set in silicone sealant.

3.02 CLEANING PROTECTION

A. Clean as recommended by manufacturer.

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END OF SECTION 10 2623.16

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SECTION 10 2813 - TOILET ACCESSORIES

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Toilet accessories as shown on Drawings and specified herein.

B. Installation of owner-furnished toilet accessories as shown on Drawings and specified herein.

1.02 SUBMITTALS

A. Manufacturer's Literature:

1. Submit manufacturer's "cut sheets" for each item specified, showing installation details, and product information.

1.03 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to job with manufacturer's unopened packages, with label in tact.

B. Store and handle products so as to avoid damage. Remove all damaged items from the job site.

C. Maintain protective covers until Substantial Completion.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Provide products, as approved by the Architect, from one of the following manufacturers:

1. "Bobrick"
2. "Bradley"
3. "ASI"
4. "AJW Architectural Products"

B. See Specifications Section 01 6200 - Product Options and Substitutions.

2.02 MATERIALS

A. Grab Bars:

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1. “Bobrick” B-6806 Series.
2. Surface mounted, stainless steel, safety grip finish, concealed mounting, snap-flange cover.
3. Provide 1-1/2” diameter x sizes and configurations as shown on Drawings.
4. Provide at locations as shown on Drawings, or if not shown, provide as follows:
   a. 36" long horizontally on rear wall of all ADA stalls.
   b. 42" long horizontally on side wall of all ADA stalls and ambulatory stalls.
   c. 18" long vertically on side wall of all ADA stalls and ambulatory stalls.

B. Sanitary Napkin Disposals:

4. “Bobrick” B-270, "Contura" Series.
2. Surface-mounted, stainless steel, satin finish.
3. Provide at locations as shown on Drawings, or if not shown, provide one per female water closet.
2. Coordinate location with partition door and other accessories.

C. Mirrors:

5. “Bobrick” B-165 Series.
6. 1/4” select float glass mirror with stainless steel angle frames.
3. Corners welded, ground and polished smooth.
4. Surface mounted, stainless steel, satin finish, concealed fasteners.
5. Install centered on lavatory or sink.
6. Provide sizes as shown on Drawings, or if not shown, provide 24"x36".
7. Provide at locations as shown on Drawings, or if not shown, provide one per lavatory or sink.

PART 3 - EXECUTION

3.01 PREPARATION

A. Finish surfaces shall be complete prior to installation of accessories.

B. Verify all materials that anchoring devices are compatible with accessories.

3.02 INSTALLATION

A. Drill holes of proper size for required anchoring devices to be concealed in finish wall behind accessories.

B. Install accessories plumb and true.

C. Grab Bars:

1. Anchor grab bars on wall and partition of end toilet compartment and at urinals indicated.
2. Install as recommended by manufacturer to withstand 500lb. downward pull.

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3.03 MOUNTING HEIGHTS

A. See Drawings for mounting heights.

B. If not shown on Drawings, confer with Architect for heights required.

C. All mounting heights shall meet all current Codes and ADA requirements.

3.04 ADJUSTING AND CLEANING

A. Check operation of accessories; make final adjustment as required.
B. Remove protective covers.
C. Clean stainless steel of all paints, and other markings, with mild detergent and water.

3.05 PROTECTION

A. Protect accessories from damage until Substantial Completion.
B. Replace any damaged accessories.

SUBMITTAL CHECK LIST

1. Manufacturer's Literature.

END OF SECTION 10 2813

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SECTION 10 4400 - FIRE EXTINGUISHERS AND CABINETS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Fire extinguishers, cabinets, and brackets as shown on the Drawings and specified herein.

1.02 QUALITY ASSURANCE

A. Provide fire extinguishers which are U.L. listed and bear U.L. "Listing Mark" for type, rating, and classification of extinguisher indicated.

1.03 SUBMITTALS

A. Product Data:

1. Manufacturer's product data sheets, cutsheets, specifications, materials description, installation and maintenance instructions.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to job in manufacturer's unopened packages with labels intact.

B. Store and handle products so as to prevent damage. Remove all damaged items from the job site.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Fire Extinguishers:

1. Dry Chemical Type:
   a. Basis of Specification: "JL Industries, Inc." Cosmic 10E.
   b. Fire Class: ABC.
   c. U.L. Rating: 4A-80BC.
   d. Capacity: 10 pounds.

2. Kitchen Type:
   a. Basis of Specification: "JL Industries, Inc." Saturn 15.
   b. Fire Class: K.
   c. U.L. Rating: K.
   d. Capacity: 6 liters.

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B. Fire Extinguisher Cabinets:

1. Use with Dry Chemical Type Extinguishers (Semi-Recessed Mounted):
   a. Basis of Specification: "JL Industries, Inc." Academy.
   b. Tub: Cold rolled steel with white powder coat finish.
   c. Trim: Semi-recessed 1-1/2" square-edge trim, aluminum, clear anodized finish.
   d. Door Style: Full glazing.
   e. Door Glazing: Clear acrylic with red vertical FE lettering.
   f. Hardware: Continuous hinge, roller catch, pull handle. Match trim finish.

2. Use with Dry Chemical Type Extinguishers (Surface Mounted):
   a. Basis of Specification: "JL Industries, Inc." Academy.
   b. Tub: Cold rolled steel with white powder coat finish.
   c. Trim: Square edge trim, aluminum, clear anodized finish.
   d. Door Style: Full glazing.
   e. Door Glazing: Clear acrylic with red vertical FE lettering.
   f. Hardware: Continuous hinge, roller catch, pull handle. Match trim finish.

3. Use with Kitchen Type Extinguishers (Semi-Recessed Mounted):
   a. Basis of Specification: "JL Industries, Inc." Academy.
   b. Tub: Cold rolled steel with white powder coat finish.
   c. Trim: Semi-recessed 1-1/4" square-edge trim, aluminum, clear anodized finish.
   d. Door Style: Full glazing.
   e. Door Glazing: Clear acrylic with red vertical FE lettering.
   f. Hardware: Continuous hinge, roller catch, pull handle. Match trim finish.

4. Provide fire-rated cabinets at all Rated Walls and Smoke Partitions.

C. Fire Extinguisher Brackets:

1. Manufacturer's standard wall mounted type for each specific extinguisher type.
2. Provide to secure top and bottom of extinguisher.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install extinguishers in cabinets and on brackets as indicated on the Drawings.

B. Install cabinets and brackets square and plumb, and in accordance with manufacturer's instructions.

C. Install in compliance with all applicable Federal, State, and local regulations.

D. Install cabinets recessed in masonry and stud framed walls as applicable.

E. Locate wall brackets as indicated. Provide blocking as required for all attachment locations.

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F. Install cabinets and brackets so as to locate extinguishers at a height of 3'-8" from floor to top of extinguisher handle (for bracket mounted extinguishers) and to center of door pull (for extinguishers in a cabinet), unless otherwise indicated on the Drawings.

3.02 ADJUSTING AND CLEANING

A. Check extinguishers for proper charge in operation.

B. Assure that all doors and hardware operate smoothly and freely.

C. Adjust or replace defective items as required.

3.03 PROTECTION

A. Protect cabinets and extinguishers from damage and deterioration until time of Substantial Completion. Touch up any marred surfaces.

SUBMITTAL CHECK LIST

1. Product Data.

END OF SECTION 10 4400

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SECTION 12 2400 - WINDOW SHADES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work covered by this section includes furnishing of and paying for all materials, labor, equipment, mounting hardware and other items required for execution and completion of roll-up fabric window shades.

B. Work covered by this Section includes:

1. Motorized Single-Roller Window Shades, with a light blocking fabric shade.

1.02 SUBMITTALS

A. Window Shades Schedule:

1. Indicate locations including room numbers, quantities and field measurements of dimensions for all window blinds.
2. Indicate proposed mounting and fastening procedurals.

B. Product Data:

1. Manufacturer's product data sheets, cutsheets, specifications, materials description, installation and maintenance instructions.

C. Samples:

1. Actual samples of all items needed for colors and finishes.
2. Colors and finishes to be selected by Architect from manufacturer's entire selection.

1.03 DELIVERY

A. Deliver materials in manufacturer's original, unopened, containers, labeled so as to allow easy identification.

1.04 WARRANTY

A. Mounting hardware and Shade Fabric – Twenty-five (25) years.

B. Motors and Controls – Five (5) years.

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PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Provide products, as approved by the Architect, from one of the following approved manufacturers:

1. "Draper"

2.02 MOTORIZED SINGLE-ROLLER WINDOW SHADES

A. Provide one of the following approved products

1. "Draper", Motorized Flexshade.

B. Description:

1. Motorized roll-up fabric interior window shades with motor operator, controls and mounting hardware.

C. Mounting Style:

1. Inside of window opening and extending from head to sill and jamb to joint.

D. Shade Motor and Control System:

1. Standard Motor: 120V AC, single phase, 60 HZ, instantly reversible, lifetime lubricated, and equipped with internal thermal overload protector, electric brake, and pre-set accessible limit switches. Tubular motor concealed inside each shade roller tube.
   a. Group Control:ISO relay - UL listed component. One ISO relay per motor. Allows 110-120V group switching via toggle switch.
   b. All shades within a room to operate on one switch.

E. Fascia:

1. L-shaped aluminum extrusion to conceal shade roller and hardware.
2. Finish: Baked enamel.
3. Color: Charcoal Bronze

2.03 LIGHT BLOCKING FABRIC

A. Basis of Specification: "SunBloc" SB9000.

B. 25% fiberglass; 75% PVC coating.

C. Fire Retardant.

D. Color:

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1. To be selected by Architect from manufacturer's entire selection.
2. Matching Backing.

PART 3 - EXECUTION

3.01 INSPECTION AND PREPARATION

A. Contractor shall be responsible for inspection of site, approval of mounting surfaces, installation conditions and field measurements for this work.

B. Field measure all openings and conditions.

3.02 INSTALLATION

A. Install shades level and plumb, allow clearance for proper operation, and demonstrate blinds to be in uniform and smooth working order.

PRODUCT DATA SHEET 1 - Provide clearance between sash and shades to permit unencumbered operation of sash hardware.

PRODUCT DATA SHEET 2 - Install the fascia, closure panels and end caps with to conceal roller and operating mechanisms. Exposed fasteners are unacceptable.

B. Isolate metal parts from concrete and mortar to prevent galvanic action.

C. Protect installed units to ensure their being in operating condition, without damage, blemish, or indication of use at Substantial Completion of project. Correct non-conforming damaged unit.

Replace units that cannot be field corrected.

3.03 CLEANING

A. Clean finished installation of dirt and finger marks. Leave work area clean and free of debris.

1.2 SUBMITTAL CHECK LIST

1. Window Shades Schedule.
2. Product Data.
3. Samples.

END OF SECTION 12 2400

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SECTION 12 3216 – PLASTIC LAMINATE CABINETS AND CASEWORK

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish and install all pre-finished, pre-fabricated, plastic-faced, cabinets and casework as shown on the Drawings and specified herein, including delivery to the site, storing, unpacking, setting in place, leveling, anchoring to walls and floors, and all other required activities need for a complete installation.

B. Color/finish selections for plastic laminate casework/countertops are indicated on the Interior Drawings.

C. Solid Surface countertops as indicated on the Drawings atop plastic laminate casework.

1.02 QUALIFICATIONS

A. Supplier's Qualifications:

1. Manufacturers of Plastic Laminate Cabinets and Casework should be pre-qualified prior to bidding.
2. Shop of manufacturer should be certified by the Architectural Woodwork Standards (AWS), and be capable of providing proof of such certification upon request.
3. Manufacturers wishing to be included on the pre-qualified list herein shall submit qualifications in writing to the Architect no later than ten (10) days prior to the bid.

B. Pre-qualified Manufacturers of Plastic Laminate Cabinets and Casework:

1. Adams Cabinetry and Installations.
2. Advanced Cabinet Systems, Inc.
3. Case Systems, Inc.
4. Classic Cabinets & Millwork.
5. Corman and Associates, Inc.
6. Euronique, Inc.
7. Four Stone Mill and Casework.
8. LSI.
9. Meyer Custom Woodworking.
10. P.R. Bean Company.
11. Smith Laminating, Inc.
12. Southern Cabinetry, Inc.
13. Stevens.
14. Stidham Cabinet, Inc.
15. Thermo Scientific Hamilton.
16. TMI.
17. Wood Tek, Inc.

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1.03 QUALITY ASSURANCE

A. Comply with the latest edition of the Architectural Woodwork Standards (AWS) “Quality Standards”. References to Premium, Custom, or Economy in this specification are to be as defined in this publication.

B. Provide items and work with a minimum of Custom Grade, with true balanced construction.

C. Provide items and installation of straight, flat, level, plumb, and true quality and craftsmanship.Items provided that create an installation not acceptable for these reasons, or otherwise deemed unacceptable for purposes of aesthetics or maintenance, shall be removed and replaced by the Contractor without additional costs to the Owner. Final determination shall be made by the Architect.

D. Any inconsistencies or irregularities in the surface or product will be cause for rejection. All rejected products shall be removed and replaced with new at no additional cost to the Owner. The evaluation of acceptance and rejection is at the sole discretion of the Architect.

1.04 SUBMITTALS

A. Samples:

1. Complete range of manufacturer's standard finishes where colors are not specified.
2. Samples of specified items only, where colors have been indicated.
3. Samples of each type, material, and color of countertop specified.

B. Shop Drawings:

1. Field measurements shall be taken to verify that cabinets and casework will fit into designed space. Entryways, corridors, and door openings shall be verified to ensure that the equipment be manufactured in a manner to permit it to be moved through properly into place.
2. Show layout of cabinets with product reference numbers, details of construction, dimensions, elevations, rough-ins, materials, finishes, hardware, and accessories.
3. Reference Architect’s nomenclature of product identification as indicated on the Drawings.

1.05 DELIVERY, STORAGE AND HANDLING

A. Protect casework during transit, delivery, storage, and handling to prevent damage, soiling, and deterioration.

B. Do not deliver casework until painting, wet work, grinding, and similar operations which could damage, soil, or deteriorate casework have been completed in installation areas.

C. Deliver casework as needed for immediate installation whenever possible. Casework delivered ahead of time for installation shall be stored by Contractor until project areas are ready for installation.

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1.06 WARRANTY

A. Casework contractor shall guarantee to replace or repair, at no expense to the Owner, all materials of this contract found to be defective within one year of acceptance (Substantial Completion), due to defective materials and/or workmanship.

1.07 DEFINITIONS

A. Clarification:

1. For purposes of this specification, definitions of surfaces shall be as indicated below.
2. Some restrictions herein may be more restrictive or differ from the AWS Quality Standards. Where differences occur, the most restrictive specification shall take precedence.

B. Exposed Surfaces:

1. Any cabinet or component surface that is visible when doors and drawers are closed.
2. All open cabinet surfaces, shelving and components.
3. Cabinet surfaces, shelving and components visible through glass doors.
4. Bottom surfaces of all cabinets that are not concealed atop permanent construction or casework.
5. Top surfaces of all cabinets that are not concealed below permanent construction or casework.
6. Side surfaces of all cabinets that are not concealed against permanent construction or casework.
7. All surfaces of all cabinets that are not concealed after fixed appliances are installed.
8. Front edges of cabinets and body members that are visible.
9. Front edges of cabinets and body members that are seen through a gap of 1/8” or greater with doors and drawers closed.
10. Ends and toe kicks when visible after installation.
11. Ends, back and sides of freestanding cabinets that are not permanently installed, attached to other casework, or are intended to be relocatable. These surfaces may be hidden from view in one application, but in full view in another when relocated.

C. Semi-Exposed Surfaces:

1. Any cabinet or component surface that is visible when doors and drawers are in the open position.
2. Any interior cabinet or component surface behind either solid doors, drawer fronts, sliding solid doors or expanded metal screen doors.
3. Back surfaces of solid doors and drawers.

D. Concealed Surfaces:

1. Surfaces not visible after installation of casework.
2. Surfaces not visible when doors and drawers are open.
3. Tops of cabinets that are to receive a counter top.
4. Surfaces which are concealed from view and non-accessible in corners and voids created by intersection of multiple cabinets.
5. Surfaces behind finished closure and filer panels.
6. Stretchers, blocking and components concealed from view by drawers.
7. Toe kicks when rubber base or like material is scheduled for installation directly to surfaces.

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PART 2 - PRODUCTS

2.01 MATERIALS

A. Hardwood Plywood: Product Standard PS 51.

B. Softwood Plywood: Product Standard PS 1.

C. Plastic Laminate:

1. Acceptable Manufacturers:
   a. "Formica"
   b. "Wilsonart"

2. Comply with NEMA LD-3 for type, thickness, color, pattern, and finish as indicated for each application.
3. Provide high pressure laminate in grades indicated for the following types of surfaces:
   a. Horizontal Surfaces High-pressure decorative laminate VGS-50 (0.050").
   b. Vertical Surfaces: High-pressure decorative laminate VGS-28 (0.028").
   c. Exposed Cabinet Body Exterior: High-pressure decorative laminate VGS-28 (0.028").
   d. Door and Drawer Fronts: High-pressure decorative laminate VGS-28 (0.028").
   e. Exposed Cabinet Body Interior (Without a Door): High-pressure decorative laminate VGS-28 (0.028").
   f. Semi-Exposed Cabinet Body Interior (Through a Glass Door): Thermally-fused melamine laminate with CL-20 cabinet liner at surface required to achieve true balanced construction, manufacturer's standard "white" in color.
   g. Interior Concealed Surfaces: Thermally-fused melamine laminate, manufacturer's standard "white" in color.

4. Balanced construction of both faces of surfaces is required.
5. Laminate grain patterns are to run vertically and be vertically matched within each unit.

D. Solid Surface Material:

1. Acceptable Manufacturers and Products:
   a. "Dupont", "Corian".
   b. 1/2" thick for countertops, installed over particleboard backer, for total thickness of 1" minimum.

3. 1/2" thick for edge banding, built-up to provide a face depth of 1", unless indicated otherwise.
4. 1/2" thick for backsplashes and end splashes, 4" high unless otherwise noted.

E. Particleboard:

1. Industrial grade engineered board core material.
2. 47 pound density, non-telegraphing.
3. 3/4" thick, medium density particleboard, Type 1-M-2.

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4. 1/2" thick minimum, medium density particleboard, Type 1-M-2, under solid surfacing countertops.

F. Accessories:

1. Filler, tops, end and side closures; finish to match adjacent cabinets and countertops.
2. Finished back and end panels as required or indicated.
3. Back splashes. End splashes only as specified.

G. Shelving:

1. Fully adjustable, typically.
2. Fixed where required for unit stability and/or positive door latching.
3. 1" thick 36" wide or greater, 3/4" thick less than 36" wide.
4. Shelves over 47" in length to have additional center support.

H. Edge Trim:

1. Material:
   a. 1mm (.020" actual) rigid PVC banding, stain finish, machine applied.
   b. 3mm rigid PVC banding, stain finish, machine applied with 3mm radius edge profile.
2. 3mm PVC banding at edges of doors and drawers.
3. 3mm PVC banding at edges of countertops, including splashes, typical.
4. 1mm PVC banding at edges of shelves, front and back.
5. 1mm PVC banding at all other case and leading edges.

I. Colors:

1. Colors as selected from manufacturer's entire selection, no limit on number of colors selected.
2. If colors are indicated on the Drawings, colors and patterns must be matched.
3. For purposes of color selections, countertops shall include all splashes, aprons, supports and cleats where no base units are provided, unless noted otherwise.
4. For purposes of color selections, all fillers and panels shall match adjacent exposed cabinet faces.

2.02 HARDWARE

A. Hinges:

1. Five knuckle, 270 degree, Institutional Grade 1 hinge.
2. Constructed of .090" minimum thickness steel.
3. Hospital tipped with non-removable pin.
4. 2-1/2" chrome, satin finish.
5. Mounted to door and case with not less than three screws per wing.
6. Concealed or with off-set wrap around wings, as selected by the Architect.
7. Lifetime guarantee as warranted by the hardware manufacturer.

B. Drawer Slides:

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1. Standard full extension telescoping drawer slide; 3/4 extension slides are not acceptable.
2. Self-closing epoxy coated steel drawer slide with smooth, quiet operation and lateral stability.
3. 100 lb. static load rating, minimum. 150 lb. static load rating, minimum at all file drawers.
4. Lifetime guarantee as warranted by the hardware manufacturer.

C. Drawer Stops:

1. Shall be provided on all drawers to prevent inadvertent removal.
2. Shall be automatic type, zinc plated steel.

D. Pulls For Drawers and Doors:

1. 4” solid metal bent wire pull.
2. Shall be of clean, modern design offering a comfortable hand grip and shall attach through drawer or door with machine screws on each end of pull.
3. Extruded aluminum with satin lacquer finish.
4. Install centered on all drawer fronts.

E. Adjustable Shelf Supports:

1. Injection molded clear polycarbonate shelf support or metal shelf support.
2. Shall friction fit into cabinet end panels and vertical dividers and be adjustable on a 32mm center precision drilled line bore pattern.
3. Shall have 2 integral 5mm diameter support pins to interface pre-drilled holes, and to prevent accidental rotation of support.
4. Shall automatically adapt to 3/4 inch or 1 inch thick shelving and provide a non-tip feature for shelving.
5. 250 lb. minimum static load rating per support without failure.
6. Shelves longer than 47” shall have additional support standard and brace at center span.

F. Door Catches:

1. Heavy duty magnetic type catch.
2. Shall have matching white plastic coated housing and dual floating magnet poles.
3. Holding strength of 5kg.
4. Doors less than 48” in height shall have 1 magnetic catch mounted at either the top or bottom of each door.
5. Doors over 48 inches in height shall have 1 magnetic catch mounted at both the top and bottom of each door.
6. Doors shall receive a matching steel strike plate attached with threaded fasteners.

G. Silencers:

1. Cork, plastic, or rubber type silencers.
2. Provide on all drawers and doors.

H. Chain Stops:

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1. Provide chain stops at the top of all doors to all base cabinets that open directly into a wall surface or obstruction.

2. Finish of chains and stops to match hinges.

2.03 FABRICATION

A. Base:

1. Continuous under all base and storage cabinets.
2. Rubber base furnished and installed per Section 09 6500.

B. Drawers:

1. Shall be constructed so as to provide full solid sides and components for the entire box.
2. Sides composed of no solid panel or of simply the guide or sliding hardware is not acceptable.

C. Joinery:

1. Handwrap fluted dowel construction.
2. 8mm minimum.
3. Doweled and glued.

PART 3 - EXECUTION

3.01 INSPECTION

A. Assure adequate anchorage, grounds, blocking, nailers, and supports.

B. Assure that plumbing and electrical rough-ins are complete.

3.02 INSTALLATION

A. Install casework plumb with top level.

B. Anchor cabinets to floors and walls.

C. Install fillers, trim, sinks and accessories required for complete installation.

D. Touch up all marred surfaces to match original.

E. Replace any items or surfaces damaged during shipping, delivery, storing, installation, or construction activities.

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F. Coordinate sinks and other items that are to be installed in casework so as to insure that they will fit into casework as intended. Obtain templates for items prior to fabrication of bases or countertops. Coordinate needed changes to cabinets to allow for items specified without additional costs to the Owner.

SUBMITTAL CHECK LIST

1. Samples.
2. Shop Drawings.

END OF SECTION 12 3216

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SECTION 22 0500 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Dielectric fittings.
3. Sleeve-seal systems.
4. Sleeves.
5. Stack-sleeve fittings.
6. Escutcheons.
7. Grout.
8. Equipment installation requirements common to equipment sections.
9. Painting and finishing.
10. Concrete bases.
11. Supports and anchorages.

1.2 ACTION SUBMITTALS

A. Product Data: For dielectric fittings.

1.3 QUALITY ASSURANCE

A. Provide plumbing systems, equipment, and materials in accordance with applicable codes and regulations, and with authorities having jurisdiction.

B. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

C. 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

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prevent damage during shipment, storage, handling, and up to substantial completion. Coordinate deliveries of mechanical materials and equipment to minimize construction site congestion.

1.5 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.

B. Coordinate installation of required supporting devices and sleeves in structural components.

C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

C. 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.

1. All castings used for coupling housings, fittings, valve bodies, etc., shall include listing/approval stamp, label, or other markings made to specified standards.

2.2 JOINING MATERIALS

A. Refer to individual Division 22 piping Sections for special joining materials not listed below.

B. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

C. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

D. Solvent Cements for Joining Plastic Piping:

1. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

2.3 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded end connections that match piping system materials.

1. Insulating Material: Suitable for system fluid, pressure, and temperature.

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B. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F with threaded end connections.

C. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

D. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

2.4 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Plastic.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.5 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

2.6 STACK-SLEEVE FITTINGS

A. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with setscrews.

2.7 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Cast-Brass Type: With polished, chrome-plated or rough-brass finish and setscrew fastener.

C. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

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D. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

E. Split-Casting Brass Type: With polished, chrome-plated or rough-brass finish and with concealed hinge and setscrew.

F. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed or exposed-rivet hinge, and spring-clip fasteners.

2.8 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.9 PLUMBING ROOF PENETRATIONS

A. Pipe Curbs for Single or Multiple Pipe Penetrations: Prefabricated heavy-gage galvanized steel or aluminum curb with mitered and welded corners, minimum 1 1/2 inch thick rigid fiberglass insulation adhered to inside walls, built-in cant and mounting flange for roof decks, wood nailer, and acrylic clad ABS plastic cover(s), PVC boot(s), and stainless steel clamps.. Size as required to suit roof opening and piping. Overall minimum height shall be 12 inches above roof insulation. Pate or equivalent.

1. Provide curbs with level tops and bottoms to match roof slope.

B. Pipe Curbs for Single Pipe Penetrations: All roof pipe penetrations up to 10" O.D. shall be flashed and sealed using a Pate or equivalent pipe seal, consisting of a spun aluminum base having a minimum five inch roof surface flange, a stepped polyvinyl chloride boot to be secured to the base and the pipe with adjustable stainless steel clamps as furnished.

1. Provide curbs with bottoms to match roof slope.

PART 3 - EXECUTION

3.1 PLUMBING DEMOLITION

A. Refer to Division 01 Section "Execution" and Division 02 Section "Selective Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove plumbing systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.

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2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

D. During domestic water demolition, eliminate all “dead-leg” sections.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

1. Drawings are diagrammatic with no attempt made to show every ell, tee, transition, fitting, or appurtenance. Provide installations that are complete in every detail, compliant with all applicable codes, and as required to provide a fully functional and operational system even though every item is not specifically indicated.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

3.3 ESCUTCHEON INSTALLATION

A. Install escutcheons for penetrations of walls, ceilings, and finished floors according to the following:

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1. Escutcheons for New Piping:
   a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
   b. Chrome-Plated Piping: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
   c. Insulated Piping: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
   d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
   e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
   f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated or rough-brass finish.
   g. Bare Piping in Equipment Rooms: One-piece, cast-brass or split-casting brass type with polished, chrome-plated or rough-brass finish.

2. Escutcheons for Existing Piping:
   a. Chrome-Plated Piping: Split-casting brass type with polished, chrome-plated finish.
   b. Insulated Piping: Split-plate, stamped-steel type with concealed or exposed-rivet hinge.
   c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
   d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
   e. Bare Piping in Unfinished Service Spaces: Split-casting brass type with polished, chrome-plated or rough-brass finish.
   f. Bare Piping in Equipment Rooms: Split-casting brass type with polished, chrome-plated or rough-brass finish.

3.4 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

   1. Sleeves are not required for core-drilled holes.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

   1. Cut sleeves to length for mounting flush with both surfaces.
      a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

   2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

   1. Cut sleeves to length for mounting flush with both surfaces.
   2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.

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3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 07 9200 "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 07 8413 "Penetration Firestopping."

3.5 STACK-SLEEVE-FITTING INSTALLATION

A. Install stack-sleeve fittings in new slabs as slabs are constructed.

1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 07 6200 "Sheet Metal Flashing and Trim."
3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
5. Using grout, seal the space around outside of stack-sleeve fittings.

B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 07 8413 "Penetration Firestopping."

3.6 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.7 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls Above Grade:
   a. Piping Smaller Than NPS 6: Cast-iron wall sleeves, galvanized-steel wall sleeves, or galvanized-steel-pipe sleeves.
   b. Piping NPS 6 and Larger: Cast-iron wall sleeves, galvanized-steel wall sleeve, or galvanized-steel-pipe sleeves.

2. Exterior Concrete Walls below Grade:
   a. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system.

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1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system.
1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:
a. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system.
1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
b. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system.
1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

4. Concrete Slabs above Grade:
a. Piping Smaller Than NPS 6: Stack-sleeve fittings.
b. Piping NPS 6 and Larger: Stack-sleeve fittings.

5. Interior Partitions:
a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

3.8 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. 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. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

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H. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. 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. PVC Nonpressure Piping: Join according to ASTM D 2855.

I. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

3.9 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Wet Piping Systems: Connect piping materials of dissimilar metals as follows:
   a. In piping NPS 2(DN 50) and smaller, install ground joint unions.

4. Wet Piping Systems: Install dielectric unions, dielectric coupling, or dielectric nipple fittings to connect piping materials of dissimilar metals.

3.10 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Sequence, coordinate, and integrate installations of plumbing equipment.

B. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

D. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations.

E. Install equipment to allow right of way for piping installed at required slope.

F. Installing contractor shall bear all additional costs, including that of Architect/Engineer redesign and that of other trades, incurred as a result of installation of other than scheduled equipment.

G. Verify final equipment locations for roughing-in.

H. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.11 PAINTING

A. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

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3.12 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 section for cast-in-place concrete."

3.13 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.14 GROUTING

A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.

1. Clean surfaces that will come into contact with grout.
2. Provide forms as required for placement of grout.
3. Avoid air entrapment during placement of grout.
4. Place grout, completely filling equipment bases.
5. Place grout on concrete bases and provide smooth bearing surface for equipment.
6. Place grout around anchors.
7. Cure placed grout.

3.15 PLUMBING ROOF PENETRATIONS

A. Install plumbing roof penetrations in accordance with roof curb manufacturer’s recommendations and in strict compliance with roofing manufacturer’s requirements.

1. Roofs with Warranty: Roof penetrations and curbs shall be installed in such a manner to maintain roofing warranty.

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B. Pipe Curbs for Pipe Penetrations: Secure boot to curb base and secure boot to pipe with adjustable stainless steel clamps.

3.16 INSTALLATION OF ACCESS DOORS

A. Where lay-in ceilings are used, the access to ceiling space is provided through the removable ceiling panels. Where access is required to valves, pipes, or other devices in spaces above non-removable ceilings or in chases, the Contractor requiring the access doors shall provide access doors. Access doors required in rated walls and ceiling shall bear the same rating. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

1. Set frames accurately in position and securely attached to supports, with face panels plumb and level in relation to adjacent finish surfaces.
2. Adjust hardware and panels after installation for proper operation.

3.17 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 22 0500

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SECTION 22 0513 - COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

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 general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

B. For motors using variable frequency controller, motors to be designed for such application and suitable for use throughout speed range without overheating.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in plumbing equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

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2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

1. Provide premium efficient motors where scheduled or when used with a variable frequency controller.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Rotor: Random-wound, squirrel cage.

F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

G. Temperature Rise: Class B.

H. Insulation: Class F.

I. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

J. Enclosure Material: Manufacturer’s standard material.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
2. Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Shaft Grounding Ring: Factory installed shaft grounding ring consisting of maintenance free, circumferential, bearing protection ring with conductive micro fiber shaft contacting material.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.

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3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

2.6 ELECTRONIC COMMUTATION MOTOR (ECM)

A. Description: Motor to be an electronic commutation motor (ECM) specifically designed for direct drive applications. Motors shall be permanently lubricated with heavy-duty ball bearings to match the equipment load and prewired to the specific voltage and phase. Internal motor circuitry shall convert AC power supplied to the fan to DC power to operate the motor. Motor shall be speed controllable down to 20% of full speed (80% turndown). Speed shall be controlled by either a potentiometer dial mounted on the motor or by a 0-10 VDC signal. Motor shall be a minimum of 85% efficient at all speeds.

PART 3 - EXECUTION (Not Applicable)

3.1 SHAFT GROUNDING RING INSTALLATION

A. If not factory installed, field install at each three phase motors utilizing a variable frequency controller a shaft grounding ring. Attach according to manufacturer's written instructions.

END OF SECTION 22 0513

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SECTION 22 0516 - EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

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. Rubber union connector packless expansion joints.
2. Metal-bellows packless expansion joints.
3. Externally pressurized metal-bellows packless expansion joints.
4. Rubber packless expansion joints.
5. Flexible-hose packless expansion joints.
6. Grooved-joint expansion joints.
7. Alignment guides and anchors.
8. Pipe loops and swing connections.

1.3 DEFINITIONS

A. BR: Butyl rubber.

B. Buna-N: Nitrile rubber.

C. CR: Chlorosulfonated polyethylene synthetic rubber.

D. CSM: Chlorosulfonyl-polyethylene rubber.

E. EPDM: Ethylene-propylene-diene terpolymer rubber.

F. NR: Natural rubber.

1.4 PERFORMANCE REQUIREMENTS

A. Compatibility: Products shall be suitable for piping system fluids, materials, working pressures, and temperatures.

B. Capability: Products shall absorb 200 percent of maximum axial movement between anchors.

1.5 ACTION SUBMITTALS

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

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B. Delegated-Design Submittal: For each anchor and alignment guide indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations: Calculate requirements for thermal expansion of piping systems and for selecting and designing expansion joints, loops, and swing connections.
2. Anchor Details: Detail fabrication of each anchor indicated. Show dimensions and methods of assembly and attachment to building structure.
3. Alignment Guide Details: Detail field assembly and attachment to building structure.
4. Schedule: Indicate type, manufacturer's number, size, material, pressure rating, end connections, and location for each expansion joint.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product Certificates: For each type of expansion joint, from manufacturer.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For expansion joints to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe and Pressure-Vessel Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. NSF Compliance as required by authorities having jurisdiction:

1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."
3. Comply with NSF 372, "Drinking Water System Components – Lead Content”

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Compatibility: Products shall be suitable for piping service fluids, materials, working pressures, and temperatures.

B. Capability: Products to absorb 200 percent of maximum axial movement between anchors.

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2.2 EXPANSION JOINTS

A. Rubber Union Connector Expansion Joints RUEJ-01:

1. Material: Twin reinforced-rubber spheres.
2. Minimum Pressure Rating: 150 psig at 170 deg F, unless otherwise indicated.
3. End Connections for NPS 2 and Smaller: Threaded.

B. Metal-Bellows Packless Expansion Joints MBEJ-01:

1. Standards: ASTM F 1120 and EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."
2. Type: Circular, corrugated bellows with external tie rods.
3. Minimum Pressure Rating: 150 psig, unless otherwise indicated.
4. Configuration: Single joint with base class(es), unless otherwise indicated.
5. Expansion Joints for Copper Tubing: Single- or multi- ply phosphor-bronze bellows, copper pipe ends, and brass shrouds.
    a. End Connections for Copper Tubing NPS 2 and Smaller: Solder joint threaded.
    b. End Connections for Copper Tubing NPS 2-1/2 to NPS 4: Solder joint.
6. Expansion Joints for Steel Piping: Single- or multi- ply stainless-steel bellows, steel pipe ends, and carbon-steel shroud.
    a. End Connections for Steel Pipe NPS 2 and Smaller: Threaded.
    b. End Connections for Steel Pipe NPS 2-1/2 and Larger: Flanged.

C. Externally Pressurized Metal-Bellows Packless Expansion Joints EPEJ-01:

1. Minimum Pressure Rating: 150 psig, unless otherwise indicated.
2. Description:
    a. Totally enclosed, externally pressurized, multi-ply, stainless-steel bellows isolated from fluid flow by an internal pipe sleeve.
    b. Carbon-steel housing.
    c. Drain plugs and lifting lug for NPS 3 and larger.
    d. Bellows shall have operating clearance between the internal pipe sleeves and the external shrouds.
    e. Joints shall be supplied with a built-in scale to confirm the starting position and operating movement.
    f. Joint Axial Movement: 4 inches of compression and 0.75 inch of extension.
3. Permanent Locking Bolts: Set locking bolts to maintain joint lengths during installation. Temporary welding tabs that are removed after installation in lieu of locking bolts are not acceptable.
4. End Connection Configuration: Flanged; one raised, fixed and one floating flange.

D. Rubber Packless Expansion Joints REJ-01:

1. Standards: ASTM F 1123 and FSA's "Technical Handbook: Non-Metallic Expansion Joints and Flexible Pipe Connectors."
2. Material: Fabric-reinforced rubber complying with FSA-PSJ-703.
3. Arch Type: Single or multiple arches with external control rods.
4. Spherical Type: Single or multiple spheres with external control rods.
5. Minimum Pressure Rating for NPS 1-1/2 to NPS 4: 150 psig at 220 deg F.

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6. Material for Fluids Containing Acids, Alkalis, or Chemicals: Butyl rubber.
7. Material for Fluids Containing Gas, Hydrocarbons, or Oil: Buna-N.
8. Material for Water: Butyl rubber.
9. End Connections: Full-faced, integral steel flanges with steel retaining rings.

E. Flexible-Hose Packless Expansion Joints FHEJ-01:

1. Description: Manufactured assembly with inlet and outlet elbow fittings and two flexible-metal-hose legs joined by long-radius, 180-degree return bend or center section of flexible hose.
2. Flexible Hose: Corrugated-metal inner hoses and braided outer sheaths.
3. Expansion Joints for Copper Tubing NPS 2 and Smaller: Copper-alloy fittings with solder-joint end connections.
   a. Bronze hoses and single-braid bronze sheaths with 450 psig at 70 deg F and 340 psig at 450 deg F ratings.

4. Expansion Joints for Copper Tubing NPS 2-1/2 to NPS 4: Copper-alloy fittings with threaded end connections.
   a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 300 psig at 70 deg F and 225 psig at 450 deg F ratings.

5. Expansion Joints for Steel Piping NPS 2 and Smaller: Carbon-steel fittings with threaded end connections.
   a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 450 psig at 70 deg F and 325 psig at 600 deg F ratings.

6. Expansion Joints for Steel Piping NPS 2-1/2 to NPS 6: Carbon-steel fittings with flanged end connections.
   a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 200 psig at 70 deg F and 145 psig at 600 deg F ratings.

2.3 GROOVED-JOINT EXPANSION JOINTS

A. Description: Factory-assembled expansion joint made of several grooved-end pipe nipples, couplings, and grooved joints.

B. Standard: AWWA C606, for grooved joints.

C. Nipples: Galvanized, ASTM A 53/A 53M, Schedule 40, Type E or S, steel pipe with grooved ends.

D. Couplings: , flexible type for steel-pipe dimensions. Include ferrous housing sections, Buna-N gasket suitable for diluted acid, alkaline fluids, and cold and hot water , and bolts and nuts.

2.4 ALIGNMENT GUIDES AND ANCHORS

A. Alignment Guides AG-01:

1. Description: Steel, factory-fabricated alignment guide, with bolted two-section outer cylinder and base for attaching to structure; with two-section guiding slider for bolting to pipe.

B. Anchor Materials:

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1. Steel Shapes and Plates: ASTM A 36/A 36M.
2. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel hex head.
3. Washers: ASTM F 844, steel, plain, flat washers.
4. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, with tension and shear capacities appropriate for application.
   a. Stud: Threaded, zinc-coated carbon steel.
   b. Expansion Plug: Zinc-coated steel.
   c. Washer and Nut: Zinc-coated steel.

5. Chemical Fasteners: Insert-type stud, bonding-system anchor for use with hardened portland cement concrete, with tension and shear capacities appropriate for application.
   a. Bonding Material: ASTM C 881/C 881M, Type IV, Grade 3, two-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.
   b. Stud: ASTM A 307, zinc-coated carbon steel with continuous thread on stud, unless otherwise indicated.
   c. Washer and Nut: Zinc-coated steel.

PART 3 - EXECUTION

3.1 EXPANSION-JOINT INSTALLATION

A. Install metal-bellows expansion joints according to EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."

B. Install rubber packless expansion joints according to FSA-PSJ-703.

C. Install grooved-joint expansion joints to grooved-end steel piping.

D. Install manufactured, nonmetallic expansion joints according to FSA's "Technical Handbook: Non-Metallic Expansion Joints and Flexible Pipe Connectors."

E. Install expansion joints of sizes matching size of piping in which they are installed.

3.2 PIPE LOOP AND SWING CONNECTION INSTALLATION

A. Install pipe bends and loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.

B. Install pipe loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.

C. Connect risers and branch connections to mains with at least five pipe fittings, including tee in main.

D. Connect risers and branch connections to terminal units with at least four pipe fittings, including tee in riser.

E. Connect mains and branch connections to terminal units with at least four pipe fittings, including tee in main.

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3.3 ALIGNMENT-GUIDE AND ANCHOR INSTALLATION

A. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.

B. Install one guide(s) on each side of pipe expansion fittings and loops. Install guides nearest to expansion joint not more than four pipe diameters from expansion joint.

C. Attach guides to pipe, and secure guides to building structure.

D. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.

E. Anchor Attachments:

1. Anchor Attachment to Steel Pipe: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
2. Anchor Attachment to Copper Tubing: Attach with pipe hangers. Use MSS SP-69, Type 24; U bolts bolted to anchor.

F. Fabricate and install steel anchors by welding steel shapes, plates, and bars. Comply with ASME B31.9 and AWS D1.1/D1.1M.

1. Anchor Attachment to Steel Structural Members: Attach by welding.
2. Anchor Attachment to Concrete Structural Members: Attach by fasteners. Follow fastener manufacturer's written instructions.

G. Use grout to form flat bearing surfaces for guides and anchors attached to concrete.

END OF SECTION 22 0516

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SECTION 22 0519 - METERS AND GAGES FOR PLUMBING PIPING

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. Thermometers.
2. Gages.

1.3 ACTION SUBMITTALS

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

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

A. NSF Compliance as required by authorities having jurisdiction:

1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."
3. Comply with NSF 372, "Drinking Water System Components – Lead Content"

PART 2 - PRODUCTS

2.1 LIQUID-IN-GLASS THERMOMETERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ashcroft Inc.
2. Blue Ribbon Corp.
3. Ernst Flow Industries.
4. Marsh Bellofram.

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5. Miljoco Corporation.
6. Nanmac Corporation.
7. Noshok.
8. Palmer Wahl Instrumentation Group.
9. REOTEMP Instrument Corporation.
10. Tel-Tru Manufacturing Company.
11. Trerice, H. O. Co.
12. WATTS.
13. Weiss Instruments, Inc.
14. Weksler Glass Thermometer Corp.
15. WIKA Instrument Corporation.
16. Winters Instruments - U.S.

B. Case: Metal or plastic, 9 inches long.

C. Tube: Red or blue reading, organic-liquid filled, with magnifying lens.

D. Tube Background: Satin-faced, nonreflective aluminum with permanently etched scale markings.

E. Window: Glass or plastic.

F. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.

G. Stem: Copper-plated steel, aluminum, or brass for thermowell installation and of length to suit installation.

H. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

2.2 THERMOWELLS

A. Manufacturers: Same as manufacturer of thermometer being used.

B. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR or CUNI.
4. Material for Use with Steel Piping: CRES or CSA.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

C. Heat-Transfer Medium: Mixture of graphite and glycerin.

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2.3 PRESSURE GAGES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ametek U.S. Gauge.
2. Ashcroft Inc.
3. Blue Ribbon Corp.
4. Ernst Flow Industries.
5. Flo Fab Inc.
6. Marsh Bellofram.
7. Miljoco Corporation.
8. Noshok.
9. Palmer Wahl Instrumentation Group.
10. REOTEMP Instrument Corporation.
11. Tel-Tru Manufacturing Company.
12. Trerice, H. O. Co.
13. WATTS.
14. Weiss Instruments, Inc.
15. Weksler Glass Thermometer Corp.
16. WIKA Instrument Corporation.
17. Winters Instruments - U.S.

B. Direct-Mounting, Dial-Type Pressure Gages: Indicating-dial type complying with ASME B40.100.

1. Standard: ASME B40.100.
2. Case: Liquid-filled type, drawn steel or cast aluminum, 4-1/2-inch diameter.
3. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
4. Pressure Connection: Brass, NPS 1/4, bottom-outlet type unless back-outlet type is indicated.
5. Movement: Mechanical, with link to pressure element and connection to pointer with front recalibration.
6. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
7. Pointer: Red or other dark-color metal.
8. Window: Glass or plastic.
9. Ring: Metal.
10. Accuracy: Grade A, plus or minus 1 percent of middle half scale.
11. Vacuum-Pressure Range: 30-in. Hg of vacuum to 15 psig of pressure.
12. Range for Fluids under Pressure: Two times operating pressure.

2.4 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4, ASME B1.20.1 pipe threads and porous-metal-type surge-dampening device. Include extension for use on insulated piping.

B. Tubing: NPS 1/4(DN 8) copper.

C. Valves: Brass ball, with NPS 1/4, ASME B1.20.1 pipe threads.

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PART 3 - EXECUTION

3.1 INSTALLATIONS

A. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Install thermowells with socket extending one-third of diameter of pipe and in vertical position in piping tees where thermometers are indicated.

E. Fill thermowells with heat-transfer medium.

F. Install direct-mounting pressure gages in piping tees with pressure gage located on pipe at most readable position.

1. Provide elbows as required to install gauges at location and angle readable from standing position on floor.

G. Install valve and snubber in piping for each pressure gage for fluids.

H. Install thermometers in the following locations:

1. Inlet and outlet of each water heater.
2. Inlets and outlets of each domestic water heat exchanger.
3. Inlet and outlet of each domestic hot-water storage tank.
4. Inlet and outlet of each remote domestic water chiller.

I. Install pressure gages in the following locations:

1. Building water service entrance into building.
2. Inlet and outlet of each pressure-reducing valve.
3. Suction and discharge of each domestic water pump.

3.2 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.3 ADJUSTING

A. Adjust faces of meters and gages to proper angle for best visibility.

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3.4 THERMOMETER SCHEDULE

A. Thermometers at inlet and outlet of each domestic water heater shall be the following:

1. Test plug with EPDM self-sealing rubber inserts.

B. Thermometers at inlets and outlets of each domestic water heat exchanger shall be the following:

1. Plastic case, industrial-style, liquid-in-glass type.
2. Test plug with EPDM self-sealing rubber inserts.

C. Thermometers at inlet and outlet of each domestic hot-water storage tank shall be the following:

1. Plastic case, industrial-style, liquid-in-glass type.
2. Test plug with EPDM self-sealing rubber inserts.

D. Thermometer stems shall be of length to match thermowell insertion length.

3.5 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Domestic Cold-Water Piping: 0 to 100 deg F.

B. Scale Range for Domestic Hot-Water Piping: 30 to 240 deg F.

3.6 PRESSURE-GAGE SCHEDULE

A. Pressure gages at discharge of each water service into building shall be the following:

1. Sealed, direct-mounted, plastic case.
2. Test plug with EPDM self-sealing rubber inserts.

B. Pressure gages at inlet and outlet of each water pressure-reducing valve shall be the following:

1. Sealed, direct-mounted, plastic case.
2. Test plug with EPDM self-sealing rubber inserts.

C. Pressure gages at suction and discharge of each domestic water pump shall be the following:

1. Sealed, direct-mounted, plastic case.
2. Test plug with EPDM self-sealing rubber inserts.

3.7 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Water Service Piping: 0 to 160 psi.

B. Scale Range for Domestic Water Piping: 0 to 160 psi.

END OF SECTION 22 0519

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SECTION 22 0523 – GENERAL DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Bronze ball valves.
2. Bronze swing check valves.

B. Related Sections:

1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

1.2 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene-diene terpolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Nonrising stem.

E. OS&Y: Outside screw and yoke.

F. RS: Rising stem.

1.3 ACTION SUBMITTALS

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

1. Certification that products comply with NSF 61 Annex G and NSF 372.

1.4 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
2. ASME B31.9 for building services piping valves.

C. NSF Compliance as required by authorities having jurisdiction:

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1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."
3. Comply with NSF 372, "Drinking Water System Components – Lead Content"

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect valve ends from damage.
3. Set ball valves open to minimize exposure of functional surfaces.
4. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. Refer to valve schedule articles for applications of valves.

C. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
4. ASME B16.18 for solder joint.
5. ASME B31.9 for building services piping valves.

D. NSF Compliance: NSF 61 and NSP 372 for valve materials for potable-water service.

E. Drinking Water System Components - Health Effects and Drinking Water System Components - Lead Content Compliance: NSF 61 and NSF 372.

F. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

G. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

H. Valve Sizes: Same as upstream piping unless otherwise indicated.

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I. Valve Bypass and Drain Connections: MSS SP-45.

J. Valve Actuator Types:

1. Handwheel: For valves other than quarter-turn types.
2. Handlever: For quarter-turn valves NPS 6 and smaller except plug valves.
3. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 3 plug valves, for each size square plug-valve head.

K. Valves in Insulated Piping: Valves in domestic cold water lines with more than 1/2-inch insulation shall include the following:

1. Ball Valves: Stem extensions or extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

L. Valve-End Connections:
1. Solder Joint: With sockets according to ASME B16.18.
2. Threaded: With threads according to ASME B1.20.1.

2.2 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Apollo Flow Controls; Conbraco Industries, Inc.
b. Crane; Crane Energy Flow Solutions.
c. FNW; Ferguson Enterprises, Inc.
d. Hammond Valve.
e. Jomar.
f. Lance Valves.
g. Milwaukee Valve Company.
h. NIBCO INC.
i. WATTS.
j. Zurn Industries, LLC.

2. Description:

a. Standard: MSS SP-110 or MSS-145.
b. CWP Rating: 600 psig.
c. Body Design: Two piece, threaded.
d. Body Material: Bronze or.
e. Ends: Threaded, press, and soldered.
f. Press Ends Connections Rating: Minimum 200 psig.
g. Seats: PTFE.
h. Stem: Bronze.
i. Port: Full.

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2.3 IRON, LUG TYPE BUTTERFLY VALVES

A. 200 CWP, Iron, Single-Flange Butterfly Valves with Aluminum-Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Description:

2.4 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. American Valve, Inc.
   b. Apollo Flow Controls; Conbraco Industries, Inc.
   c. Crane; Crane Energy Flow Solutions.
   d. Hammond Valve.
   e. Jenkins Valves; Crane Energy Flow Solutions.
   f. KITZ Corporation.
   g. Macomb Groups (The).
   h. Milwaukee Valve Company.
   i. NIBCO INC.
   j. Powell Valves.
   k. Red-White Valve Corp.
   l. Stockham; Crane Energy Flow Solutions.
   m. WATTS.

2. Description:
   a. Standard: MSS SP-80, Type 3.
   b. CWP Rating: 200 psig.
   c. Body Design: Horizontal flow.
   d. Body Material: ASTM B 62, bronze.
   e. Ends: Threaded.
   f. Disc: Bronze.

B. Class 125, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. American Valve, Inc.
   b. Apollo Valves.
   c. Crane.
   d. Hammond Valve.
   e. Jenkins Valves; Crane Energy Flow Solutions.
   f. KITZ Corporation.
   g. Macomb Groups (The).
   h. Milwaukee Valve Company.
   i. NIBCO INC.
   j. Powell Valves.
   k. Stockham; Crane Energy Flow Solutions.

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l. WATTS.

2. Description:

a. Standard: MSS SP-139.
b. CWP Rating: 200 psig(1380 kPa).
c. Body Design: Horizontal flow.
d. Body Material: Bronze.
e. Ends: Threaded, press, or soldered. See valve schedule articles.
f. Press Ends Connection Rating: Minimum 200 psig
g. Disc: Bronze.

2.5 IRON SWING CHECK VALVES

A. Class 150, Iron Swing Check Valves with Metal Seats:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Description:

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Locate valves for easy access and provide separate support where necessary.

B. Install valves with unions at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Check Valves: Install check valves for proper direction of flow.

1. Swing Check Valves: In horizontal position with hinge pin level.

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F. Install valve tags. Comply with requirements in Section 22 0553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

3.3 ADJUSTING

A. Adjust or replace leaking valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Pump-Discharge Check Valves:

a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.

B. End Connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded or soldered or press-ends.
2. For Steel Piping, NPS 2 and Smaller: Threaded.

C. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Ball Valves:

a. Two piece, full port, bronze with bronze trim.
b. May be provided with solder-joint ends instead of threaded ends.

2. Check Valves:

a. Bronze swing check valves with bronze disc, Class 125, with soldered or threaded end connections.
b. Bronze swing check valves with press-end connections.

B. Pipe NPS 2-1/2 and Larger:

1. Butterfly Valves:
2. Check Valves:

3.6 VALVE APPLICATIONS:

A. Domestic Water:

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1. Shutoff Service: Ball and butterfly valves.
2. Throttling Service: Ball and butterfly valves.
3. Check Valves:

    a. NPS 2(DN 50) and Smaller: Bronze swing check valves with nonmetallic disc.

END OF SECTION 22 0523

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SECTION 22 0529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

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. This Section includes the following:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.

B. Related Requirements:

1. See Division 21 fire-suppression sections for pipe hangers for fire-suppression piping.
2. Section 05 5000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

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PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
2. Standard: MFMA-4.
3. Channels: Continuous slotted steel channel with inturned lips.
4. Channel Width: Selected for applicable load criteria.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Non-MFMA Manufacturer Metal Framing Systems:

1. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
2. Standard: Comply with MFMA-4.
3. Channels: Continuous slotted steel channel with inturned lips.
4. Channel Width: Select for applicable load criteria.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.4 THERMAL-HANGER SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength and vapor barrier.

B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.

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C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type anchors, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Indoor Applications: Zinc-coated steel.
2. Outdoor Applications: Stainless steel.

2.6 MISCELLANEOUS MATERIALS

A. Aluminum: ASTM B 221.

B. Carbon Steel: ASTM A 1011/A 1011M.

C. Structural Steel: ASTM A 36/A 36M carbon-steel plates, shapes, and bars; black and galvanized.

D. Stainless Steel: ASTM A 240/A 240M.

E. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with requirements in Section 07 8413 "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.

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.

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3.2 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size, or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install powder-actuated fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

H. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, and at changes in direction of piping.

K. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.

M. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.
   a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.

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b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
c. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
   a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:
   a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.

5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches maximum.

3.5 PAINTING

A. Touchup: Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately after erecting hangers and supports. Use same materials as those used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

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1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded, shop-painted areas on miscellaneous metal are specified in Section 09 9123 "Interior Painting."

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A 780/A 780M.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

F. Use thermal-hanger shield inserts for insulated piping and tubing.

G. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
5. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
6. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
7. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
8. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
9. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
10. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

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H. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

I. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.

J. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
2. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
3. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
4. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
5. C-Clamps (MSS Type 23): For structural shapes.
6. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
   a. Light (MSS Type 31): 750 lb.
   b. Medium (MSS Type 32): 1500 lb.
   c. Heavy (MSS Type 33): 3000 lb.
8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

K. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

L. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.

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M. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

N. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

O. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

1. Use powder-actuated fasteners only in concrete construction that is suitable for their installation.

P. Use pipe-positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 22 0529

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SECTION 22 0553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

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. Equipment labels.
2. Pipe labels.
3. Stencils.
4. Valve tags.

1.3 ACTION SUBMITTALS

A. Valve Schedules: For each piping system.

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 locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

1.5 QUALITY ASSURANCE

A. Comply with ANSI A13.1 “Pipe Labeling Guide” for color scheme, length of field and letter height.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: Black.

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3. Background Color: White.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
   a. Size of label shall be proportional to equipment size.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number.

2.2 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic label including flow arrow formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic label with contact-type, permanent-adhesive backing. Include flow arrow label with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service matching designations or abbreviations as used on Drawings.

2.3 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.

1. Stencil Material: Fiberboard or metal.
2. Stencil Paint: Exterior, gloss, black enamel unless otherwise indicated. Paint may be in pressurized spray-can form.
3. Identification Paint: Exterior enamel in colors according to ASME A13.1 unless otherwise indicated.

2.4 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link or beaded chain; or S-hook.

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B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Provide glass front frame for each valve schedule for mounting in building mechanical room.
2. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 GENERAL INSTALLATION REQUIREMENTS

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 locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

A. Pipe Label Applications: Install pipe labels as follows:

1. Use pretensioned pipe labels or self-adhesive pipe labels.

B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

C. Locate pipe labels where piping is concealed above ceilings or exposed in unfinished mechanical rooms; accessible maintenance spaces such as shafts, tunnels, and plenums as follows:

1. Near each valve and control device.

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2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run.

D. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

3.5 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Install glass front frame valve schedule in building mechanical room. Locate at Owners representative approved location.

END OF SECTION 22 0553

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SECTION 22 0700 - PLUMBING INSULATION

PART 1 - GENERAL

1.1

1.2 RELATED DOCUMENTS

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

1.3 SUMMARY

A. Section includes insulation materials for plumbing systems:

B. Related Sections:

1. Division 23 Section "HVAC Insulation."

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated below. Include thermal conductivity, water-vapor permeance, thickness, and jackets (if any).

1. Insulation Materials:
   a. Mineral fiber.
   b. Flexible elastomeric.

2. Field-applied jackets.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

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1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 22 0529 "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application.

1. Establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

D. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

E. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Aeroflex USA, Inc.
   b. Armacell LLC.
   c. K-Flex USA.

F. Mineral-Fiber, Preformed Pipe Insulation:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Johns Manville.

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b. Knauf Insulation.
c. Manson Insulation Inc.
d. Owens Corning.

2. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ or ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

B. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

D. ASJ Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

E. PVC Jacket Adhesive: Compatible with PVC jacket.

2.4 MASTICS AND COATINGS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

B. Vapor-Retarder Mastic: Water based; suitable for indoor use on below ambient services.

1. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation type and service conditions.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
4. Comply with MIL-PRF-19565C, Type II, for permeance requirements.
5. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Water-Vapor Permeance: ASTM 96, greater than 1.0 perm at manufacturer's recommended dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Color: White.

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2.5 SEALANTS

A. Joint Sealants for Cellular-Glass Products:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F.
4. Color: White or gray.

B. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

2.7 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Fitting Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Adhesive: As recommended by jacket material manufacturer.
2. Color: White.
3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
   a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, and mechanical joints.

C. Self-Adhesive Outdoor Jacket: Minimum 40-mil- thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a crosslaminated polyethylene film covered with aluminum-foil facing.

1. Coordinate color of optional colors with Architect and Owner.
2. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Polyguard; Alumaguard.
   b. MFM Building Products; Flex Clad 400

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2.8 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.

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.

2.9 SECUREMENTS

A. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

B. Wire: 0.062-inch soft-annealed, stainless steel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids including fittings, valves, and specialties.

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B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item as specified in insulation system schedules.

C. 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.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. 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.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. 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 and outward clinching staples along both edges of strip, spaced 4 inches o.c.
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. Staple laps with outward clinching staples along edge at 2 inches o.c.
    a. For below-ambient services, apply vapor-barrier mastic over staples.
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.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

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N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

O. 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. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations:

B. 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 at roof structure and seal with joint sealant.

C. Insulation Installation at Aboveground Exterior 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.
3. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
4. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
5. 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.

1. Comply with requirements in Division 07 Section "Penetration Firestopping" 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 07 8413 "Penetration Firestopping."

3.5 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.

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B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. 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.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

1. Flexible elastomeric pipe insulation only allowed in concealed or mechanical room locations.

B. Insulation Installation on Roof Drain Sumps:

1. Install pipe insulation to bottom of roof drain sumps.
2. Secure insulation to roof drain sumps and seal seams with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Roof Drain Bodies:

1. Install pipe insulation to bottom of roof drain bodies exposed within building.
2. Secure insulation to roof drain bodies and seal seams with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. 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 manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

E. 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.

F. 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.

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3.7 INSTALLATION OF MINERAL-FIBER 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 above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, 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 wire or 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.

3.8 FIELD-APPLIED JACKET INSTALLATION

A. Where PVC fitting jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturers recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
2. Fill inside of fitting jackets to prevent collapse of jacket.

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3.9 FINISHES

A. Paintable Jacket Material: Paint jacket with paint system identified in Division 09 painting Sections.

B. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 09 9113 "Exterior Painting" and Section 09 9123 "Interior Painting."

3.10 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable pipe insulation materials and thicknesses are identified for each piping system and pipe size range.

1. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Chrome-plated pipes and fittings.
2. Underground piping.

3.11 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. NPS 1 and Smaller: Insulation shall be one of the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
   b. Flexible Elastomeric: 1/2 inch thick.

2. NPS 1-1/4 and Larger: Insulation shall be one of the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
   b. Flexible Elastomeric: 1 inch thick.

B. Domestic Hot and Recirculated Hot Water:

1. NPS 1 and Smaller: Insulation shall be one of the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
   b. Flexible Elastomeric: 1 inch thick.

2. NPS 1-1/4 and Larger: Insulation shall be one of the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inch thick.
   b. Flexible Elastomeric: 1-1/2 inch thick.

C. Overflow Storm Water:

1. All Pipe Sizes: Vertical line up to drain body and all piping to point of building exit insulation shall be one of the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
   b. Flexible Elastomeric: 1 inch thick.

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D. Storm Water:

1. All Pipe Sizes: Vertical line up to drain body and runs within 30 Feet of drain body insulation shall be one of the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
   b. Flexible Elastomeric: 1 inch thick.

E. Roof Drain and Overflow Drain Bodies:

1. All Pipe Sizes: Insulation shall be one of the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
   b. Flexible Elastomeric: 1 inch thick.

F. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:

1. All Pipe Sizes: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.

G. Floor Drains, Traps, and Sanitary Drain Piping within 20 Feet of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F:

1. All Pipe Sizes: Insulation shall be one of the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
   b. Flexible Elastomeric: 1 inch thick.

3.12 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. Pipe Fittings with Mineral Fiber Insulation:

1. PVC Fitting Covers: 20 mils thick, white.

C. Exposed Vertical Piping within 8 feetof Floor:

3.13 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION 22 0700

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SECTION 22 0800 - COMMISSIONING OF PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes commissioning process requirements for plumbing systems, assemblies, and equipment.

B. Related Sections:

1. Division 01 Section "General Commissioning Requirements" for general commissioning requirements.
2. Division 23 Section "Commissioning of HVAC" for HVAC commissioning requirements.
3. Division 26 Section "Commissioning of Electrical" for electrical commissioning requirements.

1.2 ABBREVIATIONS

A. Refer to Division 01 Section “General Commissioning Requirements” for list of abbreviations used in the Specifications and in the Commissioning Plan.

1.3 DEFINITIONS

A. Refer to Division 01 Section “General Commissioning Requirements” for list of definitions used in the Specifications and in the Commissioning Plan.

1.4 COORDINATION

A. Refer to Division 01 Section “General Commissioning Requirements” for requirements pertaining to coordination during the commissioning process.

1.5 COMMISSIONING PROCESS

A. Refer to Division 01 Section “General Commissioning Requirements” for requirements pertaining to the commissioning process.

1.6 COMMISSIONING TEAM RESPONSIBILITIES

A. Provide information requested by the CxA for final commissioning documentation.

1. Test reports

B. Assist the CxA in all verification and functional performance tests.

C. Refer to Division 01 Section “General Commissioning Requirements” for additional requirements pertaining to the contractor responsibilities.

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1.7 SYSTEMS TO BE COMMISSIONED

A. Any plumbing equipment or systems that are monitored and or controlled by Building Management System will be commissioned with no sampling methods.

B. Refer to Division 01 Section “General Commissioning Requirements” for plumbing systems to be commissioned.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. Refer to Division 01 Section “General Commissioning Requirements” for test equipment requirements.

PART 3 - EXECUTION

3.1 MEETINGS

A. Refer to Division 01 Section “General Commissioning Requirements” for meeting requirements.

3.2 START-UP, PREFUNCTIONAL CHECKLISTS AND INITIAL CHECKOUT

A. No commissioning checklists will be required to be completed by Plumbing contractor.

B. Refer to Division 01 Section “General Commissioning Requirements” for additional participation requirements for start-up, prefucntional checklists and initial checkout.

3.3 FUNCTIONAL PERFORMANCE TESTING

A. Sampling: No sampling of any equipment will be permitted. All equipped or types referenced in Division 01 Section “General Commissioning Requirements” will be 100% sample rate regardless of qty or size of equipment or system.

B. Refer to Division 01 Section “General Commissioning Requirements” for additional participation requirements for functional performance testing.

3.4 DOCUMENTATION, NON-CONFORMANCE AND APPROVAL OF TESTS

A. Refer to Division 01 Section “General Commissioning Requirements” for approval procedures.

3.5 DEFERRED TESTING

A. Refer to Division 01 Section “General Commissioning Requirements” for requirements pertaining to deferred testing.

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3.6 WRITTEN WORK PRODUCTS

A. Refer to Division 01 Section “General Commissioning Requirements” for requirements pertaining to written work products related to the commissioning process.

END OF SECTION 22 0800

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SECTION 22 1116 - DOMESTIC WATER PIPING

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. This Section includes domestic water piping inside the building.

B. Related Sections include the following:

1. Division 22 Section "Facility Water Distribution Piping" for water-service piping outside the building from source to the point where water-service piping enters the building.
2. Division 22 Section "Facility Water Distribution Piping" for water-service piping and water meters outside the building from source to the point where water-service piping enters the building.

1.3 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing domestic water piping systems with 125 psig, unless otherwise indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Water Samples: Specified in Part 3 "Cleaning" Article.

B. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for potable domestic water piping and components.

C. Comply with NSF 372, "Drinking Water System Components – Lead Content" for potable domestic water piping and components.

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1.6 FIELD CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Construction Manager no fewer than two days in advance of proposed interruption of water service.
2. Do not interrupt water service without Construction Manager's written permission.

1.7 REGULATORY REQUIREMENTS

A. Comply with the provisions of the following:

1. Kentucky State Plumbing Code.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372.

C. Transition Couplings for Aboveground Pressure Piping: Coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.2 COPPER TUBE AND FITTINGS

A. Soft Copper Tube: ASTM B 88, Types K , water tube, annealed temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.

B. Hard Copper Tube: ASTM B 88, Types L , water tube, drawn temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought- copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.
3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
4. Copper, Grooved-End Fittings: ASTM B 75 copper tube or ASTM B 584 bronze castings.
   a. Grooved-End-Tube Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections, gasket suitable for domestic water, and bolts and nuts.

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b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1) Anvil International, Inc.
   2) Victaulic Company of America.
   3) Tyco/Grinnell.

2.3 PEX TUBE AND FITTINGS

A. PEX Distribution System: Crosslinked polyethylene (PEX), manufactured in accordance with ASTM F876 and ASTM F877.

1. Fittings: ASTM F1960 metal cold expansion or ASTM F 1807, metal insert and crimp rings.
2. Pressure/Temperature Rating: Minimum 100 psig and 180 deg F.
3. Provide pre-insulated PEX for underslab applications.

2.4 MECHANICAL JOINT COPPER PRESS FITTING SYSTEM

A. At the Installer's option, mechanical joint copper press fitting system using Type L copper tubing may be used for 4 inch and smaller above ground domestic water systems in lieu of soldered or threaded connections as specified.

B. Provide manufacturer’s standard mechanical joint copper press fittings and couplings which are suitable for the temperature range and operating pressures specified for each system and have the approval of state and local codes having jurisdiction.

C. Fittings shall conform to the material and sizing requirements of ASME B16.18 or ASME B16.22. O-rings for fittings shall be EPDM.

D. Manufacturers: Subject to compliance with requirements, provide product by one of the following:

1. Ridgid/Viega “ProPress”
2. NIBCO “Press”
3. Apollo “Xpress”

2.5 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials:

1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
2. Full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys.

D. Flux: ASTM B 813, water flushable.

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E. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.6 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Standard: ASSE 1079.
2. Pressure Rating: 125 psig minimum at 180 deg F.
3. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Standard: ASSE 1079.
2. Factory-fabricated, bolted, companion-flange assembly.
3. Pressure Rating: 125 psig minimum at 180 deg F.
4. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

1. Nonconducting materials for field assembly of companion flanges.
2. Pressure Rating: 150 psig.
3. Gasket: Neoprene or phenolic.
4. Bolt Sleeves: Phenolic or polyethylene.
5. Washers: Phenolic with steel backing washers.

E. Dielectric Nipples:

1. Standard: IAPMO PS 66.
2. Electroplated steel nipple complying with ASTM F 1545.
3. Pressure Rating and Temperature: 300 psig at 225 deg F.
4. End Connections: Male threaded or grooved.
5. Lining: Inert and noncorrosive, propylene.

2.7 VALVES

A. General-duty valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

B. Balancing and drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."

2.8 PIPE COVER SYSTEM

A. Description: Factory-fabricated vertical and horizontal steel pipe cover system with concealed surface mounted attachments for concealment of piping and its supports and insulation.

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1. Cover system shall incorporate a concealed snap-lock connection which, once assembled, renders the cover essentially irremovable with the use of ordinary tools.

B. Cover: Smooth in appearance and made of 18-gauge powder coated steel.

1. Color: Architect to select from manufactures full range of standard colors.

C. Manufacturers: Grice Engineering, Interlock or Arsco Manufacturing, JG Innovations.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Comply with requirements in Section 31 2000 "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

A. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."

B. Install under-building-slab copper tubing according to CDA's "Copper Tube Handbook."

C. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing."

D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Pressure gages are specified in Division 22 Section "Meters and Gages for Plumbing Piping," and drain valves and strainers are specified in Division 22 Section "Domestic Water Piping Specialties."

1. Include a backflow preventer as required by local authority having jurisdiction.

E. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.

F. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 22 1119 "Domestic Water Piping Specialties."

G. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 22 1123 "Domestic Water Pumps."

H. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Section 22 0519 "Meters and Gages for Plumbing Piping."

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3.3 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."

B. 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. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

C. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

D. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

E. Grooved Joints: Assemble joints with grooved-end-pipe or grooved-end-tube coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

F. Press Connections: Copper press fitting connections shall be made in accordance with the manufacturer's installation instructions. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool approved by the manufacturer.

G. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

H. Joints for PEX Tubing: Join according to ASTM F 1807 for metal insert and copper crimp ring fittings and ASTM F 1960 for cold expansion fittings and reinforcing rings.

3.4 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.

3.5 WATER METER INSTALLATION

A. Rough-in domestic water piping for water meter connection according to utility company's requirements.

B. Water meters will be furnished and installed by utility company.

C. Install water meters according to AWWA M6 and utility's requirements.

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3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger, support products, and installation in Section 22 0529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Individual, Straight, Horizontal Piping Runs: According to the following:
   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch.

E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
4. NPS 2-1/2: 108 inches with 1/2-inch rod.

F. Install supports for vertical copper tubing every 10 feet.

G. Install vinyl-coated hangers for PEX tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1 and Smaller: 32 inches with 3/8-inch rod.

H. Install hangers for vertical PEX tubing every 48 inches.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

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3.8 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 22 0553 "Identification for Plumbing Piping and Equipment."

3.9 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Inspect domestic water piping as follows:
   a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
   b. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
      1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
      2) Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
   c. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
   d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Test domestic water piping as follows:
   a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
   b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
   c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
   d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

B. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.

C. Prepare reports for tests and required corrective action.

3.10 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.

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4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
   a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
   b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.11 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new domestic water piping before using.
2. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.
3. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as described below:
   a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
   b. Fill and isolate system according to either of the following:
      1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
      2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
   c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
   d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Prepare and submit reports of purging and disinfecting activities.

3.12 PIPE AND FITTING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

B. Flanges may be used on aboveground piping, unless otherwise indicated.

C. Grooved joints may be used on aboveground grooved-end piping.

D. Under Building Slab Domestic Water Piping to Island Sinks:

1. Pre-Insulated PEX Tube; fittings for PEX tube; and crimped or cold expansion joints.

E. Aboveground Domestic Water Piping: Use any of the following piping materials for each size range:

1. NPS 1/4 and Smaller for Dishwasher, Coffee Maker, and Refrigerator Final Connection: Soft copper tube, Type L; copper fittings; and soldered or compression joints.

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2. NPS 1 and Smaller: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
3. NPS 1-1/4 and NPS 1-1/2: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
4. NPS 2: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
5. NPS 2-1/2 : Hard copper tube, Type L; copper pressure fittings; and soldered joints.
6. NPS 2: Hard copper tube, Type L with grooved ends; copper grooved-end fittings; grooved-end-tube couplings; and grooved joints.
7. NPS 2-1/2 : Hard copper tube, Type L with grooved ends; copper grooved-end fittings; grooved-end-tube couplings; and grooved joints.

F. At Installer's option for aboveground domestic water piping, install Type L, drawn copper tube with mechanical joint copper press fittings for pipe sizes 4 inches and smaller.

1. Valves with bodies meeting requirements of Section "General Duty valves for Plumbing Piping" may be used in mechanical joint copper press systems

3.13 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use bronze ball valves for piping NPS 2 and smaller. Use cast-iron butterfly valves with flanged ends for piping NPS 2-1/2 and larger.
2. Throttling Duty: Use bronze ball valves for piping NPS 2 and smaller. Use cast-iron butterfly valves with flanged ends for piping NPS 2-1/2 and larger.
3. Hot-Water-Piping, Balancing Duty: Calibrated balancing valves.
4. Drain Duty: Hose-end drain valves.

B. Cast-iron, grooved-end valves may be used with grooved-end piping.

C. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, on each water supply to plumbing fixtures that do not have supply stops and on each water supply to plumbing fixtures that do have supply stops but where take off from main or branch is not in the same room.

D. Use check valves to maintain correct direction of domestic water flow to and from equipment.

E. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping.

1. Install hose-end drain valves at low points in water mains, risers, and branches.

F. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow. Calibrated balancing valves are specified in Division 22 Section "Domestic Water Piping Specialties."

END OF SECTION 22 1116

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SECTION 22 1119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 HYPERLINK "http://contact.arcomnet.com/ContentContact.aspx?sect=221119&ver=09/01/17&format=FL&sid=13860" 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. This Section includes the following domestic water piping specialties:

1. Backflow preventers.
2. Calibrated balancing valves.
3. Temperature-actuated water mixing valves.
4. Strainers.
5. Outlet boxes.
6. Wall hydrants.
7. Drain valves.
8. Water hammer arresters.

B. Related Sections include the following:

1. Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers and pressure gages in domestic water piping.
2. Division 22 Section "Sanitary Waste Piping Specialties" for trap seal protection device.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

B. Backflow preventer assembly test reports.

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1.6 QUALITY ASSURANCE

A. NSF Compliance as required by authorities having jurisdiction:

1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."
3. Comply with NSF 372, "Drinking Water System Components – Lead Content"

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Potable-water piping and components shall comply with NSF 61 and NSF 14.

B. Comply with NSF 372 for low lead.

2.2 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Ames Co.
   b. Conbraco Industries, Inc.; Apollo Valves.
   c. FEBCO; SPX Valves & Controls.
   d. Watts Industries, Inc.; Water Products Div.
   e. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
5. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
7. Accessories:
   a. Valves: Ball type with threaded ends on inlet and outlet ofNPS 2 and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
   b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

B. Beverage-Dispensing-Equipment Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Conbraco Industries, Inc.
   b. Watts Industries, Inc.; Water Products Div.
   c. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1022.
3. Operation: Continuous-pressure applications.
4. Size: NPS 1/4 or NPS 3/8.

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5. Body: Stainless steel.
6. End Connections: Threaded.

2.3 CALIBRATED BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Bell & Gossett.
   b. Taco, Inc.
   c. Armstrong International, Inc.
   d. Tour Andersson.
   e. Apollo Valves.
   f. Watts Industries, Inc.; Water Products Div.

2. Type: Ball valve with two readout ports and memory setting indicator.
3. Body: Bronze.
4. Size: Same as connected piping, but not larger than NPS 2.

2.4 TEMPERATURE-ACTUATED WATER MIXING VALVES

A. Primary, Thermostatic, Water Mixing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Apollo/Conbraco Industries, Inc.
   b. Armstrong International, Inc.
   c. Lawler Manufacturing Company, Inc.
   d. Leonard Valve Company.
   e. Powers; a Watts Industries Co.
   f. Symmons Industries, Inc.

2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig.
4. Type: Exposed-mounting, thermostatically controlled water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded union inlets and outlet.
7. Accessories: Manual temperature control, dial thermometer, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Valve Pressure Rating: 125 psig minimum, unless otherwise indicated.
9. Valve Finish: Rough bronze.
10. Piping Finish: Copper.

B. Individual-Fixture, Water Tempering Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Acorn Controls.
   b. Cash Acme.
   c. Apollo/Conbraco Industries, Inc.
   d. Honeywell Water Controls.

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e. Lawler Manufacturing Company, Inc.
f. Leonard Valve Company.
g. Powers; a Watts Industries Co.
h. Watts Industries, Inc.; Water Products Div.
i. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1070, thermostatically controlled water tempering valve.
3. Pressure Rating: 125 psig minimum, unless otherwise indicated.
4. Body: Bronze or brass body with corrosion-resistant interior components.
5. Temperature Control: Adjustable.
6. Inlets and Outlet: Threaded with integral check valves.
7. Finish: Rough or chrome-plated bronze.
8. Tempered-Water Setting: 110 deg F.

2.5 STRAINERS FOR DOMESTIC WATER PIPING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ames.
2. Apollo.
3. Watts.
4. Mueller
5. Wilkins.

B. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum, unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2(DN 65) and larger.
4. Screen: Stainless steel with round perforations, unless otherwise indicated.
5. Perforation Size:
   a. StrainersNPS 2 and Smaller: 0.020 inch.
   b. Strainers NPS 2-1/2 to NPS 4: 0.062 inch.
   c. Strainers NPS 5 and Larger: 0.10 inch.

6. Drain: Pipe plug for NPS 2 and smaller; Factory-installed, hose-end drain valve for NPS 2-1/2 and larger.

2.6 OUTLET BOXES

A. Ice Maker Outlet Boxes:

1. Mounting: Recessed.
2. Material and Finish: Enameled-steel or epoxy-painted-steel or plastic box and faceplate.
3. Supply Shutoff Fittings: NPS 1/4 quarter turn ball valve, chrome plated.

2.7 HOSE BIBBS

A. Close Coupled Wall Hydrant (Hose Bibb):

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1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Josam Company.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   d. Tyler Pipe; Wade Div.
   e. Watts Drainage Products Inc.
   f. Woodford Manufacturing Company.
   g. Zurn Plumbing Products Group.

2. Basis of Design: Woodford B75.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Inlet: NPS 3/4 .
6. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
7. Box: Slim, flush mounting with cover.
8. Box and Cover Finish: Chrome plated.
9. Operating Keys(s): One with each wall hydrant.

B. Hose Bibbs:

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig.
7. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Service Areas: Rough bronze.
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle or operating key.
12. Operation for Service Areas: Wheel handle.
13. Operation for Finished Rooms: Operating key.
14. Include operating key with each operating-key hose bibb.
15. Include wall flange with each chrome- or nickel-plated hose bibb.

2.8 WALL HYDRANTS

A. Nonfreeze Wall Hydrants (NFWH):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Josam Company.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   d. Tyler Pipe; Wade Div.
   e. Watts Drainage Products Inc.
   f. Woodford Manufacturing Company.
   g. Zurn Plumbing Products Group.

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2. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
3. Standard: ASME A112.21.3M for exposed-outlet, self-draining wall hydrants.
4. Pressure Rating: 125 psig.
5. Operation: Loose key.
6. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
7. Inlet: NPS 3/4 or NPS 1.
8. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
9. Box: Deep, flush mounting with cover.
10. Box and Cover Finish: Polished nickel bronze.
11. Box and Cover Finish: Chrome plated**.**
12. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
13. Nozzle and Wall-Plate Finish: Polished nickel bronze.
14. Nozzle and Wall-Plate Finish: Rough bronze.
15. Operating Keys: Two with each wall hydrant.

2.9 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

B. Gate-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-80 for gate valves.
2. Pressure Rating: Class 125.
3. Size: NPS 3/4.
4. Body: ASTM B 62 bronze.
5. Inlet: NPS 3/4 threaded or solder joint.
6. Outlet: Garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.10 WATER HAMMER ARRESTERS

A. Water Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Josam Company.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.

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d. Tyler Pipe; Wade Div.
e. Watts.
f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Metal bellows.
4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
3. Do not install bypass piping around backflow preventers.
4. Register each backflow preventer with the local jurisdiction for ongoing testing.

C. Install calibrated balancing valves in locations where they can easily be adjusted.

D. Install primary temperature-actuated water mixing valves in accordance with manufacturer’s requirements, and with shutoff valves on inlets and with shutoff valve on outlet.

E. Install Y-pattern strainers for water on supply side of each inline pump and elsewhere as indicated.

F. Install individual water tempering valves at each connection to barrier-free lavatories and sinks in accordance with manufacturers' recommendations and in compliance with the plumbing code and authority having jurisdiction.

G. Outlet Boxes: Install boxes recessed in wall or surface mounted on wall. Install 2-by-4-inch fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Section 06 1000 "Rough Carpentry."

H. Install water hammer arresters in water piping according to PDI-WH 201.

I. Install nonfreeze wall hydrants with valve body within building, not within outside wall.

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3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and prepare test reports:

1. Test each backflow preventer according to authorities having jurisdiction and the device's reference standard.
2. Test each domestic water piping specialty according to authorities having jurisdiction and the device's reference standard.

B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.4 ADJUSTING

A. Set field-adjustable flow set points of calibrated balancing valves.

B. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION 22 1119

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SECTION 22 1123 - DOMESTIC WATER PUMPS

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. This Section includes the following all-bronze and bronze-fitted centrifugal pumps for domestic water circulation:

1. Wet rotor circulator with ECM

B. Terminology used in this Section is from HI 1.1-1.2 and HI 5.1-5.6.

1.3 DEFINITIONS

A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include materials of construction, rated capacities, certified performance curves with operating points plotted on curves, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water pumps to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of domestic water pumps and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. UL Compliance: Comply with UL 778 for motor-operated water pumps.

D. NSF Compliance as required by authorities having jurisdiction:

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1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."
3. Comply with NSF 372, "Drinking Water System Components – Lead Content"

1.7 DELIVERY, STORAGE, AND HANDLING

A. Retain shipping flange protective covers and protective coatings during storage.

B. Protect bearings and couplings against damage.

C. Comply with pump manufacturer's written rigging instructions for handling.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 WET ROTOR INLINE PUMPS

A. Manufacturers:

1. Bell & Gossett.

B. Basis of Design: Bell & Gossett Model ecocirc XL.

C. Description: Factory-assembled and -tested, wet rotor in-line pumps with ECM motor and integrated variable frequency drive.

1. Pump and Motor Assembly: Motor and impeller on common shaft and designed for installation with pump and motor shaft mounted horizontally.
2. Casing: Lead-free bronze, with companion-flange connections.
3. Impeller: Plastic or stainless steel.
4. Shaft: Stainless steel.
5. Rotor: Permanent magnet.
6. Bearing: Carbon sleeve.
7. Gasket/O-Ring: EPDM.
8. All Other Wetted Parts: Stainless steel.
9. Motor Type: Electronically commutated motor /permanent magnet and includes:
    a. Class F motor insulation.
    b. Integrated motor protection against over/under voltage, over temperature of motor and/or electronics, over current, locked rotor and dry run (no load condition).

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10. Integrated Variable Frequency Drive: Tested as one unit by the manufacturer and includes:
    a. MODBUS or BACnet connections built into the VFD as standard.
    b. Analog inputs, such as 0-10V and 4-20mA inputs built into the VFD.

11. Maximum Working Pressure: 175 psi.
12. Maximum Working Temperature: 230°F.

2.3 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 22 0500 "Common Motor Requirements for Plumbing Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

2.4 CONTROLS

A. Thermostats: Electric; adjustable for control of hot-water circulation pump.

1. Manufacturers:
    a. Honeywell International, Inc.
    b. Square D.
    c. White-Rodgers Div.; Emerson Electric Co.

2. Type: Strap-on sensor for installation on hot-water circulation piping.
3. Operation of Pump: On or off.
4. Power Requirement: 120 V, ac.
5. Settings: Start pump at 100 deg F and stop pump at 120 deg F.

2.5 FLEXIBLE CONNECTORS

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of domestic-water-piping system to verify actual locations of connections before pump installation.

3.2 PUMP INSTALLATION

A. Comply with HI 1.4.

B. Install pumps with access for periodic maintenance including removal of motors, impellers, couplings, and accessories.

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C. Install horizontally mounted, in-line, separately coupled and close-coupled centrifugal pumps with shaft(s) horizontal.

D. Pump Mounting: Install vertically mounted, in-line, close-coupled centrifugal pumps with cast-iron base mounted on concrete base using elastomeric pads. Comply with requirements for concrete base specified in [**Section 03 3000 "Cast-in-Place Concrete."**] [**Section 03 3053 "Miscellaneous Cast-in-Place Concrete."**]

1. Minimum Deflection: 1 inch.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.

E. Install continuous-thread hanger rods and spring hangers of size required to support pump weight.

1. Comply with requirements for vibration isolation devices specified in Section 22 0548.13 "Vibration Controls for Plumbing Piping and Equipment." Fabricate brackets or supports as required.
2. Comply with requirements for hangers and supports specified in Section 22 0529 "Hangers and Supports for Plumbing Piping and Equipment."

3.3 CONTROL INSTALLATION

A. Install electric-type thermostats on hot-water return piping.

3.4 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to pumps to allow service and maintenance.

C. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles. Refer to Division 22 Section "Domestic Water Piping."

1. Install shutoff valve and strainer on suction side of pumps, and check valve and throttling valve on discharge side of pumps. Install valves same size as connected piping. Refer to Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty valves for domestic water piping and Division 22 Section "Domestic Water Piping Specialties" for strainers.

D. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

E. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

F. Connect thermostats to pumps that they control.

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3.5 IDENTIFICATION

A. Comply with requirements for identification specified in Section 22 0553 "Identification for Plumbing Piping and Equipment" for identification of pumps.

3.6 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Check piping connections for tightness.
3. Clean strainers on suction piping.
4. Set thermostats for automatic starting and stopping operation of pumps.
5. Perform the following startup checks for each pump before starting:
    a. Verify bearing lubrication.
    b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
    c. Verify that pump is rotating in the correct direction.
6. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
7. Start motor.
8. Open discharge valve slowly.
9. Adjust temperature settings on thermostats.
10. Adjust timer settings.

3.7 ADJUSTING

A. Adjust domestic water pumps to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust initial temperature set points.

C. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

END OF SECTION 22 1123

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SECTION 22 1316 - SANITARY WASTE AND VENT PIPING

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. This Section includes soil and waste, sanitary drainage and vent piping inside the building.

B. This Section includes soil and waste, sanitary drainage and vent piping inside the building and to a point five feet outside the building.

C. This Section includes forced main waste piping inside the building.

D. The following Sections contain related requirements:

1. Division 22 Section "Sanitary Waste Piping Specialties" for soil, waste, and vent piping system specialties.

1.3 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.
2. Forced Main Waste Piping: 50 psig.

1.4 ACTION SUBMITTALS

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

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control inspection and test reports.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

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1.7 REGULATORY REQUIREMENTS

A. Comply with the provisions of the following:

1. Kentucky State Plumbing Code.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Refer to Part 3 "Piping Applications" Article for applications of pipe, fitting, and joining materials.

C. Hub-and-Spigot, Cast-Iron Pipe and Fittings: ASTM A 74, Service class.

1. Gaskets: ASTM C 564, rubber.
2. Caulking Materials: ASTM B29, pure lead and oakum or hemp fiber.

D. Hubless Cast-Iron Pipe and Fittings: ASTM A 888 and CISPI 301.

1. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
   a. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.

E. Steel Pipe: ASTM A 53/A 53M, Type E, Schedule 40, galvanized. Include ends matching joining method.

1. Drainage Fittings: ASME B16.12, galvanized, threaded, cast-iron drainage pattern.
   a. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized, seamless steel pipe. Include ends matching joining method.

F. Solid-Wall PVC Pipe: ASTM D 2665, solid-wall drain, waste, and vent.

1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.

G. Cellular-Core PVC Pipe: ASTM F 891, drain, waste, and vent.

1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.

H. Adhesive Primer: ASTM F656.

I. Solvent Cement: ASTM D2564.

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PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 31 2000 "Earth Moving."

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.

1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Sanitary sewer piping outside the building is specified in Division 22 Section "Facility Sanitary Sewers."

E. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."

F. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

G. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing."

H. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

I. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

J. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

1. Below slab sanitary drains shall be minimum 3-inch (76-mm) unless otherwise indicated with reducer down to above slab pipe size located at floor line.

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K. Install soil and waste drainage and vent piping at the minimum slopes required by plumbing code.

L. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

M. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.

N. Install underground PVC soil and waste drainage piping according to ASTM D 2321.

O. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.3 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."

B. Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Gasketed Joints: Make with rubber gasket matching class of pipe and fittings.
2. Hubless Joints: Make with rubber gasket and sleeve or clamp.

C. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

1. For indoor applications, use PVC glue that has a VOC content of 510 g/L or less.
2. For indoor applications, use PVC primer that has a VOC content of 550 g/L or less.

3.4 HANGER AND SUPPORT INSTALLATION

A. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Individual, Straight, Horizontal Piping Runs: According to the following:
   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

C. Support vertical piping at base and at each floor.

D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.

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E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.
3. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

F. Install supports for vertical cast-iron soil piping every 15 feet.

G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 84 inches with 3/8-inch rod.
2. NPS 1-1/2: 108 inches with 3/8-inch rod.

H. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
2. NPS 3: 48 inches with 1/2-inch rod.

I. Install supports for vertical PVC piping every 48 inches.

3.5 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code. Refer to other Division 22 plumbing fixtures sections.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 22 Section "Sanitary Waste Piping Specialties."
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Comply with requirements for cleanouts and drains specified in Section 22 1319 "Sanitary Waste Piping Specialties."

D. Connect force-main piping to the following:

1. Sanitary Sewer: To exterior force main.
2. Sewage Pump: To sewage pump discharge.

3.6 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping.

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B. Comply with requirements for identification specified in Section 22 0553 "Identification for Plumbing Piping and Equipment."

3.7 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 48 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary waste and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.
   a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.
   a. Expose work that was covered or concealed before it was tested.

3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.
   a. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water.
   b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
   c. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.
   a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg.
   b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
   c. Air pressure must remain constant without introducing additional air throughout period of inspection.
   d. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

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E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved.
   a. Expose work that was covered or concealed before it was tested.

2. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials.
   a. Isolate test source and allow to stand for four hours.
   b. Leaks and loss in test pressure constitute defects that must be repaired.

3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
4. Prepare reports for tests and required corrective action.

3.8 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

E. Repair damage to adjacent materials caused by waste and vent piping installation.

3.9 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil, waste, and vent piping NPS 1 1/2(DN 40) and smaller shall be any of the following:

1. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
2. Steel pipe, drainage fittings, and threaded joints.
3. PVC pipe, PVC socket fittings, and solvent-cemented joints.

C. Aboveground, soil, waste, and vent piping NPS 2(DN 50) through NPS 10(DN 250) shall be any of the following:

1. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
2. PVC pipe, PVC socket fittings, and solvent-cemented joints.
   a. PVC above ground only allowed in concealed locations.

D. Underground, soil, waste, and vent piping NPS 10(DN 250) and smaller shall be any of the following:

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1. Service class, hub-and-spigot, cast-iron soil pipe and fittings; gaskets; and compression joints.
2. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
3. PVC pipe, PVC socket fittings, and solvent-cemented joints.

E. Aboveground piping shall be the following:

1. PVC solid wall pipe, PVC socket fittings, and solvent-cemented joints.

END OF SECTION 22 1316

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SECTION 22 1319 - SANITARY WASTE PIPING SPECIALTIES

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. This Section includes the following sanitary drainage piping specialties:

1. Cleanouts.
2. Floor drains.
3. Trap-seal protection devices.
4. Air-admittance valves.

B. Related Requirements:

1. Section 22 1423 "Storm Drainage Piping Specialties" for trench drains for storm water, channel drainage systems for storm water, roof drains, and catch basins.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene.

B. FOG: Fats, oils, and greases.

C. PVC: Polyvinyl chloride.

1.4 ACTION SUBMITTALS

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

1.5 CLOSEOUT SUBMITTALS

1.6 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic sanitary waste piping specialty components.

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PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Exposed End of Pipe Cast-Iron Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Josam Company; Josam Div.
   b. MIFAB, Inc.
   c. Sioux Chief Mfg. Co.
   d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   e. Tyler Pipe; Wade Div.
   f. Watts Drainage Products Inc.
   g. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M.
3. Size: Same as connected drainage piping
4. Body Material: Hubless, cast-iron soil pipe as required to match connected piping.
5. Closure: Countersunk, brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Cast-Iron Floor Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Josam Company; Josam Div.
   b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   c. Tyler Pipe; Wade Div.
   d. Watts Drainage Products Inc.
   e. Zurn Plumbing Products Group; Light Commercial Operation.
   f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M for adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Adjustable housing.
5. Body or Ferrule: Cast iron.
6. Outlet Connection: Spigot.
7. Closure: Brass plug with straight threads and gasket.
8. Adjustable Housing Material: Cast iron with threads.
9. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
10. Frame and Cover Type:
    a. Ceramic, Mosaic & Quarry Tile Floors: Terrazzo top type with square nickel bronze top.
    b. Asphalt & Vinyl Tile Floors: Tile top type with square nickel bronze top.
    c. Terrazzo Floors: Terrazzo top type with round nickel bronze top.
    d. Carpet Floors: Carpet flange or Carpet marker type with round nickel bronze top.
    e. Other Finished Floors: Heavy duty type with round nickel bronze top.
    f. Unfinished Concrete Floors: Heavy duty type with round cast iron top.

C. Cast-Iron Interior Finished Wall Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

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a. Josam Company; Josam Div.
b. MIFAB, Inc.
c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
d. Tyler Pipe; Wade Div.
e. Watts Drainage Products Inc.
f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk, drilled-and-threaded brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, flat, stainless-steel cover plate with screw.

D. Cast-Iron Interior Unfinished Accessible Area Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Josam Company; Josam Div.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   d. Tyler Pipe; Wade Div.
   e. Watts Drainage Products Inc.
   f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M.
3. Size: Same as connected drainage piping.
4. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk, drilled-and-threaded brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains - General:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Josam Company; Josam Div.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   d. Tyler Pipe; Wade Div.
   e. Watts Drainage Products Inc.
   f. Zurn Plumbing Products Group; Light Commercial Operation.
   g. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.6.3.

B. Cast Iron Floor Drains: Coated gray iron body having integral double drainage flange with weep holes and no-hub spigot or push-on bottom outlet. Provide flashing clamp device where located in membrane floor or when flashing is required for pans. Floor drain type designations and sizes are indicated on Drawings and scheduled below:

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1. FD-1: Toilet rooms and finished areas not specifically noted, "Wade" 1100G6 or equivalent with 6 inch (150 mm) square nickel bronze adjustable top.
2. FD-2: Mechanical room, receiving and storage room, "Wade" 1310TD or equivalent with 9 inch round ductile iron top, sediment bucket.

2.3 TRAP SEAL PROTECTION DEVICES

A. Barrier Type Trap Seal Protection Devices:

1. Subject to compliance with requirements, provide SureSeal Manufacturing Inline Floor Drain Trap Sealer, MIFAB MI-GARD Trap Seal, or Jay R. Smith Model 2692 Trap Seal.
2. Standard: ASSE 1072.
3. Size: 2 inch thru 4 inch as required

B. Fixture Air-Admittance Valves:

1. Standard: ASSE 1051, Type A for single fixture or Type B for branch piping.
2. Housing: Plastic.
3. Operation: Mechanical sealing diaphragm.
4. Size: Same as connected fixture or branch vent piping.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Install wall cleanouts in all finished spaces.
2. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
3. Locate at each change in direction of piping greater than 45 degrees.
4. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
5. Locate at base of each vertical soil and waste stack.
6. **For cleanouts at grade within 5'-0" of building** install cleanouts and extension from drain pipe to cleanout at grade where indicated. Set cleanout in poured concrete block 18 inches by 18 inches by 12 inches deep, except where location is in concrete paving. Set top of cleanout 1 inch above surrounding earth grade or flush with grade when installed in paving.
7. Align square tops parallel with building walls.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with cover flush with finished wall.

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E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage.
3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
5. Align square tops parallel with floor tile.

F. Install trap-seal protection devices at floor sink and floor drain outlets (omit at shower floor drains) during trim out stage of project.

G. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

H. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

3.3 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 1319

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SECTION 22 1413 - FACILITY STORM DRAINAGE PIPING

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. This Section includes storm drainage piping inside the building.

B. Related Sections include the following:

1. Division 22 Section "Storm Drainage Piping Specialties" for storm drainage piping system specialties.

1.3 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:

1. Storm Drainage Piping: 10-foot head of water.

1.4 ACTION SUBMITTALS

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

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control inspection and test reports.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

1.7 REGULATORY REQUIREMENTS

A. Comply with the provisions of the following:

1. Kentucky State Plumbing Code.

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1.8 FIELD CONDITIONS

A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Construction Manager no fewer than two days in advance of proposed interruption of storm drainage service.
2. Do not proceed with interruption of storm drainage service without Construction Manager's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, fitting, and joining materials.

B. Hub-and-Spigot, Cast-Iron Pipe and Fittings: ASTM A 74, Service class.

1. Gaskets: ASTM C 564, rubber.
2. Caulking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

C. Hubless Cast-Iron Pipe and Fittings: ASTM A 888 and CISPI 301.

1. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
   a. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.

D. Solid-Wall PVC Pipe: ASTM D 2665, solid-wall drain, waste, and vent.

1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.

E. Cellular-Core PVC Pipe: ASTM F 891, drain, waste, and vent.

1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.

F. Adhesive Primer: ASTM F 656.

G. Solvent Cement: ASTM D 2564.

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PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 31 2000 "Earth Moving."

3.2 PIPING INSTALLATION

A. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."

B. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers. Cleanouts are specified in Division 22 Section "Storm Drainage Piping Specialties."

C. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing."

D. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

E. Make changes in direction for storm piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

F. Lay buried building drain piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

G. Install storm drainage piping at the minimum slopes required by plumbing code.

H. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

I. Install above slab PVC storm drainage piping according to ASTM D 2665.

J. Install underground PVC storm drainage piping according to ASTM D 2321.

K. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.3 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."

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B. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

C. Hubless Cast-Iron Soil Piping Coupled Joints: Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.

D. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

1. For indoor applications, use PVC glue that has a VOC content of 510 g/L or less.
2. For indoor applications, use PVC primer that has a VOC content of 550 g/L or less.

3.4 HANGER AND SUPPORT INSTALLATION

A. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Individual, Straight, Horizontal Piping Runs: According to the following:
   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.

E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.
3. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

F. Install supports for vertical cast-iron soil piping every 15 feet.

G. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
2. NPS 3: 48 inches with 1/2-inch rod.

H. Install supports for vertical PVC piping every 48 inches.

I. Support piping and tubing not listed above according to MSS SP-58 and manufacturer's written instructions.

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3.5 CONNECTIONS

A. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.

B. Connect storm drainage piping to roof drains and storm drainage specialties.

3.6 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 48 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test storm drainage piping according to procedures of authorities having jurisdiction.

1. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
2. Prepare reports for tests and required corrective action.

3.7 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.8 PIPING SCHEDULE

A. Aboveground storm drainage piping NPS 2(DN 50) through NPS 10(DN 250) shall be any of the following:

1. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
2. PVC pipe, PVC socket fittings, and solvent-cemented joints.
   a. PVC above ground only allowed in concealed locations.

B. Underground storm drainage piping NPS 10(DN 250) and smaller shall be any of the following:

1. Service class, hub-and-spigot, cast-iron soil pipe and fittings; gaskets; and compression joints.

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2. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
3. PVC pipe, PVC socket fittings, and solvent-cemented joints.

END OF SECTION 22 1413

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SECTION 22 1423 - STORM DRAINAGE PIPING SPECIALTIES

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. This Section includes the following storm drainage piping specialties:

1. Cleanouts.
2. Roof drains.

B. Related Requirements:

1. Section 07 6200 "Sheet Metal Flashing and Trim" for penetrations of roofs.
2. Section 07 8413 "Penetration Firestopping" for firestopping roof penetrations.

1.3 ACTION SUBMITTALS

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

1.4 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Josam Company; Josam Div.
2. MIFAB, Inc.
3. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
4. Sioux Chief Mfg. Co.
5. Tyler Pipe; Wade Div.
6. Watts Drainage Products Inc.
7. Zurn Plumbing Products Group; Specification Drainage Operation.

B. Exposed End of Pipe Cast-Iron Cleanouts:

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1. Standard: ASME A112.36.2M.
2. Size: Same as connected drainage piping
3. Body Material: Hubless, cast-iron soil pipe as required to match connected piping.
4. Closure: Countersunk, brass plug.
5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

C. Cast-Iron Floor Cleanouts:

1. Standard: ASME A112.36.2M for adjustable housing cleanout.
2. Size: Same as connected branch.
3. Type: Adjustable housing.
4. Body or Ferrule: Cast iron.
5. Outlet Connection: Spigot.
6. Closure: Brass plug with straight threads and gasket.
7. Adjustable Housing Material: Cast iron with threads.
8. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
9. Frame and Cover Type:
    a. Ceramic, Mosaic & Quarry Tile Floors: Terrazzo top type with square nickel bronze top.
    b. Asphalt & Vinyl Tile Floors: Tile top type with square nickel bronze top.
    c. Terrazzo Floors: Terrazzo top type with round nickel bronze top.
    d. Carpet Floors: Carpet flange or Carpet marker type with round nickel bronze top.
    e. Other Finished Floors: Heavy duty type with round nickel bronze top.
    f. Unfinished Concrete Floors: Heavy duty type with round cast iron top.

D. Cast-Iron Interior Finished Wall Cleanouts:

1. Standard: ASME A112.36.2M. Include wall access.
2. Size: Same as connected drainage piping.
3. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
4. Closure: Countersunk, drilled-and-threaded brass plug.
5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
6. Wall Access: Round, flat, stainless-steel cover plate with screw.

E. Cast-Iron Interior Unfinished Accessible Area Cleanouts:

1. Standard: ASME A112.36.2M.
2. Size: Same as connected drainage piping.
3. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
4. Closure: Countersunk, drilled-and-threaded brass plug.
5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

2.2 ROOF DRAINS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Josam Company; Josam Div.
2. MIFAB, Inc.
3. Sioux Chief Mfg. Co.
4. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
5. Tyler Pipe; Wade Div.

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6. Watts Drainage Products Inc.
7. Zurn Plumbing Products Group; Light Commercial Operation.
8. Zurn Plumbing Products Group; Specification Drainage Operation.

B. Cast-Iron Roof Drains - General:

1. Standard: ASME A112.21.2M.

C. Cast Iron Roof Drains: Coated cast iron wide flange body, flashing ring/gravel stop, standard under deck clamp and cast iron dome strainer. Provide steel bearing pan in roof decks for added bearing surface area. Roof drain type designations and sizes are indicated on drawings and scheduled below:

1. RD-1: General Roof Locations "J.R. Smith" 1010 or equivalent with cast iron dome, bearing pan, deck clamp, and extension flange.
   a. Coordinate height of required extension flange with insulation thickness at each roof drain.

2. RD-2: Overflow Drain Locations "J.R. Smith" 1010 with cast iron dome, bearing pan, 2-inch (50-mm) high dam, deck clamp, and extension flange.
   a. Coordinate height of required extension flange with insulation thickness at each roof drain.

3. RD-3: Parapet Drain Locations "J.R. Smith" 1510 with threaded 90 deg. Side outlet and secured nickel bronze flashing clamp and grate.

D. Roof Drain Downspout Expansion Joints: "J.R. Smith" 1710 Series or equivalent expansion joint for downspouts.

E. Overflow Drain Downspout Nozzles: "J.R. Smith" 1770 or equivalent nickel bronze, round with removable stainless steel screen.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Install wall cleanouts in all finished spaces.
2. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
3. Locate at each change in direction of piping greater than 45 degrees.
4. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
5. Locate at base of each vertical soil and waste stack.
6. For cleanouts at grade within 5'-0" of building install cleanouts and extension from drain pipe to cleanout at grade where indicated. Set cleanout in poured concrete block 18 inches by 18 inches by 12 inches deep, except where location is in concrete paving. Set top of cleanout 1 inch above surrounding earth grade or flush with grade when installed in paving.
7. Align square tops parallel with building walls.

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C. For floor cleanouts for piping below floors in unfinished spaces or other spaces as indicated, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions.

1. Install roof-drain flashing collar or flange so that there will be no leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
2. Position roof drains for easy access and maintenance.
3. Install expansion joints in downspouts 25 feet or more in height, where horizontal offset is less than 5 feet.

F. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

G. Install conductor nozzles at exposed bottom of conductors where they spill onto grade.

H. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

3.3 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 1423

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SECTION 22 3300 - ELECTRIC DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following electric water heaters:

1. Light-commercial electric water heaters.
2. Compression tanks.
3. Water heater accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type and size of water heater indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: Diagram power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Source quality-control test reports.

B. Field quality-control test reports.

C. Warranty: Special warranty specified in this Section.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain same type of electric water heaters through one source from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

D. ASME Compliance: Where indicated, fabricate and label commercial water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

E. NSF Compliance as required by authorities having jurisdiction:

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1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."
3. Comply with NSF 372, "Drinking Water System Components – Lead Content"

1.6 COORDINATION

A. Coordinate size and location of concrete bases with Architectural and Structural Drawings.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric water heaters that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures including storage tank and supports.
   b. Faulty operation of controls.
   c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Period(s): From date of Substantial Completion:
3. Light-Commercial Electric Water Heaters:
   1) Storage Tank: Five years.
   2) Controls and Other Components: Three years.
   b. Compression Tanks: One year(s).

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 LIGHT-COMMERCIAL ELECTRIC WATER HEATERS

A. Description: Comply with UL 174 for household, storage electric water heaters.

1. Manufacturers:
   a. Bradford White Corporation.
   b. Lochinvar Corporation.
   c. Rheem Water Heater Div.; Rheem Manufacturing Company.
   d. Ruud Water Heater Div.; Rheem Manufacturing Company.
   e. Smith, A. O. Water Products Company.

2. Storage-Tank Construction: Steel, vertical arrangement.

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a. Tappings: ASME B1.20.1 pipe thread.
b. Pressure Rating: 150 psig.
c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.

3. Factory-Installed Storage-Tank Appurtenances:
   a. Anode Rod: Replaceable magnesium.
   b. Dip Tube: Provide unless cold-water inlet is near bottom of tank.
   c. Drain Valve: ASSE 1005.
   d. Insulation: Comply with ASHRAE/IESNA 90.1.
   e. Jacket: Steel with enameled finish.
   f. Heat Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
   g. Heating Elements: Two; electric, screw-in immersion type; wired for simultaneous operation, unless otherwise indicated.
   h. Temperature Control: Adjustable thermostat for each element.
   i. Safety Control: High-temperature-limit cutoff device or system.
   j. Relief Valve: ASME rated and stamped and complying with ASME PTC 25.3 for combination temperature and pressure relief valves. Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select relief valve with sensing element that extends into storage tank.

4. Special Requirements: NSF 5 construction with legs for off-floor installation.

2.3 COMPRESSION TANKS

A. Description: Steel pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.

1. Manufacturers:
   a. AMTROL Inc.
   b. Armstrong Pumps, Inc.
   c. Bell and Gossett.
   d. Smith, A. O.; Aqua-Air Div.
   e. State Industries, Inc.
   f. Taco, Inc.
   g. Watts Regulator Co.
   h. Wessels Co.

2. Construction:
   a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1, pipe thread.
   b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
   c. Air-Charging Valve: Factory installed.

2.4 SOURCE QUALITY CONTROL

A. Test and inspect water heater storage tanks, specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

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B. Hydrostatically test commercial water heater storage tanks before shipment to minimum of one and one-half times pressure rating.

C. Prepare test reports.

PART 3 - EXECUTION

3.1 WATER HEATER INSTALLATION

A. Install commercial water heaters on concrete bases.

1. Exception: Omit concrete bases for commercial water heaters if installation on stand, bracket, suspended platform, or direct on floor is indicated.
2. Concrete base construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."

B. Install water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

C. Install thermometer on outlet piping of water heaters. Refer to Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.

D. Install water regulator, with integral bypass relief valve, in booster-heater inlet piping and water hammer arrester in booster-heater outlet piping.

E. Install piping-type heat traps on inlet and outlet piping of water heater storage tanks without integral or fitting-type heat traps.

F. Fill water heaters with water.

G. Charge compression tanks with air.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to water heaters to allow service and maintenance. Arrange piping for easy removal of water heaters.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

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1. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, confirm proper operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Remove and replace water heaters that do not pass tests and inspections and retest as specified above.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial electric water heaters. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 22 3300

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SECTION 22 4000 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes plumbing fixtures and related components.

B. Related Sections include the following:

1. Division 22 Section "Domestic Water Piping Specialties" for mixing valves and specialty fixtures not included in this Section.

1.2 DEFINITIONS

A. Barrier-Free Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.

B. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Piping and general-duty valves are included where indicated. Fittings specified in this Section include:

1. Supplies and stops.
2. Faucets and spouts.
3. Drains and tailpieces.
4. Traps and waste pipes.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.

1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

B. Regulatory Requirements: Comply with the following:

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1. Kentucky Building Code (ANSI117) for plumbing fixtures for people with disabilities.
2. Kentucky State Plumbing Code.
3. Local authority having jurisdiction.
4. Kentucky and local Department of Health requirements.

C. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

D. NSF Compliance as required by authorities having jurisdiction:

1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."
3. Comply with NSF 372, "Drinking Water System Components – Lead Content"

E. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with specified requirements, provide commercial grade plumbing fixtures by one of the following:

1. Lavatories, Water Closets, Urinals:
   a. American Standard
   b. Kohler
   c. Zurn
   d. Sloan
   e. Mansfield

2. **Acron**Stainless Steel Sinks:
   a. Elkay
   b. Just
   c. Franke Commercial

3. Faucets:
   a. American Standard
   b. Chicago Faucet
   c. Delta
   d. Elkay
   e. Kohler
   f. Moen.
   g. T & S Brass
   h. Speakman
   i. Symmons
   j. Zurn

4. Flush Valves:

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a. Sloan
b. Zurn

5. Water Closet Seats:
   a. American Standard
   b. Bemis
   c. Centoco
   d. Church
   e. Kohler
   f. Olsonite
   g. ProFlo
   h. Zurn

6. Water Coolers:
   a. Murdock

7. Fixture Supports:
   a. Josam
   b. Wade
   c. Zurn
   d. Jay R. Smith
   e. MIFAB
   f. Watts.

2.2 WATER CLOSETS

A. WC-1 Water Closets (Floor Mounted): Vitreous china, bottom outlet, floor mounted 1.28 gallon siphon jet elongated bowl, white in color, with close- coupled tank; American Standard "Cadet" Model 215CB.104 or equivalent. Provide floor flange, brass bolts, nuts, washers and bolt caps. Provide TS-1 seat, and supply and stop as specified in the Articles below.

PER ADA, PROVIDE TANKS FOR BF, TANK-TYPE WATER CLOSETS WITH LEVER HANDLE MOUNTED ON WIDE SIDE OF COMPARTMENT.

B. WC-1 Water Closets (Barrier-Free Floor Mounted): Vitreous china, bottom outlet, floor mounted 1.28 gallon siphon jet elongated bowl, white in color, with close-coupled tank; American Standard "Cadet" Model 215AB.104 or equivalent. Provide floor flange, brass bolts, nuts, washers and bolt caps. Provide TS-1 seat, and supply and stop as specified in the Articles below

2.3 URINALS

A. UR-1 Urinals (Wall Mounted): Vitreous china, washout 0.5 gallon wall urinal, white in color, with integral extended shields, flushing rim and trap, 3/4" top spud, 2" outlet connection and supporting hangers. American Standard "Washbrook" Model 6590.001 or equivalent. Provide carriers and FV-2 flush valve as specified in the Articles below. (Refer to mounting heights schedule for Barrier-Free rim heights.)

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2.4 LAVATORIES

A. LAV-1 Lavatories: 20" x 18" vitreous china lavatory, white in color, with backsplash, front overflow, and chrome plated non-removable grid strainer with tailpiece, fabricated for concealed arm or wall hanger supports. Drill lavatories for 4" center faucets. American Standard "Lucerne" Model 0355.012 or equivalent. Provide concealed arm carriers, F-1 faucet, trap, and supplies and stops as specified in the Articles below. (Refer to mounting heights schedule for Barrier-Free requirements.)

1. Provide offset tailpiece on barrier-free units.
2. Provide thermostatic mixing valve on hot water line to lavatory faucet. Mount below lavatory within trap shield. Refer to Section 22 1119 for mixing valve.
3. Provide plastic under lavatory trap and supplies shield on barrier-free units. Refer to articles below.

2.5 MOP BASINS

A. MB-1 Mop Basin: One piece molded stone 10" high basin with 2" shoulders 24" x 24" overall basin size. Furnish with factory installed 3" drain body with removable stainless steel strainer. Furnish with manufacture's standard mop hanger, two stainless steel wall shields, and hose and hose bracket accessories for field installation. Mustee Model 63M or equivalent. Provide F-3 faucet as specified in the Articles below.

2.6 SINKS

A. SK-1 Stainless Steel Sinks (Barrier-Free): 23-1/2" x 18-1/4" x 4-7/8" undermount single compartment sink, with center back drain location; with LKAD-35 spin-lok stainless steel basket strainer with rubber stopper and chrome plated 1-1/2" offset tailpiece. Fabricate sink from 18-gage, Type 304 stainless steel conforming to ASTM A167, finished one side only in accordance with ASTM A 480 No. 4 finish, and sound deadened. Elkay Model ELUHAD-211555 or equivalent. Provide F-2 faucet, trap, and supplies and stops as specified in the Articles below.

1. Provide offset tailpiece on barrier-free units.
2. Provide thermostatic mixing valve on hot water line to sink faucet. Mount below sink within knee board. Refer to Section 22 1119 for mixing valve.

2.7 FAUCETS

A. F-1 Lavatory Faucet: Polished chrome plated all metal single handle, single hole, deck mounted faucet, with ceramic cartridge, and 0.50 gpm vandal resistant chrome plated constant flow outlet. Delta Model 22C631 or equivalent.

B. F-2 Sink Faucet: Sink Faucet: Vibrant Stainless deck mount, single hole, swing gooseneck spout with 1.5 gpm constant flow outlet, pull out sprayer, and single lever metal handle handles. Kohler Purist Model K-7505 or equivalent.

C. F-3 Service Faucet: Rough chrome plated cast brass, combination service sink fitting with vacuum breaker, 3/4" threaded hose spout, metal lever handles indexed "HOT" and "COLD" plus red and blue

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index tabs, wall brace, pail hook, adjustable flanged female supply arms and having integral stops. Chicago Faucet Model 897-RCF or equivalent.

2.8 FLUSH VALVES

A. FV-1 Flush Valve: Quiet, exposed, chrome plated, diaphragm operated flush valve for 1.28 gallon water closets, with non-hold-open low force/ADA compliant handle; chloramine resistant, dual seal diaphragm with a clog resistant, minimum dual filtered by-pass; 1" I.P.S. screw driver operated combination angle check and stop valve with protective vandal resistant cap; sweat solder kit; adjustable tailpiece; cast wall flange with set screw; vacuum breaker; and spud coupling and flange for 1-1/2" top spud connection. Sloan Model 111-1.28 -HET or equivalent.

B. FV-2 Flush Valve: Quiet, exposed, chrome plated, diaphragm operated 0.125 gallon urinal flush valve, with non-hold open low force/ADA compliant handle; chloramine resistant, dual seal diaphragm with a clog resistant, minimum dual filtered by-pass; 3/4" I.P.S. screw driver angle stop with protective vandal resistant cap; sweat solder kit; adjustable tailpiece, cast wall flange, vacuum breaker; and spud coupling and flange for 3/4" top spud connection. Zurn Model Z6003AV-ULF or equivalent.

2.9 TOILET SEATS

A. TS-1 Elongated, heavy duty, solid white plastic toilet seats with molded-in bumpers, closed back/open front, less cover, and having stainless steel check hinge and stainless steel nuts. Centoco Model 500STSCC or equivalent.

2.10 FIXTURE SUPPORTS

A. General: All Fixture support carriers to conform to ANSI A112.6.1M (American National Standards Institute).

B. Urinal and Water Cooler Support Carriers: Wade W-400-AM11-M36 or equivalent foot supported carrier with rectangular structural steel uprights, top support plate, and lower bearing plate with studs.

C. Water Closet Support Carriers: Wade W-300 series or equivalent foot supported carrier with vertical or horizontal waste fitting configuration as required by waste piping installation. Single closet carriers shall be provided with rear anchoring foot. Closet coupling and fixture support rods shall be of proper length for wall thickness. M4 rod support feet shall be furnished when span from inside of finish block wall to face of carrier faceplate exceeds 6". M4 rod support feet shall also be provided on each water closet carrier installed on stud type wall construction.

D. Lavatory Support Carriers: "Wade" Model W-520-M36 Series or equivalent concealed arm, foot supported carrier with rectangular structural steel uprights.

2.11 UNDER-LAVATORY GUARDS

A. Under-lavatory Shield-Type Guard:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Truebro by IPS Corporation; Lav-Shield.

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b. Zurn Industries, Inc.; Rigid Lavatory Enclosure – Vandal Guard.

2. Description: One piece shield for covering supply and drain piping assemblies and other underlav mounted accessories to prevent direct contact with and to provide vandal resistance. Field trim to fit tightly to lavatory and adjacent surfaces.
3. Material and Finish: Rigid, high impact, stain resistant, molded PVC plastic, white.

B. Under-Lavatory Guard:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Plumberex Specialty Products, Inc.
   b. Truebro by IPS Corporation.
   c. ProFlo

2. Description: Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping; allow service access without removing coverings.
3. Material and Finish: Antimicrobial, molded plastic, white.

2.12 FITTINGS, TRIM AND ACCESSORIES

A. Fittings for Plumbing Fixtures: Fittings include the following:

1. Supply Inlets: Copper tube, size required for final connection.
2. Supply Stops: Chrome-plated brass body, angle or straight configuration with compression fittings, loose-key type; size to match inlet pipe and supply riser.
3. Supply Risers: 3/8-inch OD flexible chrome-plated brass tube with 1/2-inch IPS straight or offset, knob-end tailpiece; or braided flexible stainless steel.
4. Traps: Chrome-plated, 17 gauge tubular brass P-trap and wall bend, with slip-joint inlet, wall flange, and escutcheon; same size as fixture outlet connection.
   a. For concealed applications within water coolers or casework, ASTM F 409 PVC one or two-piece trap and waste to wall maybe used.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.

B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.

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B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.

1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.

C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.

D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.

E. Install wall-mounting fixtures with tubular waste piping attached to supports.

F. Install counter-mounting fixtures in and attached to casework.

G. Install fixtures level and plumb according to roughing-in drawings.

H. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

1. Exception: Use ball valves if supply stops are not specified with fixture. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

I. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

J. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

K. Install toilet seats on water closets.

L. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.
2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

M. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."

N. Set mop basins in leveling bed of cement grout. Grout is specified in Division 22 Section "Common Work Results for Plumbing."

O. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

P. Install flush valves in accordance with manufacturer's instructions. Adjust settings and verify proper operation.

1. Install flush valves on barrier-free units with handles on wide side of stall.

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Q. Install under-lavatory insulation kits at barrier-free lavatory and sink locations in accordance with the following:

1. Cover hot- and cold-water supply risers, stops and handles, tailpiece, trap, and wall bend. Install in accordance with manufacturer's installation instructions. Trim connectors flush so no sharp edges remain.

R. Install under-lavatory protective shield at barrier-free wall mounted lavatory locations in accordance with manufacturer's installation instructions.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

3.4 FIELD QUALITY CONTROL

A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.

B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

3.5 ADJUSTING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Adjust mixing valve maximum temperature limit stop in accordance with manufacturers' recommendations and in compliance with the plumbing code and authority having jurisdiction.

C. Replace washers and seals of leaking and dripping faucets and stops.

3.6 CLEANING

A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:

1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
2. Remove sediment and debris from drains.

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B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.7 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain the following:

1. Faucets.
2. Flush valves.

B. Refer to Division 01 Section "Demonstration and Training."

3.9 FIXTURE HEIGHT SCHEDULE

A. Install fixtures to heights above finished floor as indicated.

1. Water Closet:
   a. Standard: 15 inches to top of bowl rim.
   b. Barrier Free: 17 to 19 inches, top of seat.

2. Water Closet Flush Valves:
   a. Standard: 11 inches min. above bowl rim.

3. Urinal:
   a. Standard: 22 inches to top of bowl rim.
   b. Barrier Free: 17 inches maximum to top of bowl rim.

4. Urinal Flush Valves:
   a. Standard: 11 inches min. above top.
   b. Barrier Free: 46 inches maximum to flush valve handle.

5. Lavatory:
   a. Standard: 34 inches to top of basin rim.
   b. Barrier Free: 34 inches to top of basin rim.

3.10 FIXTURE ROUGH-IN SCHEDULE

A. Line sizes indicated below are run-out sizes, reduce size as required at connection to fixture. Main lines and drops shall be installed in sizes as indicated on drawings.

1. Water Closet (Flush Valve Type):
   a. Cold Water: 1-1/4 Inch.

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b. Waste: 4 Inch.
c. Vent: 2 Inch.

2. Urinal (Flush Valve Type):
   a. Cold Water: 1 Inch.
   b. Waste: 2 Inch.
   c. Vent: 1-1/2 Inch.

3. Lavatory:
   a. Hot Water: 1/2 Inch.
   b. Cold Water: 1/2 Inch.
   c. Waste: 1-1/2 Inch.
   d. Vent: 1-1/4 Inch.

4. Sink:
   a. Hot Water: 1/2 Inch.
   b. Cold Water: 1/2 Inch.
   c. Waste: 2 Inch.
   d. Vent: 1-1/2 Inch.

END OF SECTION 22 4000

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SECTION 23 0500 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Dielectric fittings.
3. Sleeve-seal systems.
4. Sleeves.
5. Stack-sleeve fittings.
6. Escutcheons.
7. Floor plates.
8. Grout.
9. HVAC demolition.
10. Equipment installation requirements common to equipment sections.
11. Painting and finishing.
12. Concrete bases.
13. Supports and anchorages.

B. Related Sections:

1. Division 01 Section "Alternates" for requirements of alternates that relate to this Division.

1.2 QUALITY ASSURANCE

A. Provide HVAC systems, equipment, and materials in accordance with Kentucky Mechanical Code and other applicable codes and regulations, and with authorities having jurisdiction.

B. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

C. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

D. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

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1.3 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

C. 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, handling, and up to substantial completion. Coordinate deliveries of mechanical materials and equipment to minimize construction site congestion.

1.4 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.

B. Coordinate installation of required supporting devices and sleeves in structural components.

C. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

D. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

1.5 PROJECT COMMISSIONING

A. This project shall have an independent commissioning authority (CxA). Contractors for this project shall meet CxA requirements and shall coordinate with and participate in commissioning activities.

1.6 PERFORMANCE REQUIREMENTS

A. Seismic Requirements:

1. Installation of hangers and supports shall comply with SEI/ASCE 7 requirements for Site Class C in accordance with International Building Code.

B. SEI: Structural Engineering Institute

C. ASCE: American Society of Civil Engineers

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PART 2 - PRODUCTS

2.1 MANUFACTURERS

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

C. 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.

1. All castings used for coupling housings, fittings, valve bodies, etc., shall include listing/approval stamp, label, or other markings made to specified standards.

2.3 JOINING MATERIALS

A. Refer to individual Division 23 piping Sections for special joining materials not listed 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 thickness or specific material is indicated.
   a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
   b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

F. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 DIELECTRIC FITTINGS

A. Dielectric Connections: Ground joint, copper unions, ASME B16.18, cast-copper-alloy body, hexagonal stock, with ball-and-socket joint, metal-to-metal seating surfaces, and solder-joint, threaded, or solder-joint and threaded ends; and suitable system fluid, pressure and temperature.

B. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150-psig minimum working pressure as required to suit system pressures.

C. Description: Combination fitting of copper alloy and ferrous materials with threaded end connections that match piping system materials.

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1. Insulating Material: Suitable for system fluid, pressure, and temperature.

D. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F with threaded end connections.

E. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

F. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.

G. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

H. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

I. Domestic Water Piping Joining of Dissimilar Materials: Connect to galvanized piping with brass coupling, minimum 6 inch brass nipple, brass valve, brass union to copper piping.

2.5 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. Metraflex Company (The).
4. Pipeline Seal and Insulator, Inc.
5. Proco Products, Inc.
6. Thunderline

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel Stainless steel.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.6 SLEEVES

A. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

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B. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.7 STACK-SLEEVE FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Smith, Jay R. Mfg. Co.
2. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.

B. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with setscrews.

2.8 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Cast-Brass Type: With polished, chrome-plated or rough-brass finish and setscrew fastener.

C. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

D. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

E. Split-Casting Brass Type: With polished, chrome-plated or rough-brass finish and with concealed hinge and setscrew.

F. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed or exposed-rivet hinge, and spring-clip fasteners.

2.9 FLOOR PLATES

A. Description: Manufactured floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. One-Piece Floor Plates: Cast-iron flange.

B. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

1. Split-Casting Floor Plates: Cast brass with concealed hinge.

2.10 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

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B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.11 MECHANICAL ROOF PENETRATIONS

A. Roof Curbs for Duct Penetrations: Prefabricated heavy-gage galvanized steel or aluminum curb with mitered and welded corners, minimum 1 1/2 inch thick rigid fiberglass insulation adhered to inside walls, built-in cant and mounting flange for roof decks, and wood nailer. Size as required to suit roof opening and ductwork. Overall minimum height shall be 12 inches above roof insulation. Provide curbs with level tops and bottoms to match roof slope. Provide galvanized steel flashing and seal water tight. Provide insulation on interior flashing surfaces exposed to building air. Pate or equivalent.

B. Pipe Curbs for Single or Multiple Pipe Penetrations: Prefabricated heavy-gage galvanized steel or aluminum curb with mitered and welded corners, minimum 1 1/2 inch thick rigid fiberglass insulation adhered to inside walls, built-in cant and mounting flange for roof decks, wood nailer, and acrylic clad ABS plastic cover(s), PVC boot(s), and stainless steel clamps.. Size as required to suit roof opening and piping. Overall minimum height shall be 12 inches above roof insulation. Provide curbs with level tops and bottoms to match roof slope. Pate or equivalent.

C. Pipe Curbs for Single Pipe Penetrations: All roof pipe penetrations up to 10" O.D. shall be flashed and sealed using a Pate or equivalent pipe seal, consisting of a spun aluminum base having a minimum five inch roof surface flange, a stepped polyvinyl chloride boot to be secured to the base and the pipe with adjustable stainless steel clamps as furnished.

PART 3 - EXECUTION

3.1 HVAC DEMOLITION

A. Refer to Division 01 Section "Execution" and Division 02 Section "Selective Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove HVAC systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material. Prior to removing any piping, verify piping type (domestic, heating, gas, etc.).
2. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

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3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.

B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

3.3 ESCUTCHEON INSTALLATION

A. Install escutcheons for penetrations of walls, ceilings, and finished floors according to the following:

1. Escutcheons for New Piping:
    a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    b. Chrome-Plated Piping: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
    c. Insulated Piping: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
    d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
    e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
    f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated or rough-brass finish.
    g. Bare Piping in Equipment Rooms: One-piece, cast-brass or split-casting brass type with polished, chrome-plated or rough-brass finish.
    h. Escutcheons for Existing Piping:
    i. Chrome-Plated Piping: Split-casting brass type with polished, chrome-plated finish.
    j. Insulated Piping: Split-plate, stamped-steel type with concealed or exposed-rivet hinge.
    k. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.

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l. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
m. Bare Piping in Unfinished Service Spaces: Split-casting brass type with polished, chrome-plated or rough-brass finish.
n. Bare Piping in Equipment Rooms: Split-casting brass type with polished, chrome-plated or rough-brass finish.

3.4 FLOOR PLATE INSTALLATION

A. Install floor plates for piping penetrations of equipment-room floors.

1. New Piping: One-piece, floor-plate type.
2. Existing Piping: Split-casting, floor-plate type.

3.5 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

1. Sleeves are not required for core-drilled holes.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Cut sleeves to length for mounting flush with both surfaces.
   a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 07 9200 "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 07 8413 "Penetration Firestopping."

3.6 STACK-SLEEVE-FITTING INSTALLATION

A. Install stack-sleeve fittings in new slabs as slabs are constructed.

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1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
2. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
3. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
4. Using grout, seal the space around outside of stack-sleeve fittings.

B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 07 8413 "Penetration Firestopping."

3.7 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.8 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls Above Grade:
   a. Piping Smaller Than NPS 6: Cast-iron wall sleeves, galvanized-steel wall sleeves, or galvanized-steel-pipe sleeves.
   b. Piping NPS 6 and Larger: Cast-iron wall sleeves, galvanized-steel wall sleeve, or galvanized-steel-pipe sleeves.

2. Concrete Slabs above Grade:
   a. Piping Smaller Than NPS 6: Stack-sleeve fittings.
   b. Piping NPS 6 and Larger: Stack-sleeve fittings.

3. Interior Partitions:
   a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
   b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

3.9 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

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D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. 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. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.10 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Wet Piping Systems: Connect piping materials of dissimilar metals as follows:
   a. In piping NPS 2(DN 50) and smaller, install ground joint unions.

4. Wet Piping Systems: Install dielectric unions, dielectric couplings, or dielectric nipple fittings to connect piping materials of dissimilar metals.
5. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.11 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Sequence, coordinate, and integrate installations of mechanical equipment**,** giving particular attention to large equipment requiring positioning prior to closing in the building.

B. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

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D. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations.

1. Extend grease fittings to accessible locations.

E. Install equipment to allow right of way for piping installed at required slope.

F. Installing contractor shall bear all additional costs, including that of Architect/Engineer redesign and that of other trades, incurred as a result of installation of other than scheduled equipment.

G. Verify final equipment locations for roughing-in.

H. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.12 PAINTING

A. Painting of HVAC systems, equipment, and components is specified in Division 09 painting sections.

B. Painting of HVAC systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."

C. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.13 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 section for cast-in-place concrete.

3.14 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.

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C. Field Welding: Comply with AWS D1.1.

3.15 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor HVAC materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.16 GROUTING

A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.

1. Clean surfaces that will come into contact with grout.
2. Provide forms as required for placement of grout.
3. Avoid air entrapment during placement of grout.
4. Place grout, completely filling equipment bases.
5. Place grout on concrete bases and provide smooth bearing surface for equipment.
6. Place grout around anchors.
7. Cure placed grout.

3.17 MECHANICAL ROOF PENETRATIONS

A. Install mechanical roof penetrations in accordance with roof curb manufacturer's recommendations and in strict compliance with roofing manufacturer's requirements.

1. Roofs with Warranty: Roof penetrations and curbs shall be installed in such a manner to maintain roofing warranty.

B. Roof Curbs for Duct Penetrations: Provide galvanized steel flashing and seal water tight. Provide insulation on interior flashing surfaces exposed to building air.

C. Pipe Curbs for Pipe Penetrations: Secure boot to curb base and secure boot to pipe with adjustable stainless steel clamps.

3.18 INSTALLATION OF ACCESS DOORS

A. Where lay-in ceilings are used, the access to ceiling space is provided through the removable ceiling panels. Where access is required to valves, pipes, dampers or other devices in spaces above non-removable ceilings or in chases, the Contractor requiring the access doors shall provide access doors. Access doors required in rated walls and ceiling shall bear the same rating. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

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1. Set frames accurately in position and securely attached to supports, with face panels plumb and level in relation to adjacent finish surfaces.
2. Adjust hardware and panels after installation for proper operation.

3.19 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 23 0500

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SECTION 23 0513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory.

1.2 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

B. For motors using variable frequency controller, motors to be designed for such application and suitable for use throughout speed range without overheating.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

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1. Provide premium efficient motors where scheduled or when used with a variable frequency controller.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Class B.

I. Insulation: Class F.

J. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

K. Enclosure Material: Manufacturer’s standard material.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with controller.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
2. Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Shaft Grounding Ring: Factory installed Aegis Model SGR shaft grounding ring consisting of maintenance free, circumferential, bearing protection ring with conductive micro fiber shaft contacting material.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

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B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

2.6 ELECTRONIC COMMUTATION MOTOR (ECM)

A. Description: Motor to be an electronic commutation motor (ECM) specifically designed for direct drive fan applications. Motors shall be permanently lubricated with heavy-duty ball bearings to match the fan load and prewired to the specific voltage and phase. Internal motor circuitry shall convert AC power supplied to the fan to DC power to operate the motor. Motor shall be speed controllable down to 20% of full speed (80% turndown). Speed shall be controlled by either a potentiometer dial mounted on the motor or by a 0-10 VDC signal. Motor shall be a minimum of 85% efficient at all speeds.

PART 3 - EXECUTION

3.1 EXECUTION

A. Shaft Grounding Ring Installation

1. If not factory installed, field install at each three phase motors utilizing a variable frequency controller a shaft grounding ring. Attach according to manufacturer's written instructions.

END OF SECTION 23 0513

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SECTION 23 0529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following hangers and supports for HVAC system piping and equipment:

1. Fastener systems.
2. Equipment supports.

B. Related Sections include the following:

1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Division 23 Section(s) "Metal Ducts" for duct hangers and supports.

1.2 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands**,** capable of supporting combined weight of supported systems, system contents, and test water.
2. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
3. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Powder-actuated fastener systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

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1. Equipment supports.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.3, "Structural Welding Code--Sheet Steel."
4. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
5. ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated or stainless steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.2 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.3 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

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PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

F. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

G. Use thermal-hanger shield inserts for insulated piping and tubing.

H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.

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9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.
13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

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M. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

N. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

1. Use powder-actuated fasteners only in concrete construction that is suitable for their installation.

3.2 HANGER AND SUPPORT INSTALLATION

A. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

B. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

C. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

D. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

E. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

F. Install hangers and supports to allow controlled thermal movement of piping systems, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

H. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping.

I. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

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C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches maximum.

3.6 PAINTING

A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 23 0529

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SECTION 23 0553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Pipe labels.
3. Duct labels.
4. Valve tags.
5. Ceiling markers.

1.2 ACTION SUBMITTALS

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

B. Digital Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system.

1.3 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 locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

1.4 QUALITY ASSURANCE

A. Comply with ANSI A13.1 “Pipe Labeling Guide” for color scheme, length of field and letter height.

B. Comply with ANSI A13.1-1996 “Pipe Labeling Guide” for color scheme, length of field and letter height.

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PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel rivets or self-tapping screws.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
3. Letter Color: Black.
4. Background Color: White.
5. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
6. Minimum Label Size: Length and width vary for required label content, but not less than 4 by 2 inch.
7. Minimum Letter Size: 1 inch for name of units.
8. Fasteners: Stainless-steel rivets or self-tapping screws.
9. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number. Coordinate with Owner prior to installation.

D. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

E. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

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C. Background Color: White.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

1. For piping systems with differing temperatures and/or glycol concentrations, indicate “high temp” or “low temp” within preprinted pipe label.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic label including flow arrow formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic label with contact-type, permanent-adhesive backing. Include wrap around flow arrow label with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service matching designations or abbreviations as used on Drawings.

E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

2.4 DUCT LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: White.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

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E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. General Requirements for Manufactured Duct Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

J. Self-Adhesive Duct Labels: Printed plastic label with contact-type, permanent-adhesive backing. Include flow arrow label with contact-type, permanent-adhesive backing.

K. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

2.5 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches for ducts; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.

1. Stencil Material: Fiberboard or metal.
2. Stencil Paint: Exterior, gloss, black enamel unless otherwise indicated. Paint may be in pressurized spray-can form.
3. Identification Paint: Exterior enamel in colors according to ASME A13.1 unless otherwise indicated.

2.6 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
3. Fasteners: Brass wire-link or beaded chain; or S-hook.
4. Fasteners: Brass wire-link or beaded chain; or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-

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operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Provide glass front frame for each valve schedule for mounting in building mechanical room.
2. Valve-tag schedule shall be included in operation and maintenance data.

2.7 CEILING MARKERS

A. Material and Thickness: Multicolor, vinyl markers.

B. Colors: Green and blue.

C. Colors: Blue, red, yellow, and green.

D. Marker Size: 3/4 inch diameter.

E. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

2.8 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches minimum.
2. Fasteners: Reinforced grommet and wire or string.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Pipe Label Applications: Install pipe labels as follows:

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1. Use pretensioned pipe labels or self-adhesive pipe labels.
2. For 10 inches (250 mm) and smaller outside diameter including insulation, use pretensioned pipe labels.
3. For larger than 10 inches (250 mm) outside diameter including insulation, use self-adhesive pipe labels.

B. Piping Color-Coding: Painting of piping is specified in Division 09 Section "Interior Painting."

C. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, on each piping system.

D. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels , complying with ASME A13.1, on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

E. Locate pipe labels where piping is concealed above ceilings or exposed in unfinished mechanical rooms; accessible maintenance spaces such as shafts, tunnels, and plenums as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run.

F. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 25 feet along each run.
7. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
8. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

G. Pipe Label Color Schedule:

1. Chilled Water Piping (Low Temp):
   a. Background Color: Green
   b. Letter Color: White

2. Heating Water Piping:
   a. Background Color: Yellow

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b. Letter Color: Black

3.4 DUCT LABEL INSTALLATION

A. Duct Label Applications: Install duct labels as follows:

1. Use self-adhesive duct labels.
2. For 10 inches (250 mm) and smaller outside diameter including insulation, use pretensioned pipe labels.
3. For larger than 10 inches (250 mm) outside diameter including insulation, use self-adhesive pipe labels.

B. Piping Color-Coding: Painting of piping is specified in Division 09 Section "Interior Painting."

C. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, on each piping system.

D. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels , complying with ASME A13.1, on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

E. Locate duct labels where ductwork is concealed above ceilings or exposed in unfinished mechanical rooms; accessible maintenance spaces such as shafts, tunnels, and plenums as follows:

1. Near each damper and control device.
2. Near each branch connection, excluding short takeoffs for grilles and terminal units. Where flow pattern is not obvious, mark each duct at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed ducts.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run.

F. Install self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:

1. Blue: For outdoor air ducts.
2. Yellow: For supply air ducts.
3. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
4. ASME A13.1 Colors and Designs: For hazardous material exhaust.

G. Stenciled Duct Label Option: Stenciled labels, showing service and flow direction, may be provided instead of plastic-laminated duct labels, at Installer's option, if lettering larger than 1 inch high is needed for proper identification because of distance from normal location of required identification.

H. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

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3.5 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; equipment shutoff valves; convenience and hose connections; and HVAC terminal devices and similar roughing-in connections of end-use units. List tagged valves in a valve schedule.

B. Install glass front frame valve schedule in building mechanical room. Locate at Owners representative approved location.

C. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:
   a. Chilled Water: 1-1/2 inches, [round] [square] <Insert shape>.
   b. Hot Water: 1-1/2 inches, [round] [square] <Insert shape>.
   c. Gas: 1-1/2 inches, [round] [square] <Insert shape>.

2. Valve-Tag Color:
   a. Chilled Water: Green.
   b. Hot Water: Green.
   c. Gas: Yellow.

3. Letter Color:
   a. Chilled Water: Black.
   b. Hot Water: Black.
   c. Gas: Black.

3.6 CEILING MARKER INSTALLATION

A. Install ceiling markers on t-bar ceiling grids and ceiling access panels to indicate locations of shut-off and balancing valves in main heating water and chilled water supply and return piping lines and at branches.

B. Install ceiling markers on t-bar ceiling grids and ceiling access panels to indicate locations of VAV terminal units and fan powered VAV terminal units.

C. Color: Blue

1. Water: Green.
   a. No color differentiation between services required.

2. Fan Powered/Single Duct VAV Terminal Units: Blue.
   a. No color differentiation between types of equipment required.

3.7 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 23 0553

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SECTION 23 0593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Balancing Air Systems.
2. Testing, Adjusting, and Balancing Equipment.
3. Testing, adjusting, and balancing existing systems and equipment.

1.2 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. BAS: Building automation systems.

C. NEBB: National Environmental Balancing Bureau.

D. TAB: Testing, adjusting, and balancing.

E. TABB: Testing, Adjusting, and Balancing Bureau.

F. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

G. TDH: Total dynamic head.

1.3 PREINSTALLATION MEETINGS

A. TAB Conference: If requested by the Owner, conduct a TAB conference at Project site after approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Provide a minimum of 14 days' advance notice of scheduled meeting time and location.

1. Minimum Agenda Items:
   a. The Contract Documents examination report.
   b. The TAB plan.
   c. Needs for coordination and cooperation of trades and subcontractors.
   d. Proposed procedures for documentation and communication flow.

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1.4 ACTION SUBMITTALS

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

D. System Readiness Checklists: Within 90 days of Contractor's Notice to Proceed, submit system readiness checklists as specified in "Preparation" Article.

E. Examination Report: Submit a summary report of the examination review required in "Examination" Article.

F. Certified TAB Reports: Submit four copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.

G. Certified TAB reports.

H. Sample report forms.

I. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

1.6 QUALITY ASSURANCE

A. TAB Specialists Qualifications: Certified by AABC NEBB or TABB.

1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC NEBB or TABB.
2. TAB Technician: Employee of the TAB specialist and certified by AABC NEBB or TABB as a TAB technician.

B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

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1.7 FIELD CONDITIONS

A. Owner Occupancy: Owner will occupy the site and existing building during TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

B. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

C. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.8 COORDINATION

A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.

B. Perform TAB after leakage and pressure tests on distribution systems have been satisfactorily completed.

1.9 PROJECT COMMISSIONING

A. This project shall have an independent commissioning authority (CxA). TAB Specialists for this project shall meet CxA requirements and shall coordinate with and participate in commissioning activities.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 TAB SPECIALISTS

A. Subject to compliance with requirements, engage one of the following:

B. Subject to compliance with requirements, engage one of the following:

1. Subject to compliance with requirements, provide the services of one of the following:
    a. International Test and Balancing, Inc.
    b. Quality Air Service, Inc.
    c. Control Solutions
    d. Enviro-Aire/Total Balance Co.
    e. Third Coast Test and Balance
    f. Air Flow Testing Inc.
    g. Absolute Balancing Co.
    h. Hi-Tech Testing and Balancing Inc.
    i. Pro-MEC Engineering Services, Inc
    j. Kinetix Testing and Commissioning
    k. Environmental Test and Balancing, Inc.

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3.2 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.

B. Examine installed systems for balancing devices. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.

C. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.

D. Examine the approved submittals for HVAC systems and equipment.

E. See "Design Data" Article in the Evaluations.

F. Examine ceiling plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

G. Examine equipment performance data.

H. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

I. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

J. Examine test reports specified in individual system and equipment Sections.

K. Examine HVAC equipment and verify that equipment with functioning controls is ready for operation.

L. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.

M. Examine terminal units, such as variable-air-volume boxes and fan powered variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

N. Examine strainers. Verify that startup screens have been replaced by permanent screens with indicated perforations.

O. Examine control valves for proper installation for their intended function of throttling, diverting, or mixing fluid flows.

P. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

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Q. Examine system pumps to ensure absence of entrained air in the suction piping.

R. Examine operating safety interlocks and controls on HVAC equipment.

S. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.3 PREPARATION

A. Prepare a TAB plan that includes the following:

1. Equipment and systems to be tested.
2. Strategies and step-by-step procedures for balancing the systems.
3. Instrumentation to be used.
4. Sample forms with specific identification for all equipment.

B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:

1. Airside:
   a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
   b. Duct systems are complete with terminals installed.
   c. Volume, smoke, and fire dampers are open and functional.
   d. Clean filters are installed.
   e. Fans are operating, free of vibration, and rotating in correct direction.
   f. Variable-frequency controllers startup is complete and safeties are verified.
   g. Fan array controllers startup is complete and safeties are verified.
   h. Automatic temperature-control systems are operational.
   i. Ceilings are installed.
   j. Windows and doors are installed.
   k. Suitable access to balancing devices and equipment is provided.

3.4 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance"; ASHRAE 111; NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems"; SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing"; and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

C. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 23 3300 "Air Duct Accessories."

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2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 23 0713 "Duct Insulation," Section 23 0716 "HVAC Equipment Insulation," and Section 23 0719 "HVAC Piping Insulation."

D. Mark equipment and balancing devices, including damper-control positions, valve position indicators, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

E. Take and report testing and balancing measurements in inch-pound (IP) units.

3.5 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

L. Verify that air duct system is sealed as specified in Section 23 3113 "Metal Ducts."

3.6 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.
   a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
   b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
   c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.

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d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.

2. Measure fan static pressures as follows:
   a. Measure static pressure directly at the fan outlet or through the flexible connection.
   b. Measure static pressure directly at the fan inlet or through the flexible connection.
   c. Measure static pressure across each component that makes up the air-handling system.
   d. Report artificial loading of filters at the time static pressures are measured.

3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
4. Obtain approval from Engineer for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
5. Obtain approval from commissioning authority for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
6. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.

1. Measure airflow of submain and branch ducts.
2. Adjust submain and branch duct volume dampers for specified airflow.
3. Re-measure each submain and branch duct after all have been adjusted.

C. Adjust air inlets and outlets for each space to indicated airflows.

1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
2. Measure inlets and outlets airflow.
3. Adjust each inlet and outlet for specified airflow.
4. Re-measure each inlet and outlet after they have been adjusted.

D. Verify final system conditions.

1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
2. Re-measure and confirm that total airflow is within design.
3. Re-measure all final fan operating data, rpms, volts, amps, and static profile.
4. Mark all final settings.
5. Test system in economizer mode. Verify proper operation and adjust if necessary.
6. Measure and record all operating data.
7. Record final fan-performance data.

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3.7 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

A. Single Zone Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Balance systems similar to constant-volume air systems.
2. Set air inlets, air outlets, and supply fan at full-airflow condition.
3. Adjust air outlets to indicated airflow.
4. Readjust fan airflow for final maximum readings.
5. Measure operating static pressure at the sensor that controls the supply fan and verify operation of the static-pressure controller.
6. Set supply fan at minimum airflow if minimum airflow is indicated. Measure static pressure to verify that it is being maintained by the controller.
7. Check air outlets for a proportional reduction in airflow as described for constant-volume air systems.
    a. If air outlets are out of balance at minimum airflow, report the condition but leave the outlets balanced for maximum airflow.
8. Measure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.

3.8 PROCEDURES FOR MOTORS

A. Motors 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Phase and hertz.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter size and thermal-protection-element rating.
8. Service factor and frame size.

B. Motors Driven by Variable-Frequency Controllers: Test manual bypass of controller to prove proper operation.

3.9 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each water coil:

1. Entering- and leaving-water temperature.
2. Water flow rate.
3. Water pressure drop for major (more than 20 gpm) equipment coils, excluding unitary equipment such as reheat coils, unit heaters, and fan-coil units.
4. Dry-bulb temperature of entering and leaving air.
5. Wet-bulb temperature of entering and leaving air for cooling coils.
6. Airflow.

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3.10 CONTROLS VERIFICATION

A. In conjunction with system balancing, perform the following:

1. Verify temperature control system is operating within the design limitations.
2. Confirm that the sequences of operation are in compliance with Contract Documents.
3. Verify that controllers are calibrated and function as intended.
4. Verify that controller set points are as indicated.
5. Verify the operation of lockout or interlock systems.
6. Verify the operation of valve and damper actuators.
7. Verify that controlled devices are properly installed and connected to correct controller.
8. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.
9. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.

B. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions.

3.11 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

A. Contractor shall balance the entire hydronic heating system including all new and all existing systems and equipment. Contractor shall balance all new air systems and equipment. Contractor shall balance all existing air equipment as noted. Contractor shall perform pre-construction / pre-demolition tests on systems to remain as described below.

B. Prior to demolition of air and water HVAC distributions systems and equipment, measure and record existing air and water flow conditions for all equipment, ductwork and hydronic piping systems serving area being modified during the project.

1. Measure and record the operating speeds and flow rates of existing equipment.
   a. Perform an ultrasonic flow measurement on each heating water system branch within boiler room down stream from circulation pump common header.

2. Measure and record the flow rates at interconnection points between existing and new work.
3. Measure motor voltage and amperage of effected equipment. Compare the values to motor nameplate information.
4. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.

C. After revisions are complete, measure all the HVAC air and water systems modified and restore the systems to their original or scheduled capacities.

1. Compare the indicated flow rates of the renovated work to the measured flow rates and determine the new equipment flow rates.
2. Verify that the indicated flows of the renovated work result in conditions that are within the acceptable limits defined by equipment manufacturer.
3. Re-measure, record and verify the flow rates at interconnection points between existing and new work.

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4. If calculations increase or decrease the flow rates by more than 5 percent, make equipment adjustments to achieve the calculated airflow and water flow rates. If 5 percent or less, equipment adjustments are not required.
5. Balance each affect branch and main.

D. Perform a preconstruction inspection of existing equipment that is to remain and be reused.

1. Measure and record the operating speed, airflow, and static pressure of each fan.
2. Measure motor voltage and amperage. Compare the values to motor nameplate information.
3. Check the refrigerant charge.
4. Check the condition of filters.
5. Check the condition of coils.
6. Check the operation of the drain pan and condensate-drain trap.
7. Check bearings and other lubricated parts for proper lubrication.
8. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.
9. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished. Verify the following:
10. New filters are installed.
11. Coils are clean and fins combed.
12. Drain pans are clean.
13. Fans are clean.
14. Bearings and other parts are properly lubricated.
15. Deficiencies noted in the preconstruction report are corrected.

E. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.

F. Compare the indicated airflow of the renovated work to the measured fan airflows, and determine the new fan speed and the face velocity of filters and coils.

G. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.

H. If calculations increase or decrease the airflow rates and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated rates. If increase or decrease is 5 percent or less, equipment adjustments are not required.

I. Balance each air outlet.

3.12 TOLERANCES

A. Set HVAC system's airflow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 5 percent.

a. For dedicated outdoor air systems, flow rates shall not be balanced below scheduled values.

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2. Air Outlets and Inlets: Plus or minus 5 percent.
3. Heating-Water Flow Rate: Plus or minus 5 percent.
4. Cooling-Water Flow Rate: Plus or minus 5 percent.

B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.13 PROGRESS REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems balancing devices. Recommend changes and additions to systems balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: Prepare monthly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.14 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.
3. Certify validity and accuracy of field data.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Equipment operating curves.
2. Pump curves.
3. Fan curves.
4. Manufacturers' test data.
5. Field test reports prepared by system and equipment installers.
6. Other information relative to equipment performance; do not include Shop Drawings and Product Data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB specialist.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.

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9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:
    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.
12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:
    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Water flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data:
    a. Unit identification.
    b. Location.
    c. Make and type.
    d. Model number and unit size.
    e. Manufacturer's serial number.
    f. Unit arrangement and class.
    g. Discharge arrangement.
    h. Sheave make, size in inches, and bore.
    i. Center-to-center dimensions of sheave and amount of adjustments in inches.
    j. Number, make, and size of belts.
    k. Number, type, and size of filters.
    l. Variable frequency drive information.
2. Motor Data:
    a. Motor make, and frame type and size.
    b. Horsepower and rpm.

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c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):
a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Filter static-pressure differential in inches wg.
f. Preheat-coil static-pressure differential in inches wg.
g. Cooling-coil static-pressure differential in inches wg.
h. Heating-coil static-pressure differential in inches wg.
i. Outdoor airflow in cfm.
j. Return airflow in cfm.
k. Outdoor-air damper position.
l. Return-air damper position.
m. Variable frequency drive information.
n. Vortex damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:
a. System identification.
b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch o.c.
f. Make and model number.
g. Face area in sq. ft..
h. Tube size in NPS.
i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):
a. Airflow rate in cfm.
b. Average face velocity in fpm.
c. Air pressure drop in inches wg.
d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
e. Return-air, wet- and dry-bulb temperatures in deg F.
f. Entering-air, wet- and dry-bulb temperatures in deg F.
g. Leaving-air, wet- and dry-bulb temperatures in deg F.
h. Water flow rate in gpm.
i. Water pressure differential in feet of head or psig.
j. Entering-water temperature in deg F.
k. Leaving-water temperature in deg F.

G. Gas- Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:

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1. Unit Data:
   a. System identification.
   b. Location.
   c. Make and type.
   d. Model number and unit size.
   e. Manufacturer's serial number.
   f. Fuel type in input data.
   g. Output capacity in Btu/h.
   h. Ignition type.
   i. Burner-control types.
   j. Motor horsepower and rpm.
   k. Motor volts, phase, and hertz.
   l. Motor full-load amperage and service factor.
   m. Sheave make, size in inches, and bore.
   n. Center-to-center dimensions of sheave and amount of adjustments in inches.

2. Test Data (Indicated and Actual Values):
   a. Total airflow rate in cfm.
   b. Entering-air temperature in deg F.
   c. Leaving-air temperature in deg F.
   d. Air temperature differential in deg F.
   e. Entering-air static pressure in inches wg.
   f. Leaving-air static pressure in inches wg.
   g. Air static-pressure differential in inches wg.
   h. Low-fire fuel input in Btu/h.
   i. High-fire fuel input in Btu/h.
   j. Manifold pressure in psig.
   k. High-temperature-limit setting in deg F.
   l. Operating set point in Btu/h.
   m. Motor voltage at each connection.
   n. Motor amperage for each phase.
   o. Heating value of fuel in Btu/h.

H. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:
   a. System identification.
   b. Location.
   c. Make and type.
   d. Model number and size.
   e. Manufacturer's serial number.
   f. Arrangement and class.
   g. Sheave make, size in inches, and bore.
   h. Center-to-center dimensions of sheave and amount of adjustments in inches.
   i. Variable frequency drive information.

2. Motor Data:
   a. Motor make, and frame type and size.
   b. Horsepower and rpm.
   c. Volts, phase, and hertz.
   d. Full-load amperage and service factor.

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e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):
   a. Total airflow rate in cfm.
   b. Total system static pressure in inches wg.
   c. Fan rpm.
   d. Discharge static pressure in inches wg.
   e. Suction static pressure in inches wg.
   f. Variable frequency drive setpoint.

I. Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

J. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:
   a. System and air-handling-unit number.
   b. Location and zone.
   c. Traverse air temperature in deg F.
   d. Duct static pressure in inches wg.
   e. Duct size in inches.
   f. Duct area in sq. ft..
   g. Indicated airflow rate in cfm.
   h. Indicated velocity in fpm.
   i. Actual airflow rate in cfm.
   j. Actual average velocity in fpm.
   k. Barometric pressure in psig.

K. Air-Terminal-Device Reports:

1. Unit Data:
   a. System and air-handling unit identification.
   b. Location and zone.
   c. Apparatus used for test.
   d. Area served.
   e. Make.
   f. Number from system diagram.
   g. Type and model number.
   h. Size.
   i. Effective area in sq. ft..

2. Test Data (Indicated and Actual Values):
   a. Airflow rate in cfm.
   b. Air velocity in fpm.
   c. Preliminary airflow rate as needed in cfm.
   d. Preliminary velocity as needed in fpm.
   e. Final airflow rate in cfm.
   f. Final velocity in fpm.

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g. Space temperature in deg F.

L. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:

1. Unit Data:
   a. System and air-handling-unit identification.
   b. Location and zone.
   c. Room or riser served.
   d. Coil make and size.
   e. Flowmeter type.

2. Test Data (Indicated and Actual Values):
   a. Airflow rate in cfm.
   b. Entering-water temperature in deg F.
   c. Leaving-water temperature in deg F.
   d. Water pressure drop in feet of head or psig.
   e. Entering-air temperature in deg F.
   f. Leaving-air temperature in deg F.

M. Compressor and Condenser Reports: For refrigerant side of unitary systems, stand-alone refrigerant compressors, air-cooled condensing units, or water-cooled condensing units, include the following:

1. Unit Data:
   a. Unit identification.
   b. Location.
   c. Unit make and model number.
   d. Compressor make.
   e. Compressor model and serial numbers.
   f. Refrigerant weight in lb.
   g. Low ambient temperature cutoff in deg F.

2. Test Data (Indicated and Actual Values):
   a. Inlet-duct static pressure in inches wg.
   b. Outlet-duct static pressure in inches wg.
   c. Entering-air, dry-bulb temperature in deg F.
   d. Leaving-air, dry-bulb temperature in deg F.
   e. Condenser entering-water temperature in deg F.
   f. Condenser leaving-water temperature in deg F.
   g. Condenser-water temperature differential in deg F.
   h. Condenser entering-water pressure in feet of head or psig.
   i. Condenser leaving-water pressure in feet of head or psig.
   j. Condenser-water pressure differential in feet of head or psig.
   k. Control settings.
   l. Unloader set points.
   m. Low-pressure-cutout set point in psig.
   n. High-pressure-cutout set point in psig.
   o. Suction pressure in psig.
   p. Suction temperature in deg F.
   q. Condenser refrigerant pressure in psig.
   r. Condenser refrigerant temperature in deg F.
   s. Oil pressure in psig.

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t. Oil temperature in deg F.
u. Voltage at each connection.
v. Amperage for each phase.
w. Kilowatt input.
x. Crankcase heater kilowatt.
y. Number of fans.
z. Condenser fan rpm.
aa. Condenser fan airflow rate in cfm.
bb. Condenser fan motor make, frame size, rpm, and horsepower.
cc. Condenser fan motor voltage at each connection.
dd. Condenser fan motor amperage for each phase.

N. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:

1. Unit Data:
   a. Unit identification.
   b. Location.
   c. Service.
   d. Make and size.
   e. Model number and serial number.
   f. Water flow rate in gpm.
   g. Water pressure differential in feet of head or psig.
   h. Required net positive suction head in feet of head or psig.
   i. Pump rpm.
   j. Impeller diameter in inches.
   k. Motor make and frame size.
   l. Motor horsepower and rpm.
   m. Voltage at each connection.
   n. Amperage for each phase.
   o. Full-load amperage and service factor.
   p. Seal type.
   q. Variable frequency drive information.

2. Test Data (Indicated and Actual Values):
   a. Static head in feet of head or psig.
   b. Pump shutoff pressure in feet of head or psig.
   c. Actual impeller size in inches.
   d. Full-open flow rate in gpm.
   e. Full-open pressure in feet of head or psig.
   f. Final discharge pressure in feet of head or psig.
   g. Final suction pressure in feet of head or psig.
   h. Final total pressure in feet of head or psig.
   i. Final water flow rate in gpm.
   j. Voltage at each connection.
   k. Amperage for each phase.
   l. Variable frequency drive setpoint.

O. Instrument Calibration Reports:

1. Report Data:

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a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.15 VERIFICATION OF TAB REPORT

A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Engineer and commissioning authority.

B. Engineer and commissioning authority shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.

C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."

D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

E. If TAB work fails, proceed as follows:

1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.

F. Prepare test and inspection reports.

3.16 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 23 0593

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SECTION 23 0700 - HVAC INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulation materials for HVAC systems.

B. Related Sections:

1. Division 22 Section "Plumbing Insulation."
2. Division 23 Section "Metal Ducts" for duct liners.

1.2 ACTION SUBMITTALS

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

1. Mineral fiber.
2. Flexible elastomeric.
3. Field installed jackets
4. Adhesives and sealants, including printed statement of VOC content.

B. Field quality-control reports.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program.

B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

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1.5 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application.

1. Establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.6 SCHEDULING

A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. 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.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

G. Flexible Elastomeric with Factory Applied Jacket: Closed-cell, sponge- or expanded-rubber materials with laminated membrane on exterior surface, and with or without pressure sensitive adhesive. Comply with ASTM C 534, Type II for sheet materials.

H. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

I. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1.
2. Provide ASJ or FSK for ductwork applications, as scheduled.
3. Provide ASJ for equipment applications.

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J. Mineral-Fiber, Pipe, Duct and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied jacket complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Provide ASJ for equipment applications.
2. Provide ASJ or FSK for ductwork applications, as scheduled.
3.

2.2 INSULATING CEMENTS

A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. PVC Jacket Adhesive: Compatible with PVC jacket.

1. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
4. Color: White.

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C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.
2. Service Temperature Range: Minus 20 to plus 200 deg F.
3. Solids Content: 63 percent by volume and 73 percent by weight.
4. Color: White.

2.5 SEALANTS

A. Joint Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F.
4. Color: White or gray.
5. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Materials shall be compatible with insulation materials, jackets, and substrates.
7. Permanently flexible, elastomeric sealant.
8. Service Temperature Range: Minus 100 to plus 300 deg F.
9. Color: White or gray.
10. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. FSK Jacket Flashing Sealants:

1. Products:
   a. Childers Products, Division of ITW; CP-76-8.
   b. Foster Products Corporation, H. B. Fuller Company; 95-44.
   c. Marathon Industries, Inc.; 405.
   d. Mon-Eco Industries, Inc.; 44-05.
   e. Vimasco Corporation; 750.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.
5. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

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2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.7 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. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Width: 3 inches.
2. Thickness: 6.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. 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.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Width: 2 inches.
2. Thickness: 3.7 mils.
3. Adhesion: 100 ounces force/inch in width.
4. Elongation: 5 percent.
5. Tensile Strength: 34 lbf/inch in width.

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E. PVDC Tape for Indoor Applications:

F. PVDC Tape for Outdoor Applications:

2.8 SECUREMENTS

A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch or 3/4 inch wide with wing or closed seal.

B. Insulation Pins and Hangers:

1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
   a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
   b. Spindle: Copper- or zinc-coated, low carbon steel, aluminum, or stainless steel; fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
   c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

2. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
   a. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
   b. Spindle: Nylon, 0.106-inch- diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
   c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

3. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
   a. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
   b. Spindle: Copper- or zinc-coated, low carbon steel, aluminum, or stainless steel; fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
   c. Adhesive-backed base with a peel-off protective cover.

4. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, galvanized-steel, aluminum, or stainless-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
5. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

D. Wire: 0.062-inch soft-annealed, stainless steel.

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2.9 ACOUSTIC LAG WRAPPING

A. Material: Loaded vinyl barrier, limp, unreinforced.

1. Color: Black.
2. STC Rating: 26.
3. Density: One pound per square foot.

2.10 REMOVABLE INSULATED EQUIPMENT COVER

A. Provide custom built removable insulating equipment cover for equipment indicated. Covers shall conform to the shape of the equipment.

1. Construct covers using two layers of flexible vapor barrier materials with two parallel rows of lock stitching, stuffed with insulation, using belt and loops or velcro like material to hold cover in place.
2. Construct covers using two layers of flexible heat resistant materials with two parallel rows of lock stitching, stuffed with insulation, using belt and loops or velcro like material to hold cover in place.
3. Insulation thickness to provide cold face temperature of 100°F(38°C) at maximum operating temperature.
4. Cover to overlap pipe insulation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

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3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item as specified in insulation system schedules.

C. 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.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. 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.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. 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 and outward clinching staples along both edges of strip, spaced 4 inches o.c.
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. Staple laps with outward clinching staples along edge at 2 inches o.c.
4. 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. Staple laps with outward clinching staples along edge at 2 inches o.c.
    a. For below ambient services, apply vapor-barrier mastic over staples.

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5. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
6. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. 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. Tank Manholes.
5. Tank Handholes.
6. Cleanouts.

3.4 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 at roof structure and seal with joint sealant.
3. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
4. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
5. 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.
3. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
4. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
5. 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.

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E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

1. Comply with requirements in Division 07 Section "Penetration Firestopping" and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Duct: Install insulation continuously through floor penetrations that are not fire rated. For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
2. Pipe: Install insulation continuously through floor penetrations.
3. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 EQUIPMENT, TANK, AND VESSEL INSULATION INSTALLATION

A. Mineral Fiber, Pipe and Tank Insulation Installation for Tanks and Vessels: Secure insulation with adhesive and anchor pins and speed washers.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of tank and vessel surfaces.
2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
3. Protect exposed corners with secured corner angles.
4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:
    a. Do not weld anchor pins to ASME-labeled pressure vessels.
    b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
    c. On tanks and vessels, maximum anchor-pin spacing is 3 inches from insulation end joints, and 16 inches o.c. in both directions.
    d. Do not overcompress insulation during installation.
    e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
    f. Impale insulation over anchor pins and attach speed washers.
    g. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

5. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
6. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches from each end. Install wire or cable between two circumferential girdles 12 inches o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed

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aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches o.c. Use this network for securing insulation with tie wire or bands.

7. Stagger joints between insulation layers at least 3 inches.
8. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
9. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
10. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

B. Flexible Elastomeric Thermal Insulation Installation for Tanks and Vessels: Install insulation over entire surface of tanks and vessels.

1. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive.
2. Seal longitudinal seams and end joints.

3.6 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

B. Where PVC fitting jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturers recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
2. Fill inside of fitting jackets to prevent collapse of jacket.

C. 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.

D. Install self-adhesive jacket over insulation indicated. Attach and seal jacket at all edges per manufacturer’s recommendations.

3.7 FINISHES

A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

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C. Prefinished PVC Jacket Color: Final color as selected by Architect, submit color chart with shop drawings. Vary first and second coats to allow visual inspection of the completed Work.

3.8 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation: Insulate the following in accordance with insulation schedule:

1. Supply air.
2. Outdoor air.
3. Return air.
4. Relief air.
5. Exhaust air.
6. Outdoor supply air.
7. Duct mounted reheat coils.
8. Slot and linear diffuser plenums.
9. Ducts above “cloud type ceilings”.

B. Items Not Insulated:

1. Factory-insulated flexible ducts.
2. Factory-insulated plenums and casings, except as indicated.
3. Flexible connectors.
4. Vibration-control devices.
5. Factory-insulated access panels and doors.
6. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
7. Exposed supply and return metal ducts within rooms they are serving. Mechanical rooms and rooms with “cloud type ceilings” to be insulated.
8. Exposed heat pump supply and return metal ducts within rooms they are serving.
9. Exposed supply metal ducts within rooms they are serving down stream of fan coils and VAV terminal units. Mechanical rooms and rooms with “cloud type ceilings” to be insulated.
10. Volume control balancing damper lever handles.

C. Definitions:

1. Concealed: Above solid ceiling and not visible from below.
2. Exposed: In rooms with no ceilings or with partial ceilings (i.e. “cloud type ceilings”) and visible from below.
3. Finished Spaces: Spaces with room finishes accessible by building occupants.
4. Unfinished Spaces: Spaces with no or limited room finishes accessible by building maintenance and support staff only.
5. Rooms with “Cloud Type Ceilings”: Rooms where the ceilings do not extend to every wall.

3.9 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. supply and return air duct and plenum insulation shall be the following:

1. Mineral-Fiber Board with FSK Jacket or ASJ: 1-1/2 inches(38 mm) thick and 3-lb/cu. ft.(48-kg/cu. m) nominal density.

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B. insulation shall be the following:

C. Concealed outside, relief, supply and return air duct and plenum insulation shall be the following:

1. Mineral-Fiber Blanket: 1-1/2 inches(38 mm) thick and 0.75-lb/cu. ft.(12-kg/cu. m) nominal density.

D. Concealed exhaust-air duct and plenum insulation between isolation damper and penetration of building exterior shall be the following:

1. Mineral-Fiber Blanket: 1-1/2 inches(38 mm) thick and 0.75-lb/cu. ft.(12-kg/cu. m) nominal density.

E. Exposed outside, relief, supply and return air duct insulation within mechanical rooms shall be the following:

1. Mineral-Fiber Board with FSK Jacket (For Rectangular Applications): 1-1/2 inches(38 mm) thick and 3-lb/cu. ft.(48-kg/cu. m) nominal density.
2. Mineral-Fiber Duct, Pipe and Tank with FSK Jacket (For Round or Flat Oval Duct Applications): 1-1/2 inches thick.

F. Exposed exhaust-air duct insulation within mechanical rooms between isolation damper and penetration of building exterior shall be the following:

1. Mineral-Fiber Board with FSK Jacket (For Rectangular Applications): 1-1/2 inches(38 mm) thick and 3-lb/cu. ft.(48-kg/cu. m) nominal density.
2. Mineral-Fiber Duct, Pipe and Tank with FSK Jacket (For Round Duct Applications): 1-1/2 inches thick.

G. Exposed supply, return air, and exhaust duct insulation exposed in finished spaces and to be painted when exposed or above “cloud type ceilings” shall be the following:

1. Mineral-Fiber Board with ASJ (For Rectangular Applications): 1-1/2 inches(38 mm) thick and 3-lb/cu. ft.(48-kg/cu. m) nominal density.
2. Mineral-Fiber Duct, Pipe and Tank with ASJ (For Round or Flat Oval Duct Applications): 1-1/2 inches thick.

3.10 ABOVEGROUND, OUTDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Supply and return air ductwork mounted above roof to be double wall insulated ductwork. Refer to Section 23 3113 “Metal Ducts”.

B. Outdoor duct, plenum and sound trap insulation shall be the following:

1. Mineral-Fiber Board with FSK Jacket: 2 inches(50 mm) thick and 3-lb/cu. ft.(48-kg/cu. m) nominal density, with outdoor protective field applied jacket.
2. Phenolic duct by Therma-duct.

3.11 EQUIPMENT INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.

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B. Insulate equipment in paragraphs below that are not factory insulated.

END OF SECTION 23 0700

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SECTION 23 0800 - COMMISSIONING OF HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes commissioning process requirements for HVAC&R systems, assemblies, and equipment.

B. Related Sections:

1. Division 01 Section "General Commissioning Requirements" for general commissioning process requirements.
2. Division 22 Section "Commissioning of Plumbing" for plumbing commissioning requirements.
3. Division 26 Section "Commissioning of Electrical" for electrical commissioning requirements.

1.2 ABBREVIATIONS

A. HVAC&R: Heating, Ventilating, Air Conditioning, and Refrigeration.

B. Refer to Division 01 Section “General Commissioning Requirements” for additional list of abbreviations used in the Specifications and in the Commissioning Plan.

1.3 DEFINITIONS

A. Refer to Division 01 Section “General Commissioning Requirements” for definitions.

1.4 COORDINATION

A. Refer to Division 01 Section “General Commissioning Requirements” for requirements pertaining to coordination during the commissioning process.

1.5 COMMISSIONING PROCESS

A. Refer to Division 01 Section “General Commissioning Requirements” for requirements pertaining to the commissioning process.

1.6 COMMISSIONING TEAM RESPONSIBILITIES

A. Provide information requested by the CxA for final commissioning documentation.

1. Test reports

B. Assist the CxA in all verification and functional performance tests.

C. Notify the CxA a minimum of (2) weeks in advance of the time for start of the testing and balancing work.

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D. Refer to Division 01 Section “General Commissioning Requirements” for additional requirements pertaining to the contractor responsibilities.

1.7 SYSTEMS TO BE COMMISSIONED

A. Any HVAC equipment or systems that are monitored and or controlled by Building Management System will be commissioned with no sampling methods.

B. Refer to Division 01 Section “General Commissioning Requirements” for HVAC systems to be commissioned.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. Refer to Division 01 Section “General Commissioning Requirements” for test equipment requirements.

PART 3 - EXECUTION

3.1 MEETINGS

A. Refer to Division 01 Section “General Commissioning Requirements” for meeting requirements.

3.2 START-UP, PREFUNCTIONAL CHECKLISTS AND INITIAL CHECKOUT

A. No commissioning checklists will be required to be completed by Mechanical contractor as noted below:

1. Sheetmetal
2. Piping

B. Commissioning checklists will be required to be completed by Controls contractor.

C. Refer to Division 01 Section “General Commissioning Requirements” for additional participation requirements for start-up, prefucntional checklists and initial checkout.

3.3 FUNCTIONAL PERFORMANCE TESTING

A. Sampling: No sampling of any equipment will be permitted. All equipped or types referenced in Division 01 Section “General Commissioning Requirements” will be 100% sample rate regardless of qty or size of equipment or system.

B. Refer to Division 01 Section “General Commissioning Requirements” for additional participation requirements for functional performance testing.

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3.4 DOCUMENTATION, NON-CONFORMANCE AND APPROVAL OF TESTS

A. Refer to Division 01 Section “General Commissioning Requirements” for approval procedures.

3.5 DEFERRED TESTING

A. Refer to Division 01 Section “General Commissioning Requirements” for requirements pertaining to deferred testing.

3.6 WRITTEN WORK PRODUCTS

A. Refer to Division 01 Section “General Commissioning Requirements” for requirements pertaining to written work products related to the commissioning process.

END OF SECTION 23 0800

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SECTION 23 0900 – INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Work shall include furnishing all labor, materials, equipment, and service necessary for a complete and operating Building Management System (BMS), utilizing direct digital controls. The BMS shall be capable of total integration of the facility infrastructure systems with user access to all system data either locally over a secure Intranet within the building or by remote access by a standard Web Browser over the Internet. This shall include HVAC control, energy management, alarm monitoring, and all trending, reporting and maintenance management functions related to normal building operations all as indicated.

1. All labor, material, equipment and software not specifically referred to herein or on the plans, required to meet the functional intent of this specification, shall be provided without additional cost to the Owner.

B. Work shall include but not limited to providing controls and instrumentation in accordance with equipment sequence of operations and their point lists. Point lists shall be a guide to the points required for control system. Final points required shall be determined by sequence of operation requirements.

C. Work required in this section shall include providing all control components, control wiring, and services required for the connection and operation of the Air Handling Units including related variable frequency drives and VAV terminal unit boxes as indicated on drawings.

D. Work required in this section shall include providing all control components, control wiring, and services required for the connection and operation of the exhaust fans as indicated on drawings.

E. Work required in this section shall include providing all control components, control wiring, and services required for the connection and operation of the hydronic heating and equipment as indicated on drawings.

F. Work required in this section shall include providing all control components, control wiring, and services required for the connection of the remaining equipment as indicated on drawings, as specified in various Division 23 sections, and as specified in Section 23 0993.

G. Work required in this section shall include the complete Building Management System (BMS) including all controllers Interoperable LonWorks Controllers (ILC), Interoperable BACnet Controllers (IBC), control devices, control panels, controller programming, controller programming software, controller input/output wiring, power wiring, interlock and safety wiring, graphical user interface, Graphical User Interface (GUI), Graphical Development Tool (GDT), Network Area Controller(s) (NAC), server software, controller software and programming of the NAC and server, development of all graphical screens, setup of schedules, logs and alarms, global server software control applications, system integration and coordination of the NAC and server software to the Wide Area Network.

H. Ethernet LAN wiring, and Ethernet routing devices if applicable. The BMS shall provide a single point Ethernet connection utilizing OBIX TCP/IP to the Owner's WAN.

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I. Work required in this section shall include providing all electrical work required for this section. The system shall include all interconnecting wiring and conduit as required for a fully operational system as specified. Wiring shall be installed as per local codes or Division 26 whichever is more stringent.

1. Power supply wiring and conduit from power source to power connection on DDC controls and DDC control panels.
   a. Line voltage wiring shall utilize methods and materials complying with the requirements of the Electrical Specifications, local building code, and NEC.

2. Control wiring and conduit between field-installed controls, indicating devices, and control panels.
   a. Low voltage wiring shall use methods and materials complying with the requirements of the Electrical Specifications, local building code and NEC. Plenum rated cable is acceptable where concealed and accessible.

1.2 RELATED SECTIONS

A. The following Sections contain requirements that relate to this Section:

1. Division 23 Section "Common Work Results for HVAC."

1.3 WORK BY OTHERS

A. Setting in place of valves, flow meters, water pressure and differential taps, flow switches, thermal wells, dampers, airflow stations, and access doors.

B. Duct smoke detectors provide under Division 28.

1.4 ACTION SUBMITTALS

A. Refer to Division 01 for submittal administrative requirements and procedures.

B. Submittal shall consist of:

1. System architecture showing all digital devices, computers and network configuration.
2. Equipment lists of all proposed devices and equipment including data sheets of all products. Provide a PIC statement for each BACnet device and interoperability certification for each LonMark field device provided.
3. Valve, damper, and well and tap schedules showing size, configuration, capacity and location of all equipment.
4. Data entry forms for initial parameters. Contractor shall provide English listing of all analog points with columnar blanks for high and low warning limits and high and low alarm limits, and a listing of all systems with columnar blanks for beginning and end of occupancy periods; and samples of proposed text for points and messages (for at least two systems of at least 15 points total) including sample 480 character alarm message. All text shall be approved prior to data entry.
5. Schematic device wiring and piping interconnection diagrams including panel and device power and sources.
6. Software design data including flowchart of a typical DDC program showing interrelationship between inputs, PID functions, all other functions, outputs, etc.

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7. A complete written Sequence of Operation in suppliers own terminology.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data for control systems equipment to include in the operation and maintenance manual specified in Division 1. Include the following:

1. Maintenance instructions and spare parts lists for each type of control device.
2. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
3. Calibration records and list of set points.

B. Project Record Documents: Upon completion of the work, provide a complete set of 'as-built' drawings and application software on USB drive media or compact disk. Drawings shall be provided as AutoCAD™ or Visio™ compatible files. Three copies of the 'as-built' drawings shall be provided in addition to the documents on USB drive media or compact disk.

1.6 CODES AND APPROVALS

A. The complete BMS installation shall be in strict compliance to the national, state and local mechanical and electrical codes and the electrical section of these specifications. All devices shall be UL or FM listed and labeled for the specific use, application and environment to which they are applied.

B. The system shall comply with NFPA 90A Air Conditioning and 90B Warm Air Heating, Air conditioning.

C. All electronic equipment shall conform to the requirements of FCC regulation Part 15, Section 15 governing radio frequency electromagnetic interference and be so labeled.

1.7 WARRANTY

A. All components, system software, and parts supplied by the BMS contractor shall be guaranteed against defects in materials and workmanship for one year from acceptance date. The BMS contractor at no charge shall furnish labor to repair, reprogram, or replace components during the warranty period. All corrective software modifications made during warranty periods shall be updated on all user documentation and on user and manufacturer archived software disks. The Contractor shall respond to the Owners request for warranty service within 48 hours during normal business hours.

B. Warranty Access

1. The Owner shall grant to the controls installer reasonable access to the BMS during the warranty period.

1.8 BMS CONTRACTOR QUALIFICATIONS

A. The BMS contractor shall have a local office within a 50 mile(80 Km)radius of the job site, staffed with factory trained engineers fully capable of providing instruction, routine maintenance and 24-hour emergency service on all system components. The BMS contractor shall have a three year experience record in the design and installation of computerized building systems similar in scope and performance to

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that specified herein, and shall be prepared to provide evidence of this history as condition of acceptance and approval during Submittal.

1.9 SOFTWARE LICENSE AGREEMENT

A. Software licensing for the NAC and server software shall give the Owner the capability to control their system and determine which contractors can bid and engineer their system.

B. It shall be possible to insure the Owner can prevent unauthorized partners from accessing the system for engineering changes.

C. Software licensing shall have the freedom to individually manage authorized parties and independent parties.

D. The software licensing shall have no restrictions on which brand of NAC, server software or System Programming tools can interact with the system. Station Compatibility IN and Station Compatibility OUT must = ALL and Tool Compatibility must = ALL.

E. The Owner shall accept the manufacturer's standard software and firmware licensing agreement as a condition of this contract. Such license shall grant use of all programs and application software to Owner as defined by the manufacturer's license agreement, but shall protect manufacturer's rights to disclosure of trade secrets contained within such software.

1.10 ADDED POINT AND MEMORY CAPACITY

A. The BMS software/firmware provided shall have the capacity for an unlimited number of NACs. Systems requiring future upgrades to accomplish this are not acceptable; capacity shall be provided at the time of bid.

B. Total system point capacity shall have the capacity for an unlimited number of future points. Systems requiring future upgrades to accomplish this are not acceptable; capacity shall be provided at the time of bid.

C. Supervising software shall allow unlimited expansion. Supervising software that is limited to the number of network area controllers is not acceptable

1.11 TESTING AND BALANCING

A. If proper sequencing or system functions cannot be achieved with the controls, as installed, and additional controls are required, the required additional controls shall be added at the expense of the Controls provider.

1.12 DELIVERY, STORAGE, AND PROTECTION

A. Store equipment and materials inside and protected from weather.

B. Factory-Mounted Components: Arrange for shipping control devices to Vertical Unit Ventilator manufacturer for factory mounting on equipment.

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1.13 COORDINATION

A. Coordinate location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation.

B. Coordinate equipment with Division 28 Section "Fire Detection and Alarm" to achieve compatibility with equipment that interfaces with that system.

C. Coordinate equipment with Division 26 Section "Motor-Control Centers" to achieve compatibility with motor starters and annunciation devices.

1.14 PROJECT COMMISSIONING

A. Project has an independent commissioning authority (CxA). Contractors for this project shall meet CxA requirements and shall coordinate with and participate in commissioning activities.

PART 2 - PRODUCTS

2.1 INSTALLERS

A. Subject to compliance with requirements, provide installation, products and services by Knight Watch, formerly Vertex Integration.

2.2 GENERAL

A. The Building Management System (BMS) shall be comprised of a network of interoperable, stand-alone digital controllers, Network Area Controllers, server software server, graphical user interface software, Web Browser Clients, network devices and other devices as specified herein.

B. Provide the capability to open all control valves in each individual system at one time (I.E. zone, riser) to facilitate water balancing.

C. The controllers and devices shall use either the Echelon® LONMARK® or BACnet™ protocol for openness and interoperability. The controllers and devices shall be 100% programmable and configurable from within the Honeywell NiagaraAX™ Supervisor Workbench. No additional configuration tools shall be required to edit, re-program, or access the Echelon® LONMARK® or BACnet™ controllers. Controllers requiring a separate configuration tool for these functions are not acceptable.

2.3 OPEN, INTEROPERABLE, INTEGRATED ARCHITECTURES

A. The requirement of this specification is to provide a peer-to-peer networked, stand-alone, distributed control system with the capability to integrate SNMP, LonWorks, BACnet IP, BACnet MSTP, Modbus TCP/IP or Modbus RTU communication protocols in one open, interoperable system.

B. The supplied computer software shall employ object-oriented technology (OOT) for representation of all data and control devices within the system. In addition, adherence to industry standards including ANSI / ASHRAE™ Standard 135, BACnet and LonMark to assure interoperability between all system

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components is required. For each LonWorks device that does not have LonMark certification, the device supplier must provide an XIF file for the device. For each BACnet device, the device supplier must provide a PICS document showing the installed device's compliance level. Minimum compliance is Level 3; with the ability to support data read and write functionality. Physical connection of BACnet devices shall be via Ethernet. For each Modbus device supplier must provide a Registry of data points available on the system.

C. All components and controllers supplied under this contract shall be true "peer-to-peer" communicating devices. Components or controllers requiring "polling" by a host to pass data shall not be acceptable.

D. The supplied system must incorporate the ability to access all data using standard web browsers without requiring proprietary operator interface and configuration programs. An Open DataBase Connectivity (ODBC) or Structured Query Language (SQL) compliant server database is required for all system database parameter storage. This data shall reside on a supplier-installed server for all database access. Systems requiring proprietary database and user interface programs shall not be acceptable.

E. The installed system shall provide secure password access to all features, functions and data contained in the overall BMS. Secure Socket Layer (SSL) encryption shall be an available option for remote access.

F. The installed system must be totally scalable to allow for future expansion with the addition of controllers and/or input/output devices. It shall not be necessary to remove equipment supplied under this contract to expand the system.

G. The failure of any single component or network shall not interrupt the control functions of non-affected devices. A single network failure shall only affect shared communications or shared data; individual application controllers and network controllers shall continue normal operation minus only the data from a remote device from the affected network. Automatic default values for all network transported data shall be provided to allow continued operation until the network is restored.

H. A hierarchical topology is required to assure reasonable system response times and to manage the flow and sharing of data without unduly burdening the customer's internal Intranet network. Systems employing a "flat" single tiered architecture shall not be acceptable.

1. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 5 seconds for network connected user interfaces.
2. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 60 seconds for remote or dial-up connected user interfaces.

2.4 NETWORK AREA CONTROLLER (NAC)

A. The controls Installer shall supply one or more Network Area Controllers (NAC) as part of this contract. Number of area controllers required is dependent on the type and quantity of devices.

B. The Network Area Controller (NAC) shall provide the interface between the ILC, IBC and the Network server software, and provide global supervisory control functions over the control devices connected to the BMS. It shall be capable of executing application control programs to provide:

1. Calendar functions
2. Scheduling
3. Trending

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4. Alarm monitoring and routing
5. Time synchronization
6. Integration of LonWorks controller data, Modbus controller data and BACnet controller data
7. Network Management functions for all LonWorks based devices

C. The Network Area Controller must provide the following hardware features as a minimum:

1. Two Isolated Ethernet Ports – 10/100 Mbps
2. One RS-232 port
3. One RS-485 port
4. One LonWorks Interface Port – 78KB FTT-10A
5. Battery Backup
6. Flash memory for long term data backup (If battery backup or flash memory is not supplied, the controller must contain a hard disk with at least 10 gigabyte storage capacity)
7. The NAC must be capable of operation over a temperature range of 32 to 130 deg F
8. The NAC must be capable of withstanding storage temperatures of between 32 to 158 deg F
9. The NAC must be capable of operation over a humidity range of 5 to 95% RH, non-condensing

D. The NAC shall support standard Web browser access via the Intranet/Internet. It shall support a minimum of 10 simultaneous users.

E. Event Alarm Notification and actions

1. The NAC shall provide alarm recognition, storage; routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers.
2. The NAC shall be able to route any alarm condition to any defined user location whether connected to a local network or remote via dial-up telephone connection, or wide-area network.
3. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including but limited to:
   a. To alarm
   b. Return to normal
   c. To fault

4. Provide for the creation of a minimum of eight of alarm classes for the purpose of routing types and or classes of alarms, i.e.: security, HVAC, Fire, etc.
5. Provide timed (schedule) routing of alarms by class, object, group, or node.
6. Provide alarm generation from binary object “runtime” and for event counts for equipment maintenance. The user shall be able to reset runtime or event count values with appropriate password control.
7. Control equipment and network failures shall be treated as alarms and annunciated.
8. Alarms shall be annunciated in any of the following manners as defined by the user:
   a. Screen message text
   b. Text or email of the complete alarm message to multiple recipients. Provide the ability to route and send alarms based on:
      1) Day of week
      2) Time of day
      3) Recipient

9. Graphic with flashing alarm object(s)
10. Printed message, routed directly to a dedicated alarm printer
11. The following shall be recorded by the NAC for each alarm (at a minimum):

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a. Time and date
b. Location (building, floor, zone, office number, etc.)
c. Equipment (air handler #, access way, etc.)
d. Acknowledge time, date, and user who issued acknowledgement.
e. Number of occurrences since last acknowledgement.

12. Alarm actions may be initiated by user defined programmable objects created for that purpose.
13. Defined users shall be given proper access to acknowledge any alarm, or specific types or classes of alarms defined by the user.
14. A log of all alarms shall be maintained by the NAC and/or a server (if configured in the system) and shall be available for review by the user.
15. Provide a "query" feature to allow review of specific alarms by user defined parameters.
16. A separate log for system alerts (controller failures, network failures, etc.) shall be provided and available for review by the user.
17. An Error Log to record invalid property changes or commands shall be provided and available for review by the user.

F. Data Collection and Storage

1. The NAC shall have the ability to collect data for any object and store this data for future use.
2. The data collection shall be performed by log objects, resident in the NAC that shall have, at a minimum, the following configurable properties:
3. Designating the log as interval or deviation.
4. For interval logs, the object shall be configured for time of day, day of week and the sample collection interval.
5. For deviation logs, the object shall be configured for the deviation of a variable to a fixed value. This value, when reached, will initiate logging of the object.
6. For all logs, provide the ability to set the maximum number of data stores for the log and to set whether the log will stop collecting when full, or rollover the data on a first-in, first-out basis.
7. Each log shall have the ability to have its data cleared on a time-based event or by a user-defined event or action.
8. All log data shall be stored in a relational database and the data shall be accessed from a standard Web Browser.
9. All log data, when accessed from the Network server software (NS), shall be capable of being manipulated using standard SQL statements.
10. All log data shall be available to the user in the following data formats:
    a. HTML
    b. XML
    c. Plain Text
    d. Comma or tab separated values

11. Systems that do not provide log data in HTML and XML formats at a minimum shall not be acceptable.
12. The NAC shall have the ability to archive its log data to Network server software on the network. Provide the ability to configure the following archiving properties, at a minimum:
    a. Archive on time of day
    b. Archive on user-defined number of data stores in the log (buffer size)
    c. Archive when log has reached it's user-defined capacity of data stores
    d. Provide ability to clear logs once archived

G. Audit Logs

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1. Provide and maintain an Audit Log that tracks all activities performed on the NAC. Provide the ability to specify a buffer size for the log and the ability to archive the log based on time to the Network server software. For each log entry, provide the following data:
   a. Time and date
   b. User ID
   c. Change or activity: i.e., Change set-point, add or delete objects, commands, etc.

H. Database Back-Up and Storage

1. The NAC shall have the ability to automatically backup its database. The database shall be backed up based on a user-defined time interval.
2. Copies of the current database and, at the most recently saved database shall be stored on the Network server software. The age of the most recently saved database is dependent on the user-defined database save interval.
3. The NAC database shall be stored, at a minimum, in XML format to allow for user viewing and editing, if desired. Other formats are acceptable as well, as long as XML format is supported.

2.5 INTEROPERABLE LON CONTROLLER (ILC)

A. Controls shall be microprocessor based Interoperable LonMark™ or LonWorks Controllers (ILC). Where possible, all Interoperable LonWorks Controllers shall bear the applicable LonMark™ interoperability logo on each product delivered.

B. HVAC control shall be accomplished using LonMark™ based devices where the application has a LonMark profile defined. Where LonMark devices are not available for a particular application, devices based on LonWorks shall be acceptable. Publicly available specifications for the Applications Programming Interface (API) must be provided to Owner for each LonWorks / LonMark controller defining the programming or setup of each device. The controls Installer shall provide all programming, documentation and programming tools necessary to set up and configure the supplied devices per the specified sequences of operation.

C. The controls Installer shall run the LonWorks network trunk to the nearest Network Area Controller (NAC). Coordinate locations of the NAC with the LonMark devices to ensure that maximum network wiring distances, as specified by the LonWorks wiring guidelines, are not exceeded. A maximum of 126 devices may occupy any one LonWorks trunk and must be installed using the appropriate trunk termination device. All LonWorks and LonMark devices must be supplied using FTT-10A LonWorks communications transceivers.

D. The Network Area Controller (NAC), will provide all scheduling, alarming, trending, and network management for the LonMark / LonWorks based devices.

E. The ILCs shall communicate with the NAC at a baud rate of not less than 78.8K baud. The ILC shall provide LED indication of communication and controller performance to the technician, without cover removal.

F. All ILCs shall be fully application programmable and shall at all times maintain their LONMARK certification, if so certified. Controllers offering application selection only (non-programmable), require a 10% spare point capacity to be provided for all applications. All control sequences within or programmed into the ILC shall be stored in non-volatile memory, which is not dependent upon the presence of a battery, to be retained.

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G. The controls Installer shall provide documentation for each device, with the following information at a minimum:

1. Network Variable Inputs (nvi's); name and type
2. Network Variable Outputs (nvo's); name and type
3. Network configuration parameters (nci, nco); name and type

H. It is the responsibility of the controls Installer to ensure that the proper Network Variable Inputs and Outputs (nvi and nvo) are provided in each ILC, as required by the point charts.

I. The controls Installer of any programmable ILC shall provide one copy of the manufacturer's programming tool, with documentation, to the Owner.

2.6 INTEROPERABLE BACnet CONTROLLER (IBC)

A. Controls shall be microprocessor based Interoperable BACnet Controllers (IBC) in accordance with the ANSI/ASHRAE Standard 135-1995. The application control program shall be resident within the same enclosure as the input/output circuitry, which translates the sensor signals. The system supplier must provide a PICS document showing the installed systems compliance level to the ANSI/ASHRAE Standard 135-1995, to Owner.

B. The IBCs shall communicate with the NAC via an Ethernet connection at a baud rate of not less than 10 Mbps or via the RS485 connection at a baud rate of not less than 38 kbps.

C. The IBC Sensor shall connect directly to the IBC and shall not utilize any of the I/O points of the controller. The IBC Sensor shall provide a two-wire connection to the controller that is polarity and wire type insensitive. The IBC Sensor shall provide a communications jack for connection to the BACnet communication trunk to which the IBC controller is connected. The IBC Sensor, the connected controller, and all other devices on the BACnet bus shall be accessible by the POT.

D. All IBCs shall be fully application programmable and shall at all times maintain their BACnet Level 3 compliance. Controllers offering application selection only (non-programmable), require a 10% spare point capacity to be provided for all applications. All control sequences within or programmed into the IBC shall be stored in non-volatile memory, which is not dependent upon the presence of a battery, to be retained.

E. The controls Installer shall provide documentation for each device, with the following information at a minimum:

1. BACnet Device; MAC address, name, type and instance number
2. BACnet Objects; name, type and instance number

F. Ensure that the proper BACnet objects are provided in each IBC, as required by the point charts.

2.7 NETWORKS

A. The Local Area Network (LAN) shall be a 100 Megabits/sec Ethernet network supporting TCP/IP, BACnet IP, Modbus, Java, XML, and HTTP for maximum flexibility for integration of building data with enterprise information systems

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B. Local area network minimum physical and media access requirements:

1. Ethernet; IEEE standard 802.3
2. Cable; 10 Base-T, UTP-8 wire, category 5E or 6
3. Minimum throughput; 10 Mbps, with ability to increase to 100 Mbps

2.8 NETWORK ACCESS

A. Owners WAN / LAN Access: Controls Installer must adhere to Owner's policy and requirements to obtain Owner's WAN access.

2.9 GRAPHICAL USER INTERFACE (GUI)

A. The graphical component of the BMS is of critical importance and should consider the following descriptions and graphic representations to be the minimum acceptable. Enhanced graphics shall include detailed 2-dimensional building site and floor plan graphics, 3-dimentional equipment graphics with fan, damper and valve animations providing operators an aid to comprehending complex system operation. Every graphic page shall contain a tabular and cascading menu navigational structure, established in an HTML frame based format to allow immediate "one-click" access to other building systems without the need to back up through the navigational tree.

B. Navigation is done through the use of an HTML-based menu bar. The contents of the menu bar shall be customized to match the specific requirements of each building, while retaining the same general categories for consistency and familiarity.

1. The menu bar shall employ cascading menus. With this navigation concept, the operator shall not be more than two mouse button operations from any view. Some examples of the operator screens follow.
2. Displays shall provide real-time information with visual display of alarm condition by change of color and/or flashing text/color background.
3. Displays can be viewed from a non-proprietary, commercial Web Browser.
4. Points that have been defined as data-writes, either as a digital (on/off) or analog (change value) point type, will be setup such that an operator, by right-clicking the data object or graphic, will be able to command a digital value, or modify an analog value. Operators shall view equipment status from the menu. Menu items shall include headings for major equipment categories such as Air Handling Units, Boiler, Chillers, Zone Control, Lighting, etc. Cascading menus from each major category, shall allow the operator to select a particular piece of equipment; i.e. AHU-1 or Chiller.
5. A maximum of 40 points will be provided in a single status display screen. Points that have been defined as data-writes, either as a digital (on/off) or analog (change value) point type, shall be setup such that an operator, by right-clicking the data object or graphic, shall be able to command a digital value, or modify an analog value.

C. All Graphics and schedules will reside at the supervisory software level and not at the NAC level to allow for "one password" access to all NACs on the system and global scheduling and trending.

2.10 CUSTOM GRAPHICS - REQUIRED

A. Home Page

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1. The building site overview shall provide a “mouse over” function to highlight the floor plan area to be accessed as a navigational aid. Room numbers and/or names will be included at the owner’s request. Critical data points, i.e. Outdoor Air Temperature, Outdoor Air Relative Humidity, Hot Water Supply Temperature, Chilled Water Supply Temperature or National Weather Service data will be continuously visible, in real time, within the HTML frame on all screens. Additional points may be added or deleted at the owner’s request without cost.

B. Floor Plans

1. Detailed floor plans shall be created with a vector drawing program accurately depicting the actual building layout to include all rooms, walls, and hallways. All space sensors shall be accurately placed in their actual locations and tagged with their real time space temperature and equipment each is associated with, i.e. 72.5°F/RTU-1, 74.2°/AHU-1, 73.4°/TU-1. Floor plans too large to be practically shown with data points will provide a “mouse over” function to highlight the floor plan area to be accessed. Room numbers and/or names will be included at the owner’s request.

C. Mechanical Systems

1. Detailed graphics for each mechanical system shall include; AHUs, RTUs, HXs, CW Piping and Pumps, HW Piping and Pumps, HPs, TUs, and EFs as a minimum. Mechanical systems shall include on-screen access to their respective set-points, trend logs and schedule. All time schedules will be setup as directed by the owner prior to final job turnover.
2. Dynamic trends of all data points shall be set up (specification will be followed as to actual number of trend points possible) prior to final job turnover. Each trend will be available directly on screen for quick trend access.
3. Data points will be shown for all relevant inputs and outputs and be positioned near the actual device. Analog and digital parameters will be able to be modified directly from the equipment screen.

D. Terminal Units

1. Terminal units such as heat pumps, fan coil units, unit ventilators, reheat coils, booster coils and VAV boxes will depict the actual configuration of the equipment controlled. Actual equipment configurations from manufacturers web sites and/or photos of installed equipment shall be used to ensure graphic depictions are as “near actual” as possible.

E. Schedules

1. Graphical schedules shall allow the operator to adjust time of day schedules by dragging the On Event slider. An unlimited number of On/Off events shall be allowed for each schedule and schedules can be linked into a Master/Slave scheduling scheme. Schedules shall allow the user to add/edit/delete holiday and special event schedules. Schedules shall be included for each major piece of equipment.

F. Logging

1. Logs shall be provided for all points defined as requiring collection and archiving of their real-time values. Log data will be provided in HTML, XML, comma- and tab-separated value, and plain-text formats.
   a. Coordinate with Owner and Engineer for required points for logging.

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b. Each of the following of point types shall be continuously trended. The user shall have the ability to select up to 3 points to be displayed on a single trending graph.
   1) All Temperatures
   2) All Temperature setpoints
   3) All Damper Positions
   4) All Valve Positions
   5) All VFD %
   6) All Airflows
   7) All Occupancy statuses
   8) All Enthalpies
   9) All Humidity's
   10) All CO2s

2. Setup parameters for each log include; log intervals, number of collection samples, log collection times and archive times, delta logging with change value selection, etc.
3. For every log, the data shall be viewable in both tabular and chart formats.
4. Logs shall be archived to the server software daily at a user specified time of day. Archive data shall be available from the creation time of the log until the last archive time.
5. For every log, the data can be viewed in both tabular and chart formats.
6. Logs and archives will be accessible from a Web Browser (Internet Explorer 5.0 or greater).
7. Analog Logs: Value Collected every 15 minutes for a log total of 2 days.

2.11 WEB BROWSER CLIENTS

A. The system shall be capable of supporting an unlimited number of clients using a standard Web browser such as Internet Explorer™ or Netscape Navigator™. Systems requiring additional software (to enable a standard Web browser) to be resident on the client machine, or manufacturer-specific browsers shall not be acceptable.

B. The Web browser software shall run on any operating system and system configuration that is supported by the Web browser. Systems that require specific machine requirements in terms of processor speed, memory, etc., in order to allow the Web browser to function with the BMS, shall not be acceptable.

C. The Web browser client shall support at a minimum, the following functions:

1. User log-on identification and password shall be required. If an unauthorized user attempts access, a blank web page shall be displayed. Security using Java authentication and encryption techniques to prevent unauthorized access shall be implemented.
2. HTML programming shall not be required to display system graphics or data on a Web page. HTML editing of the Web page shall be allowed if the user desires a specific look or format.
3. Storage of the graphical screens shall be in the NAC or server software, without requiring any graphics to be stored on the client machine. Systems that require graphics storage on each client are not acceptable.
4. Real-time values displayed on a Web page shall update automatically without requiring a manual "refresh" of the Web page.
5. Users shall have administrator-defined access privileges. Depending on the access privileges assigned, the user shall be able to perform the following:
   a. Modify common application objects, such as schedules, calendars, and set points in a graphical manner.

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1) Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.
2) Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.

b. Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.
c. View logs and charts
d. View and acknowledge alarms
e. Setup and execute SQL queries on log and archive information

6. The system shall provide the capability to specify a user's (as determined by the log-on user identification) home page. Provide the ability to limit a specific user to just their defined home page. From the home page, links to other views, or pages in the system shall be possible, if allowed by the system administrator.
7. Graphic screens on the Web Browser client shall support hypertext links to other locations on the Internet or on Intranet sites, by specifying the Uniform Resource Locator (URL) for the desired link.

2.12 SERVER SOFTWARE FUNCTIONS AND HARDWARE

A. The server software shall be provided. The server software shall support all TCP/IP connected to the control system router.

B. The Network server software shall provide the following functions, at a minimum:

1. Global Data Access: The server software shall provide complete access to distributed data defined anywhere in the system.
2. Distributed Control: The server software shall provide the ability to execute global control strategies based on control and data objects in any control system in the network, local or remote.
3. The server software shall include a master clock service for its subsystems and provide time synchronization for all control systems.
4. The server software shall accept time synchronization messages from trusted precision Atomic Clock Internet sites and update its master clock based on this data.
5. The server software shall provide scheduling for all control systems and their underlying field control devices.
6. The server software shall provide demand limiting that operates across all control systems. The server software must be capable of multiple demand programs for sites with multiple meters and or multiple sources of energy. Each demand program shall be capable of supporting separate demand shed lists for effective demand control.
7. The server software shall implement the BACnet Command Prioritization scheme (16 levels) for safe and effective contention resolution of all commands issued to control systems. Systems not employing this prioritization shall not be accepted.
8. Each control system supported by the server software shall have the ability to archive its log data, alarm data and database to the Network server software, automatically. Archiving options shall be user-defined including archive time and archive frequency.
9. The server software shall provide central alarm management for all control systems supported by the server software. Alarm management shall include:
   a. Routing of alarms to display, printer, email and pagers
   b. View and acknowledge alarms
   c. Query alarm logs based on user-defined parameters

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10. The server software shall provide central management of log data for all control systems supported by the server software. Log data shall include process logs, runtime and event counter logs, audit logs and error logs. Log data management shall include:
    a. Viewing and printing log data
    b. Exporting log data to other software applications
    c. Query log data based on user-defined parameters

C. Server software Hardware Requirements: supplied by

1. The system integrator will be responsible for loading and testing the software on the PC.
2. The system integrator will coordinate with the owner for testing and authorization.

2.13 SYSTEM PROGRAMMING

A. The Graphical Development Tool (GDT) shall provide the ability to perform system programming and graphic display engineering as part of a complete software package. The programming toolset will be provided to the owner as part of this project. The programming software shall be the same programming toolset as used by the contractor's engineers when programming this project. Access to the programming functions and features of the GDT shall be through password access as assigned by the system administrator.

B. The GDT shall be available in two versions; a thick-client version licensed to the computing platform on which it is installed and a thin-client version, capable of providing the complete set of engineering functions through a standard Web Browser. Programming and development tools not capable of providing all engineering and application development functions with a standard Web Browser are not acceptable.

C. A library of control, application, and graphic objects shall be provided to enable the creation of all applications and user interface screens. Applications are to be created by selecting the desired control objects from the library, dragging or pasting them on the screen, and linking them together using a built in graphical connection tool. Completed applications may be stored in the library for future use. Graphical User Interface screens shall be created in the same fashion. Data for the user displays is obtained by graphically linking the user display objects to the application objects to provide "real-time" data updates. Any real-time data value or object property may be connected to display its current value on a user display. All graphics must be created with a vector 3-D imaging software package, i.e., Dream Weaver, Illustrator, Cool 3-D or other commercially available graphics package.

D. Programming Methods

1. Provide the capability to copy objects from the supplied libraries, or from a user-defined library to the user's application. Objects shall be linked by a graphical linking scheme by dragging a link from one object to another. Object links will support one-to-one, many-to-one, or one-to-many relationships. Linked objects shall maintain their connections to other objects regardless of where they are positioned on the page and shall show link identification for links to objects on other pages for easy identification. Links will vary in color depending on the type of link; i.e., internal, external, hardware, etc.
2. Configuration of each object will be done through the object's property sheet using fill-in the blank fields, list boxes, and selection buttons. Use of custom programming, scripting language, or a manufacturer-specific procedural language for configuration will not be accepted.

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3. The software shall provide the ability to view the logic in a monitor mode. When on-line, the monitor mode shall provide the ability to view the logic in real time for easy diagnosis of the logic execution. When off-line (debug), the monitor mode shall allow the user to set values to inputs and monitor the logic for diagnosing execution before it is applied to the system.
4. All programming shall be done in real-time. Systems requiring the uploading on the owner's IT network, and downloading of database objects shall not be allowed.
5. The system shall support object duplication within a customer's database. An application, once configured, can be copied and pasted for easy re-use and duplication. All links, other than to the hardware, shall be maintained during duplication.

2.14 OBJECT LIBRARIES

A. A standard library of objects shall be included for development and setup of application logic, user interface displays, system services, and communication networks.

B. The objects in this library shall be capable of being copied and pasted into the user's database and shall be organized according to their function. In addition, the user shall have the capability to group objects created in their application and store the new instances of these objects in a user-defined library.

C. In addition to the standard libraries specified here, the supplier of the system shall maintain an on-line accessible (over the Internet) library, available to all registered users to provide new or updated objects and applications as they are developed.

D. All control objects shall conform to the control objects specified in the BACnet specification.

E. The library shall include applications or objects for the following functions, at a minimum:

1. Scheduling Object. The schedule must conform to the schedule object as defined in the BACnet specification, providing 7-day plus holiday & temporary scheduling features and a minimum of 10 on/off events per day. Data entry to be by graphical sliders to speed creation and selection of on-off events.
2. Calendar Object. . The calendar must conform to the calendar object as defined in the BACnet specification, providing 12-month calendar features to allow for holiday or special event data entry. Data entry to be by graphical "point-and-click" selection. This object must be "linkable" to any or all scheduling objects for effective event control.
3. Duty Cycling Object. Provide a universal duty cycle object to allow repetitive on/off time control of equipment as an energy conserving measure. Any number of these objects may be created to control equipment at varying intervals
4. Temperature Override Object. Provide a temperature override object that is capable of overriding equipment turned off by other energy saving programs (scheduling, duty cycling etc.) to maintain occupant comfort or for equipment freeze protection.
5. Start-Stop Time Optimization Object. Provide a start-stop time optimization object to provide the capability of starting equipment just early enough to bring space conditions to desired conditions by the scheduled occupancy time. Also, allow equipment to be stopped before the scheduled un-occupancy time just far enough ahead to take advantage of the building's "flywheel" effect for energy savings. Provide automatic tuning of all start / stop time object properties based on the previous day's performance.
6. Demand Limiting Object. Provide a comprehensive demand-limiting object that is capable of controlling demand for any selected energy utility (electric, oil, and gas). The object shall provide the capability of monitoring a demand value and predicting (by use of a sliding window prediction

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algorithm) the demand at the end of the user defined interval period (1-60 minutes). This object shall also accommodate a utility meter time sync pulse for fixed interval demand control. Upon a prediction that will exceed the user defined demand limit (supply a minimum of 6 per day), the demand limiting object shall issue shed commands to either turn off user specified loads or modify equipment set points to effect the desired energy reduction. If the list of sheddable equipment is not enough to reduce the demand to below the set point, a message shall be displayed on the users screen (as an alarm) instructing the user to take manual actions to maintain the desired demand. The shed lists are specified by the user and shall be selectable to be shed in either a fixed or rotating order to control which equipment is shed the most often. Upon suitable reductions in demand, the demand-limiting object shall restore the equipment that was shed in the reverse order in which it was shed. Each sheddable object shall have a minimum and maximum shed time property to effect both equipment protection and occupant comfort.

F. The library shall include control objects for the following functions. All control objects shall conform to the objects as specified in the BACnet specification.

1. Analog Input Object - Minimum requirement is to comply with the BACnet standard for data sharing. Allow high, low and failure limits to be assigned for alarming. Also, provide a time delay filter property to prevent nuisance alarms caused by temporary excursions above or below the user defined alarm limits.
2. Analog Output Object - Minimum requirement is to comply with the BACnet standard for data sharing.
3. Binary Input Object - Minimum requirement is to comply with the BACnet standard for data sharing. The user must be able to specify either input condition for alarming. This object must also include the capability to record equipment run-time by counting the amount of time the hardware input is in an “on” condition. The user must be able to specify either input condition as the “on” condition.
4. Binary Output Object - Minimum requirement is to comply with the BACnet standard for data sharing. Properties to enable minimum on and off times for equipment protection as well as interstart delay must be provided. The BACnet Command Prioritization priority scheme shall be incorporated to allow multiple control applications to execute commands on this object with the highest priority command being invoked. Provide sixteen levels of priority as a minimum. Systems not employing the BACnet method of contention resolution shall not be acceptable.
5. PID Control Loop Object - Minimum requirement is to comply with the BACnet standard for data sharing. Each individual property must be adjustable as well as to be disabled to allow proportional control only, or proportional with integral control, as well as proportional, integral and derivative control.
6. Comparison Object - Allow a minimum of two analog objects to be compared to select either the highest, lowest, or equality between the two linked inputs. Also, allow limits to be applied to the output value for alarm generation.
7. Math Object - Allow a minimum of four analog objects to be tested for the minimum or maximum, or the sum, difference, or average of linked objects. Also, allow limits to be applied to the output value for alarm generation.
8. Custom Programming Objects - Provide a blank object template for the creation of new custom objects to meet specific user application requirements. This object must provide a simple BASIC-like programming language that is used to define object behavior. Provide a library of functions including math and logic functions, string manipulation, and e-mail as a minimum. Also, provide a comprehensive on-line debug tool to allow complete testing of the new object. Allow new objects to be stored in the library for re-use.
9. Interlock Object - Provide an interlock object that provides a means of coordination of objects within a piece of equipment such as an Air Handler or other similar types of equipment. An example is to link the return fan to the supply fan such that when the supply fan is started, the

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return fan object is also started automatically without the user having to issue separate commands or to link each object to a schedule object. In addition, the control loops, damper objects, and alarm monitoring (such as return air, supply air, and mixed air temperature objects) will be inhibited from alarming during a user-defined period after startup to allow for stabilization. When the air handler is stopped, the interlocked return fan is also stopped, the outside air damper is closed, and other related objects within the air handler unit are inhibited from alarming thereby eliminating nuisance alarms during the off period.

10. Temperature Override Object - Provide an object whose purpose is to provide the capability of overriding a binary output to an "On" state in the event a user specified high or low limit value is exceeded. This object is to be linked to the desired binary output object as well as to an analog object for temperature monitoring, to cause the override to be enabled. This object will execute a Start command at the Temperature Override level of start/stop command priority unless changed by the user.
11. Composite Object - Provide a container object that allows a collection of objects representing an application to be encapsulated to protect the application from tampering, or to more easily represent large applications. This object must have the ability to allow the user to select the appropriate parameters of the "contained" application that are represented on the graphical shell of this container.

G. The object library shall include objects to support the integration of devices connected to the Network Area Controller or server software. At a minimum, provide the following as part of the standard library included with the programming software:

1. LonMark/LonWorks devices. These devices shall include, but not be limited to, devices for control of HVAC, lighting, access, and metering. Provide LonMark manufacturer-specific objects to facilitate simple integration of these devices. All network variables defined in the LonMark profile shall be supported. Information (type and function) regarding network variables not defined in the LonMark profile shall be provided by the device manufacturer.
2. For devices not conforming to the LonMark standard, provide a dynamic object that can be assigned to the device based on network variable information provided by the device manufacturer. Device manufacturer shall provide an XIF file and documentation for the device to facilitate device integration.
3. For BACnet devices, provide the following objects at a minimum:
    a. BACnet AI
    b. BACnet AO
    c. BACnet BI
    d. BACnet BO
    e. BACnet Device
4. For each BACnet object, provide the ability to assign the object a BACnet device and object instance number.

2.15 OTHER CONTROL SYSTEM HARDWARE

A. Ethernet Switches

1. 8 Port 10/100 MBPS Switch / Hub
2. Din Rail Mounted
3. LED communication indicators
4. Acceptable Manufacturers

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a. Contemporary Controls
b. INTEL
c. Cisco Systems

B. Temperature Sensors and Transmitters

1. General Sensor & Transmitter Requirements
   a. Provide sensors and transmitters required as outlined in the input/output summary and sequence of operation, and as required to achieve the specified accuracy as specified herein.
   b. Temperature transmitters shall be equipped with individual zero and span adjustments. The zero and span adjustments shall be non-interactive to permit calibration without iterative operations. Provide a loop test signal to aid in sensor calibration.
   c. Temperature transmitters shall be sized and constructed to be compatible with the medium to be monitored. Transmitters shall be equipped with a linearization circuit to compensate for non-linearities of the sensor and bridge and provide a true linear output signal.
   d. Temperature sensors shall be of the resistance type and shall be 10K or 20K Ohm Thermistor type.
      1) Thermistors are acceptable provided the mathematical relationship of a thermistor with respect to resistance and temperature with the thermistor fitting constraints is contained with the controllers operating software and the listed accuracy's can be obtained. Submit proof of the software mathematical equation and thermistor manufacturer fitting constants used in the thermistor mathematical/expressions. Thermistors shall be of the Thermistor (NTC) Type with a minimum of 50 ohm/°C. resistance change versus temperature to insure good resolution and accuracy.
   e. The following accuracy's are required and include errors associated with the sensor, lead wire and A to D conversion.
      1)

Point Type	Accuracy
Outside Air	+/-3%
Chilled/Hot Water	+/-1%
Room Temperature	+/-1%
Duct Temperature	+/-3%

      2) Sensors used in energy or process calculations shall be accurate over the process temperature range. Submit a manufacturer's calibration report indicating that the calibration certification is traceable to the National Bureau of Standards (NBS) Calibration Report Nos. 209527/222173.

2. Thermowells
   a. When thermowells are required, the sensor and well shall be supplied as a complete assembly including well head and Greenfield fitting, except where wells are to be installed under separate contract.
   b. Thermowells shall be pressure rated and constructed in accordance with the system working pressure
   c. Thermowells and sensors shall be mounted in a threadolet or 1/2" NPT saddle and allow easy access to the sensor for repair or replacement.
   d. Thermowells shall be constructed of the following materials:
      1) Hot Water; brass.
      2) Chilled Water; brass.

3. Outside Air Sensors

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a. Outside air sensors shall be designed to withstand the environmental conditions to which they will be exposed. They shall also be provided with a solar shield.
b. Sensors exposed to wind velocity pressures shall be shielded by a perforated plate surrounding the sensor element.
c. Temperature transmitters shall be of NEMA 3R construction and rated for ambient temperatures.
d. Solar load sensors shall be provided in locations shown. The use of a thermistor combined with a solar compensator is acceptable. Provide calibration charts as part of the O&M Manual.

4. Duct Type Sensors
   a. Duct mount sensors shall mount in a hand box through a hole in the duct and be positioned so as to be easily accessible for repair or replacement. A neoprene grommet (sealtite fitting and mounting plate) shall be used on the sensor assembly to prevent air leaks.
   b. Duct sensors shall be insertion type and constructed as a complete assembly including lock nut and mounting plate. Duct sensors probe shall be constructed of 304 stainless steel.
   c. For outdoor air duct applications, use a weatherproof mounting box with weatherproof cover and gasket.

5. Averaging Duct Type Sensors
   a. Where called out on the drawings and points lists, provide averaging type duct sensors. Thermistor sensors are acceptable. The sensor shall be multi-point sensitive through the length of the temperature conducting tubing. The thermistors shall be configured in a series / parallel method which creates an end result of total average resistance equal to the same span as a standard thermistor.
   b. Provide capillary supports at the sides of the duct to support the sensing element.

6. Acceptable Manufacturers
   a. Honeywell
   b. Johnson Controls
   c. ACI

C. Relative Humidity Sensors/Transmitters

1. The sensor shall be a solid state, resistance type relative humidity sensor of the Bulk Polymer Design. The sensor element shall be washable and shall resist surface contaminations.
2. Humidity transmitter shall be equipped with non-interactive span and zero adjustments, a 2 wire isolated loop powered, 4-20ma, 0-10.0 VDC linear proportional output.
3. The humidity transmitter shall meet the following overall accuracy including lead loss and A to D conversion.
   a. Room Type Sensor ±2% RH
   b. Duct Type Sensor ±2% RH

4. Outside air relative humidity sensors shall be installed in a rain proof, perforated cover. The transmitter shall be installed in a NEMA 3R enclosure with sealtite fittings and stainless steel bushings.
5. Provide a single point humidity calibrator, if required, for field calibration. Transmitters shall be shipped factory pre-calibrated.
6. Duct type sensing probes shall be constructed of 304 stainless steel and be equipped with a neoprene grommet, bushings and a mounting bracket.
7. Acceptable Manufacturers:

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a. Vailsala
b. ACI
c. Veris
d. Honeywell
e. Johnson Controls

D. Differential Pressure Transmitters and Accessories

1. General Air and Water Pressure Transmitter Requirements:
   a. Pressure transmitters shall be constructed to withstand 100% pressure over-range without damage and to hold calibrated accuracy when subject to a momentary 40% over-range input.
   b. Pressure transmitters shall provide the option to transmit a 0 to 5V dc, 0 to 10V dc, or 4 to 20 mA output signal.
   c. Differential pressure transmitters used for flow measurement shall be sized to the flow sensing device and shall be supplied with shutoff and bleed valves in the high and low sensing pick-up lines (3 valve manifolds).
   d. Provide a minimum of a NEMA 1 housing for the transmitter. Locate transmitters in accessible local control panels wherever possible.
   e. Low air pressure, differential pressure transmitters used for room pressurization control (i.e. laboratories, OR's clean rooms, etc.) shall be equipped with a LED display indicating the transmitter output signal.
   f. Duct sensing pressure applications where the velocity exceeds 1500 fpm shall utilize a static pressure traverse probes.

2. Low Air Pressure Applications
   a. The pressure transmitter shall be capable of transmitting a linear electronic signal proportional to the differential of the room and reference static pressure input signals with the following minimum performance specifications.
      1) Span: Not greater than two times the design space DP.
      2) Accuracy: Plus or minus 0.5% of F.S.
      3) Dead Band: Less than 0.3% of output.
      4) Repeatability: Within 0.2% of output.
      5) Linearity: Plus or minus 0.2% of span.
      6) Response: Less than one second for full span input.
      7) Temperature Stability: Less than 0.05% output shift per degree change.
   b. The transmitter shall utilize variable capacitance sensor technology and be immune to shock and vibration.
   c. Acceptable Manufacturers
      1) Auto Tran
      2) Veris
      3) Setra

3. Medium to High Air Pressure Applications
   a. The pressure transmitter shall be similar to the Low Air Pressure Transmitter except the performance specifications are not as severe. Provide differential pressure transmitters which meet the following performance requirements.
      1) Zero & span: (% F.S./Deg. C): .05% including linearity, hysteresis and repeatability
      2) Accuracy: 1% F.S. (best straight line)
      3) Static Pressure Effect: 0.5% F.S.
      4) Thermal Effects: ±.05% F.S. /Deg. C.

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b. Acceptable manufacturers:
   1) Auto Tran
   2) Veris
   3) Setra

E. Low Differential, Water Pressure Applications

1. The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20mA output in response to variation of flow meter differential pressure or water pressure sensing points.
2. The differential pressure transmitter shall have non-interactive zero and span adjustments adjustable from the outside cover and meet the following performance specifications.
   a. 0 – 10 input differential pressure range
   b. 4 - 20 mA output
   c. Maintain accuracy up to 20 to 1 ratio turndown
   d. Reference Accuracy: $\pm$ 0.2% of full span

3. Provide a two year warranty for each transmitter. Replace all transmitters found to be defective at no cost to the Owner during the warranty period. Acceptable Manufacturers:
   a. Tobar
   b. Veris
   c. Foxboro
   d. Omega
   e. Bailey
   f. Modus

F. Medium to High Differential Water Pressure Applications

1. The differential pressure transmitter shall meet the low pressure transmitter specifications except the following:
   a. Reference Accuracy: ±l% of full span (includes non-linearity, hysteresis, and repeatability)
   b. Warranty: 1 year.

2. Acceptable Manufacturers:
   a. Auto Tran
   b. Veris
   c. ACI
   d. Setra

3. Bypass Valve Assembly: Mount stand-alone pressure transmitters in a bypass valve assembly panel. The panel shall be constructed to NEMA 1 standards. The transmitter shall be installed in the panel with hi and low connections piped and valved. Air bleed units, bypass valves and compression fittings shall be provided

G. Electronic Valve And Damper Actuators

1. General Requirements
   a. Electronic actuators shall be electric, direct-coupled type capable of being mounted over the shaft of the damper. They shall be UL listed and the manufacturer shall provide a 2 year unconditional warranty from the date of commissioning. Power consumption shall not exceed 8 watts or 15 VA of transformer sizing capacity per high torque actuator nor 2 watts

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or 4 VA for VAV actuators. Sound level shall not exceed 45 dB for high torque or 35 dB for VAV actuators.

b. Electronic overload protection shall protect actuator motor from damage. If damper jams actuator shall not burn-out. Internal end switch type actuators are not acceptable. Actuators may be mechanically and electrically paralleled on the same shaft to multiply the available torque. A reversing switch shall be provided to change action from direct to reverse in relation to control signal as operation requires.

c. Warranty must be two years by manufacturer on actuator as a whole and all components.

d. Acceptable manufacturers:
   1) Honeywell
   2) Johnson Controls
   3) Belimo

2. Control Damper Actuators
   a. OA (outside air), RA (return air), and EA (exhaust air) actuators shall be spring return type for safety functions. Individual battery backup, capacitor return is not acceptable.
   b. The control circuit shall be fully modulating using 2 - 10 volt or 4 - 20 mA signals. Accuracy and repeatability shall be within $\pm$ 1/21 of control signal. A 2 - 10 v or 4 - 20 mA signal shall be produced by the actuator which is directly proportional to the shaft clamp position which can be used to control actuators which are paralleled off a master motor or to provide a feedback signal to the automation system indicating damper position. Accuracy shall be within $\pm$ 2.5%.
   c. Face and bypass dampers and other control dampers shall be modulating using the same control circuit detailed above but shall not be spring return.

3. Miscellaneous Damper Actuators
   a. OA combustion and ventilation air intake and EA damper actuators shall be 2 position spring return closed if any water piping, coils or other equipment in the space which the damper serves needs to be protected from freezing. Otherwise drive open, drive closed type 2 position may be used.
   b. Provide auxiliary switches on damper shaft or blade switch to prove damper has opened on all air handling equipment handling 100% outside air.

4. Air Terminals
   a. Air terminal actuators shall use fully modulating floating (drive open, drive closed) 3 wire control or use control circuit as detailed in control dampers depending on the controllers' requirements.

5. Combination Smoke and Fire Damper Actuators
   a. Actuators shall be factory mounted and connected to the damper section and shall conform to UL 555S specifications.

H. Valve Actuators

1. Control Valves Actuators (3 inch and smaller)
   a. Actuators shall have a gear release button on all non-spring return models to allow manual setting. The actuator shall have either an insulating air gap between it and the linkage or a non-conducting thermoplastic linkage. Care shall be taken to maintain the actuator's operating temperatures and humidity within its specifications. Pipes shall be fully insulated and heat shields shall be installed if necessary. Condensation may not form on actuators and shall be prevented by a combination of insulation, air gap, or other thermal break.

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b. The control circuit shall be fully modulating using 2 - 10 volt or 4 - 20 mA signals. Accuracy and repeatability shall be within 1/21 of control signal. A 2 - 10 v or 4 - 20 mA signal shall be produced by the actuator which is directly proportional to the shaft clamp position which can be used to control actuators which are paralleled off a master motor or to provide a feedback signal to the automation system indicating valve position.

c. Valve body and actuators shall be shipped fully assembled and tested at the valve factory prior to shipment.

2. Control Valve Actuators (4 inch and larger).

a. The valve actuator shall consist of a permanent split capacitor, reversible type electric motor which drives a compound epicycle gear. The electric actuator shall have visual mechanical position indication, readable from a distance of 8 meters, showing output shaft and valve position. Unit shall be mounting directly to the valves without brackets and adapters, or readily adapted to suit all other types quarter-turn valves.

b. The actuator shall have an integral terminal strip, which, through conduit entries, will ensure simple wiring to power supplies. Cable entries shall have UL recommended gland stops within the NPT hole to prevent glands from being screwed in too far and damaging cable.

c. The actuator shall be constructed to withstand high shock and vibrations without operations failure. The actuator cover shall have captive bolts to eliminate loss of bolts when removing the cover from the base. One copy of the wiring diagram shall be provided with the actuator.

d. The actuator shall have a self-locking gear train which is permanently lubricated at the factory. The gearing shall be run on ball and needle bearings. Actuators with 70 N-m or more output torque shall have two adjustable factory calibrated mechanical torque limit switches of the single-pole, double-throw type. The motor shall be fitted with thermal overload protection. Motor rotor shaft shall run in ball bearings at each end of motor.

e. The actuator housing shall be hard anodized aluminum for full environmental protection.

f. The environmental temperature range of the actuator shall be -22 to 140 deg F.

g. For intermittent on/off service, the actuator shall be rated at a 20% duty cycle (i.e., 12 minutes extended duty in every hour, or alternatively; one complete cycle every 2 minutes). For more frequent cycling and modulating service, an actuator shall be rated for continuous duty. The actuator rated for continuous duty shall be capable of operating 100% of the time at an ambient temperature of 104 deg F.

h. The actuator shall have an integral self-locking gear train. Motor brakes shall not be required to maintain desired valve position. Levers or latches shall not be required to engage or disengage the manual override. Mechanical travel stops, adjustable to 15° in each direction of 90° rotation shall be standard, as well as two adjustable travel limit switches with electrically isolated contacts. Additional adjustable switches shall be available as option.

i. Single Phase Motor: The motor shall have Class B insulation capable of withstanding locked-rotor for 25 seconds without overheating. Wiring shall also be Class B insulation. An auto-reset thermal cut-out protector shall be embedded in the motor windings to limit heat rise to 175 deg Fin a 104 deg Fambient. All motors shall be capable of being replaced by simply disconnecting the wires and then removing mounting bolts. Disassembly of gears shall not be required to remove the motor.

j. Materials of Construction: The electric actuator shall have a pressure die-cast, hard anodized aluminum base and cover. The compound gear shall be made of die-cast, hard anodized aluminum or steel. An alloy steel worm gear shall be provided for manual override and torque limiting. Bearings for gears shall be of the ball and needle type; bronze bearings shall be used on the shafting parts.

k. Accessories:

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1) Potentiometer for providing continuous feedback of actuator position at the controller (for valves specified position feedback).

l. Acceptable manufacturers:
1) Honeywell
2) Johnson Controls
3) Belimo

I. Pressure Independent Modulating Control Valves (PICV)

1. PICV valves shall have control and flow control performed by the same valve. PICV valves utilizing a separate ball, globe or butterfly valve in association with a dynamic balancing valve or flow measuring station shall not be acceptable.
2. Valve bodies 2" (50mm) and smaller shall be brass. Valve bodies 3" thru 6" shall be ductile iron.
3. Valves shall have (2) factory installed pressure/temperature ports as part of the actual valve body.
4. Piston and Spring Assembly: Stainless steel or corrosion resistant, tamper proof, self cleaning, removable.
   a. Field adjustable flow rate without removing cartridge from the valve body.
      1) In lieu of field adjustability, provide up to 10% of the total project PICV quantity of up or down sized flow rate cartridges as requested by Engineer during TAB.
5. Combination Assemblies: Include bonze or brass-alloy ball valve with stainless steel ball.
6. Identification Tag: Marked with zone identification, valve number, and flow rate.
7. Performance: Maintain constant flow, plus or minus 5 percent over system pressure fluctuations.
8. Minimum CWP Rating: 175 psig.
9. Maximum Operating Temperature: 250 deg F.
10. Seals: EDPM and Teflon

J. Switches

1. Differential Pressure Switches
   a. All pressure sensing elements shall be corrosion resistant. Pressure sensing elements shall be bourdon tubes, bellows, or diaphragm type. Units shall have tamper-proof adjustable range and differential pressure settings.
   b. Pressure sensor switch contacts shall be snap action micro-switch type. Sensor assembly shall operate automatically and reset automatically when conditions return to normal. Complete sensor assembly shall be protected against vibration at all critical movement pivots, slides and so forth.
   c. Differential pressure switches shall be vented to withstand a 50% increase in working pressure without loss of calibration.
   d. Acceptable Manufacturers: Mercoid, Dryer, McDonnell Miller.

2. Electric Low Limit Thermostat (Freeze Stat)
   a. Duct type, fixed 4 deg Fdifferential, range 32 to 60 deg F. Sensing element shall be a 20 feetlong capillary tube responding to the lowest temperature sensed along any 12 inchesof bulb length. Switch shall be SPDT 120/240 volts AC, rated for 10 amps at 120 volts full load. Unit shall be manually reset. Provide one low limit thermostat for each 20 sq. ft.or fraction thereof of coil surface area.
   b. Provide DPST switches, 1 NO, 1 NC contact.
   c. Provide manual type low limit thermostat set at 36 deg Fon each air handling unit.
   d. Provide thermostat override on air handling units for smoke control in area being served.

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3. Water Flow Switches
   a. UL listed, suitable for all service application conditions. Body minimum working pressure rating shall equal or exceed service pressure. Switch electrical rating shall be 230 volts AC 3.7 ampere, 115 volts AC 7.4 ampere, and 125 VAC 115-230 VAC AC Pilot duty. Unit shall have two SPDT switches. Actuating flow rated shall be field adjustable for the specified and indicated service. Switch location shall preclude exposure to turbulent or pulsating flow conditions. Flow switch shall not cause pressure drop exceeding 2 psi at maximum system flow rate.
   b. Acceptable Manufacturer: McDonnel-Miller.

4. Strap-On Aquastat
   a. UL listed, provided with a suitable removable spring clip for attaching aquastat to pipe and a snap-action SPDT switch. Switch set-point shall be as indicated. Electrical rating shall be 5 amperes, 120 VAC.

5. Current Sensitive Switches: Solid state, split core current switch that operates when the current level (sensed by the internal current transformer) exceeds the adjustable trip point. Current switch to include an integral LED for indication of trip condition and a current level below trip set point.

K. Flow, Pressure And Electrical Measuring Apparatus

1. Shielded Static Pressure Sensor
   a. Provide for each zone where required a shielded static pressure sensor suitable for ceiling surface mounting, complete with multiple sensing ports, pressure impulse suppression chamber, airflow shielding, and 3/8" compression takeoff fittings, all contained in a welded stainless steel casing, with polish finish on the exposed surfaces.
   b. These probes shall be capable of sensing the static pressure in the proximity of the sensor to within 1% of the actual pressure value while being subjected to a maximum airflow of 1000 feet/min. from a radial source.
   c. The shielded static sensing devices shall be used for both reference and space pressure sensing.
   d. Pressure sensors used for outside air pressure reference purposes shall be equipped with a conduit seal for pneumatic tubing and bushings for a weather tight installation.

2. Static Pressure Traverse Probe
   a. Provide multipoint traverse probes in the duct at each point where static pressure sensing is required.
   b. Each duct static traverse probe shall contain multiple static pressure sensors located along the exterior surface of the cylindrical probe. Pressure sensing points shall not protrude beyond the surface of the probe.
   c. The duct static traverse probe shall be of 304 stainless steel construction and (except for 3/4" dia. probes with lengths of 24 inchesor less) be complete with threaded end support rod, sealing washer and nut, and mounting plate with gasket and static pressure signal fitting. The static traverse probe shall be capable of producing a steady, non-pulsating signal of standard static pressure without need for correction factors, with an instrument accuracy of $\pm$ 1/2%.
   d. Acceptable Manufacturers:
      1) Auto Tran
      2) Veris
      3) Setra

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L. Relays And Contactors

1. Relays other than those associated with digital output cards shall be general purpose, enclosed type and protected by a heat and shock resistant duct cover. Number of contacts and operational function shall be as required.
2. Solid State Relays (SSR): Input/output isolation shall be greater than IOE^{9} ohms with a breakdown voltage of 1500V root mean square or greater at 60 Hz. The contact life shall be 10 x 10 E^{6} operations or greater. The ambient temperature range of SSRs shall be -18 to 140 deg F. Input impedance shall not be less than 500 ohms. Relays shall be rated for the application. Operating and release time shall be for 100 milliseconds or less. Transient suppression shall be provided as an integral part of the relay.
3. Contactors: Contactors shall be of the single coil, electrically operated, mechanically held type. Positive locking shall be obtained without the use of hooks, latches, or semipermanent magnets. Contractor shall be double-break-silver-to-silver type protected by arcing contacts. The number of contacts and rating shall be selected for the application. Operating and release times shall be 100 milliseconds or less. Contactors shall be equipped with coil transient suppression devices.

M. Temperature Control Panels

1. Furnish temperature control panels of code gauge steel with locking doors for mounting all devices as shown. Panels shall conform to NEMA 1 standards, unless otherwise indicated.
2. Control panels shall meet all requirements of UL508A and shall be so certified.
3. All external wiring shall be connected to terminal strips mounted within the panel.
4. Provide engraved phenolic nameplates identifying all devices mounted on the face of control panels and the identification number of the panel.
5. A complete set of ‘as-built’ control drawings (relating to the controls within that panel) shall be furnished within each control panel.

N. Variable Frequency Drives

1. Furnish Variable Frequency Drives (VFD) for installation by the electrical contractor (Div. 16). Drives shall be factory equipped with a LonTalk FTT-10A communications interface.
2. The variable frequency drive (VFD) shall generate the required variable frequency through three main input voltage lines connected to an LC filter and diode bridge. This shall produce a DC voltage for an insulated gate bi-polar transistor (IGBT) bridge. The IGBT bridge shall produce a pulse-width modulated (PWM) AC voltage for the motor. A microprocessor shall control the motor according to measured signals and control commands sent from the VFD control panel.
3. The VFD enclosure shall be INSERT ENCLOSURE TYPE (NEMA 1, NEMA 12, OPEN CHASSIS).
4. VFD shall be suitable for INSERT DESIRED VOLTAGE RANGE (208-240 VAC, 380-500 VAC, or 525-690 VAC). The VFD shall maintain functionality from -15% to +10% of nominal voltage at a frequency of 45-66 Hz. Ambient operating temperature range shall be 14 F to 104 F, and the humidity range: 5 to 95% RH (non-condensing).
5. The VFD shall accommodate inputs of 0-10 VDC, 4-20 mA, up to six digital inputs. VFD outputs shall include current of 0-20 mA, 500 ohm maximum with 10 bit resolution, and two programmable changeover relay outputs with switching capacity of 24 VDC, 8A; 250 VAC, 8A; and 125 VDC, 0.4A.
6. The VFD shall accommodate Modbus, LonTalk, and BACnet communications protocols for field bus control.
7. The variable frequency drive shall have separate pre-loaded user-programmable applications which can be modified using a personal computer-based commissioning tool with an optional

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software package, or an alpha-numeric LCD user interface. Aforementioned application functionality shall include but not be limited to:

a. Basic Functionality Application providing the following:
   1) Control I/O signals (two (2) analog inputs, one (1) digital input, and one (1) analog output) are fixed
   2) One (1) programmable digital input and one (1) programmable digital output
   3) All parameters have default values,
   4) No more than nine (9) parameter settings are required for startup and operation.

b. Expanded Functionality Application providing all capabilities in the previous application as well as the following:
   1) One (1) programmable digital input and all outputs are programmable
   2) Frequency limit and prohibit capability
   3) Programmable start/stop and reversing logic
   4) Automatic restart
   5) Programmable actions for motor thermal and stall protection
   6) DC brake at stop

c. Application that provides all previously mentioned capability as well as enabling the use of two different control and frequency sources. Each source must be programmable.

d. Application which provides all functionality from the Expanded Functionality Application as well as accommodates multiple, required fixed speed references.

e. PID Control Application – Uses internal PID control loop to control motor frequency as well as providing:

f. Input and output phase supervision

g. Programmable capability for three (3) digital inputs and all outputs

h. Sleep function

i. Multi-purpose Control Application – The frequency reference can be selected from analog inputs, joystick control, motor potentiometer, or a mathematical function of the analog inputs.

j. Application specifically designed to control one leading variable speed drive and up to 3 auxiliary drives.

8. Variable frequency drives shall be UL listed and sized for the power and loads applied.
9. Drives shall include built-in radio frequency interference (RFI) filters and be constructed to operate in equipment rooms and shall not be susceptible to electromagnetic disturbances typically encountered in such environments. Similarly, the drives must not excessively disturb the environment within which it is used.
10. All VFDs over 3 horsepower shall be provided with an AC choke before rectifiers. All included chokes and filters shall be integrated in the factory enclosure.
11. VFDs shall be installed in strict conformance to the manufacturer's installation instructions, and shall be rated to operate over a temperature range of 14 to 104 F.
12. VFD automatic operation shall be suitable for 4-20 ma input signal. Each VFD shall be fan cooled and have an integral keypad and alphanumeric "plain-language" display unit for user interface. The display shall indicate VFD status (RUN motor rotation, READY, STOP, ALARM, and FAULT), and shall indicate the VFD current control source (DDC input signal, keypad, or field bus control). In addition to the alphanumeric display, the display unit shall have three pilot lights to annunciate when the power is on (green), when the drive is running (green, blinks when stopping and ramping down), and when the drive was shut down due to a detected fault (red, fault condition presented on the alphanumeric display).
13. Three types of faults shall be monitored, "FAULT" shall shut the motor down, "FAULT Auto-reset" shall shut the motor down and try to restart it for a programmable number of tries, and "FAULT

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Trip" shall shut the motor down after a FAULT Auto-reset fails to restart the motor. Coded faults shall be automatically displayed for the following faults:

a. Over current
b. Over voltage
c. Earth ground
d. Emergency stop
e. System (component failure)
f. Under voltage
g. Phase missing
h. Heat sink under temperature
i. Heat sink over temperature
j. Motor stalled
k. Motor over temperature
l. Motor underload
m. Cooling fan failure
n. Inverter bridge over temperature
o. Analog input control under current
p. Keypad failure
q. Other product unique monitored conditions

14. In addition to annunciating faults, at the time of fault occurrence the VFD shall capture and make available to the user certain system data for subsequent analysis during fault trouble shooting, including duration of operation (days, hours, minutes, seconds),output frequency, motor current, motor voltage, motor power, motor torque, DC voltage, unit temperature, run status, rotation direction, and any warnings. The last 30 fault occurrences shall be retained as well as the fault data listed in the previous sentence of each fault. New faults beyond 30 shall overwrite the oldest faults.
15. The display unit keypad shall allow setting operational parameters including minimum and maximum frequency, and acceleration and deceleration times. The display shall offer user monitoring of faults, frequency, unit temperature, and motor speed, current, torque, power, voltage, and temperature.
16. Acceptable manufacturers:
    a. ABB
    b. Honeywell
    c. Square D

O. Any automatic control dampers not specified to be integral with other equipment. Frames shall not be less than 0.094 inch galvanized steel. Blades shall not be over 8 incheswide nor less than 0.063 inch galvanized steel roll formed. Bearings shall be oilite, ball-bearing or nylon with steel shafts. Side seals shall be stainless steel of the tight-seal spring type. Dampers and seals shall be suitable for temperature ranges of -40 to 200 deg F.

1. Individual damper sections shall have a maximum of 16 sq. ft. of damper surface and each individual damper section to have its own damper operator.
2. All proportional control dampers shall be opposed blade type and all two-position dampers shall be parallel blade types.
3. Dampers shall be sized to meet ductwork or opening size.
4. Dampers shall be ultra-low leakage dampers and the blade edges shall be fitted with replaceable, snap-on, inflatable seals to limit damper leakage to 6 CFM per square foot for dampers in excess of sixteen inches square at 1-inch wg.

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P. Thermally Isolated Dampers: Ruskin Model CDT150 or equivalent extruded aluminum thermally isolated control dampers with insulated air-foil shaped blades.

Q. Digital Wall Module: Each wall module shall provide temperature indication to the digital controller.

1. Provide software-limited set point adjustment and occupied/unoccupied override capability where indicated.
2. Module mounted adjustments shall use buttons, no slides or wheels.
3. Where indicated, provide plate type security temperature sensors.

R. Water Flow Meters: Water flow meters shall be axial turbine style flow meters which translate liquid motion into electronic output signals proportional to the flow sensed. Flow sensing turbine rotors shall be non-metallic and not impaired by magnetic drag. Flow meters shall be 'insertion' type complete with 'hot-tap' isolation valves to enable sensor removal without water supply system shutdown. Accuracy shall be ± 2% of actual reading from 0.4 to 20 feet per secondflow velocities.

S. Duct smoke detectors shall be furnished and connected to the building fire alarm under Division 28. Contacts shall be provided for the BMS contractor to connect for fan shutdown as specified in the Sequence of Operations.

T. Carbon Dioxide sensors shall be 0-10 Vdc analog output type, with corrosion free gold-plated Non-dispersive Infrared sensing, designed for duct mounting. Sensor shall incorporate internal diagnostics for power, sensor, analog and output checking, and Automatic Background Calibration algorithm for reduced maintenance. Sensor range shall be 0-3000 PPM with +/- 5% and +/- 50 PPM accuracy.

2.16 ELECTRICAL POWER MONITOR

A. Provide Veris Model H8163 or equivalent electrical power monitor to monitor the electrical consumption for the entire facility. The monitoring shall be installed on the 480 volt side of the power coming into the building. Provide a meter for each feed into the building (two required). All communications to building DDC control system shall be BACnet.

1. Monitor shall have a normally open pulse output with selectable pulse output rates of 0.10, 0.25, 0.50, or 1.00 kWh per pulse.
2. Monitor shall have a normally closed phase-loss alarm output operating at 100mA @ 24VAC/DC.

B. Monitor shall consist of digital electronic circuitry, conforming to ANSI C12.1 metering accuracy standards, and shall consist of a meter and current transformers calibrated together as a system. The monitor's accuracy shall be +/- 1% from 2% to 100% of the rated current over a temperature range of 0-50°C.

1. Monitor electronics shall automatically correct for current transformer phase reversal.

C. Monitor shall require no annual recalibration by users in the field and shall derive operating power from its metering connections.

D. Monitor shall be factory assembled shall have a visual display to show accumulated kWh on the top half of the display while the bottom half of the display scrolls through Amps, Voltage, PF, KVAR, KVA, KW Real Power.

E. The information and capabilities provided by the monitor shall include the following:

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1. Current, per phase and three-phase total
2. Voltage, per phase and three-phase total, phase-to-phase & phase-neutral
3. Real Power (kW), per phase and three-phase total
4. Reactive Power (kVAR), three phase total
5. Apparent Power (kVA), three phase total
6. Power Factor, per-phase and three-phase total
7. Real Energy (kWh), three phase total

PART 3 - EXECUTION

3.1 GENERAL

A. The BMS shall be designed, installed, and commissioned in a turnkey operational manner; including all labor not noted in Work by Others paragraph of PART I of this section of these specifications, and not noted in other sections of these specifications.

B. Where control devices are installed on insulated piping or ductwork, provide standoff brackets or thermowells sized to clear insulation thickness. Provide extended sensing elements, actuator linkages, and other accessories as required.

3.2 SEQUENCE OF OPERATION

A. Refer to M 600 series drawings for sequence of operations.

3.3 INSTALLATION

A. All controls Installer work shall be installed, wired, circuit tested and calibrated by factory certified technicians qualified for this work.

B. Line and low voltage electrical connections to control equipment shall be provided by the controls Installer in accordance with these specifications.

C. All control devices mounted on the face of control panels shall be clearly identified as to function and system served with permanently engraved phenolic labels.

D. All wiring and tubing shall be properly supported and run in a neat and workmanlike manner. All wiring and tubing exposed and in equipment rooms shall run parallel to or at right angles to the building structure. All tubing and wiring within enclosures shall be neatly bundled and anchored to prevent obstruction to devices and terminals. All wiring shall be in accordance with all local and national codes. All line voltage wiring, all wiring exposed, and all wiring in equipment rooms shall be installed in conduit in accordance to the electrical specifications. All electronic wiring shall be #18 AWG minimum THHN and shielded if required, except standard network (Ethernet, LonWorks, etc.) cabling shall be as tested and recommended in lieu of #18 gauge twisted, #22 or #24 gauge is acceptable if used as a part of an engineered structured cabling system. The control manufacturer must submit technical and application documentation demonstrating that this cabling system has been tested and approved for use by the manufacturer of both the control system and the engineered structured cabling system.

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1. Low voltage system cables shall be neatly routed and independently supported with cable rings to the nearest cable tray, technology closet, conduit run or equipment connection.
2. All wiring in ceiling plenums shall be plenum rated.

E. This contractor shall provide all sensing, control, and interlock wiring and tubing for the following unless shown or specified elsewhere by others:

1. Boiler interlocks.
2. Chiller interlocks.
3. Hydronic piping pressure sensors.
4. CO2 sensors.
5. Connection between occupancy sensors provided by Division 26 and control devices.
6. Smoke detection devices and HVAC equipment shut-down devices.

F. The controls contractor shall install all software and enter all computer data into the network area controllers, operator work stations, hardware, and related computers including all control programs, initial approved parameters and settings, and graphics.

G. Verify location of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation. Install wall-mounting devices in electrical outlet boxes at heights to match lighting controls.

H. For airflow monitoring devices, perform the following field tests and inspections and prepare test reports:

1. Operational Test: After substantial completion of airflow system, start units to confirm proper operation and readings. Remove and replace malfunctioning units and retest.
2. Test calibration to confirm proper operation and readings.

3.4 ACCEPTANCE

A. The BMS contractor shall completely check out, calibrate and test all connected hardware and software to insure that the system performs in accordance with the approved specifications and sequences of operations.

1. Coordinate with other Installers the checkout of each controlled system

B. The controls Installer shall perform tests to verify proper performance of components, routines, and points. Repeat tests until proper performance results. This testing shall include a point-by-point log to validate 100% of the input and output points of the DDC system operation.

C. Upon completion of the performance tests described above, repeat these tests, point by point as described in the validation log above in presence of Owner's Representative, as required. Properly schedule these tests so testing is complete at a time directed by the Owner's Representative. Do not delay tests so as to prevent delay of occupancy permits or building occupancy.

D. System Acceptance: Satisfactory completion is when the controls Installer has performed successfully all the required testing to show performance compliance with the requirements of the Contract Documents to the satisfaction of the Owner’s Representative. System acceptance shall be contingent upon completion and review of all corrected deficiencies.

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3.5 TRAINING

A. All training shall be by the BMS Installer and shall utilize operators' manuals and as-built documentation.

B. The controls Installer shall provide 40 hours of instruction to the Owner's designated personnel on the operation of the BMS and describe its intended use with respect to the programmed functions specified. Operator orientation of the BMS shall include, but not be limited to; device programming software, graphical development software, graphical user interface, the overall operation program, equipment functions (both individually and as part of the total integrated system), commands, systems generation, advisories, and appropriate operator intervention required in responding to the System's operation.

C. The training shall be in three sessions as follows:

1. Initial Training: One day session (8 hours) after system is started up and at least one week before first acceptance test. Manual shall have been submitted at least two weeks prior to training so that the Owners' personnel can start to familiarize themselves with the system before training begins.
2. Follow-Up Training: Two one day sessions (8 hours each) after initial training, and before Formal Acceptance. These sessions will deal with more advanced topics and answer questions.
3. Warranty Follow Up: Two one day sessions (8 hours each) to be scheduled at the request of the Owner during the one year warranty period. These sessions shall cover topics as requested by the owner such as; how to add additional points, create and gather data for trends, graphic screen generation or modification of control routines.

D. On-Line Service: Include 40 hours of on-line service assistance to include but not be limited to:

1. Programming changes or modifications, including changes and adjustments to control algorithms
2. Graphic changes or modifications as requested by the Owner or consulting engineer.
3. Operator assistance to include short (1 hour or less) refresh training on system diagnostics and operation, i.e., geothermal optimization, scheduling, trending or operator setup.
4. Consulting engineer assistance to include assistance on control system optimization.

3.6 POINTS LIST

A. Refer to M 600 series Drawings for points list. Provide all additional points as required to accomplish all BMS sequences indicated in the drawings and specifications.

END OF SECTION 23 0900

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SECTION 23 1123 - FACILITY NATURAL GAS PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Piping specialties.
3. Piping and tubing joining materials.
4. Valves.
5. Pressure regulators.
6. Mechanical sleeve seals.

1.2 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:

1. Piping and Valves: 100 psig minimum unless otherwise indicated.

B. Natural-Gas System Pressure within Buildings: 0.5 psig or less.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of the following:

1. Piping specialties.
2. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
3. Pressure regulators. Indicate pressure ratings and capacities.
4. Dielectric fittings.
5. Mechanical sleeve seals.
6. Escutcheons.

B. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For pressure regulators to include in emergency, operation, and maintenance manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.

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B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Natural-Gas Service: Do not interrupt natural-gas service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide purging and startup of natural-gas supply according to requirements indicated:

1. Notify Construction Manager and Owner no fewer than seven days in advance of proposed interruption of natural-gas service.
2. Do not proceed with interruption of natural-gas service without Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
    a. Material Group: 1.1.
    b. End Connections: Threaded or butt welding to match pipe.
    c. Face: Lapped.
    d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
    e. Bolts and Nuts: ASME B18.2.1, carbon steel.

5. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
    a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

2.2 PIPING SPECIALTIES

A. Appliance Flexible Connectors:

1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
4. Corrugated stainless-steel tubing with polymer coating.
5. Operating-Pressure Rating: 0.5 psig.

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6. End Fittings: Zinc-coated steel.
7. Threaded Ends: Comply with ASME B1.20.1.
8. Maximum Length: 72 inches.

B. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

C. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.3 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.

B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 MANUAL GAS SHUTOFF VALVES

A. See "Manual Gas Shutoff Valve Schedules" below for where each valve type is applied in various services.

B. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.

1. CWP Rating: 125 psig.
2. Threaded Ends: Comply with ASME B1.20.1.
3. Tamperproof Feature: Locking feature for valves indicated in "Manual Gas Shutoff Valve Schedule" Articles.
4. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
5. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.

C. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.

1. CWP Rating: 125 psig.
2. Threaded Ends: Comply with ASME B1.20.1.
3. Flanged Ends: Comply with ASME B16.5.
4. Tamperproof Feature: Locking feature for valves indicated in "Manual Gas Shutoff Valve Schedule" Articles.
5. Service Mark: Initials "WOG" shall be permanently marked on valve body.

D. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

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a. BrassCraft Manufacturing Company; a Masco company.
b. Conbraco Industries, Inc.; Apollo Div.
c. Lyall, R. W. & Company, Inc.
d. McDonald, A. Y. Mfg. Co.
e. Perfection Corporation; a subsidiary of American Meter Company.

2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated bronze.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Threaded-body packnut design with adjustable-stem packing.
7. Ends: Threaded.
8. CWP Rating: 600 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

E. Bronze Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Lee Brass Company.
   b. McDonald, A. Y. Mfg. Co.

2. Body: Bronze, complying with ASTM B 584.
3. Plug: Bronze.
4. Ends: Threaded or flanged.
5. Operator: Square head or lug type with tamperproof feature where indicated.
6. Pressure Class: 125 psig.
7. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

F. Cast-Iron, Nonlubricated Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. McDonald, A. Y. Mfg. Co.
   b. Mueller Co.; Gas Products Div.
   c. Xomox Corporation; a Crane company.

2. Body: Cast iron, complying with ASTM A 126, Class B.
3. Plug: Bronze or nickel-plated cast iron.
4. Seat: Coated with thermoplastic.
5. Stem Seal: Compatible with natural gas.
6. Ends: Threaded or flanged.
7. Operator: Square head or lug type with tamperproof feature where indicated.
8. Pressure Class: 125 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

G. Cast-Iron, Lubricated Plug Valves: MSS SP-78.

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1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Flowserve.
   b. Homestead Valve; a division of Olson Technologies, Inc.
   c. McDonald, A. Y. Mfg. Co.
   d. Milliken Valve Company.
   e. Mueller Co.; Gas Products Div.
   f. R&M Energy Systems, A Unit of Robbins & Myers, Inc.
   g. .

2. Body: Cast iron, complying with ASTM A 126, Class B.
3. Plug: Bronze or nickel-plated cast iron.
4. Seat: Coated with thermoplastic.
5. Stem Seal: Compatible with natural gas.
6. Ends: Flanged.
7. Operator: Gear drive.
8. Pressure Class: 125 psig.
9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

2.5 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 and smaller; flanged for regulators NPS 2-1/2 and larger.

B. Line Pressure Regulators: Comply with ANSI Z21.80.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Actaris.
   b. American Meter Company.
   c. Eclipse Combustion, Inc.
   d. Fisher Control Valves and Regulators; Division of Emerson Process Management.
   e. Invensys.
   f. Maxitrol Company.
   g. Richards Industries; Jordan Valve Div.

2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
6. Orifice: Aluminum; interchangeable.
7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
10. Overpressure Protection Device: Factory mounted on pressure regulator.

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11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
12. Maximum Inlet Pressure: 2 psig.

C. Appliance Pressure Regulators: Comply with ANSI Z21.18.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Canadian Meter Company Inc.
   b. Eaton Corporation; Controls Div.
   c. Harper Wyman Co.
   d. Maxitrol Company.
   e. SCP, Inc.

2. Body and Diaphragm Case: Die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber.
6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
7. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
8. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
9. Maximum Inlet Pressure: 1 psig.

2.6 DIELECTRIC FITTINGS

A. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Capitol Manufacturing Company.
   b. Central Plastics Company.
   c. Hart Industries International, Inc.
   d. McDonald, A. Y. Mfg. Co.
   e. Watts Regulator Co.; Division of Watts Water Technologies, Inc.
   f. Wilkins; Zurn Plumbing Products Group.

2. Minimum Operating-Pressure Rating: 150 psig.
3. Combination fitting of copper alloy and ferrous materials.
4. Insulating materials suitable for natural gas.
5. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

B. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Capitol Manufacturing Company.
   b. Central Plastics Company.
   c. Watts Regulator Co.; Division of Watts Water Technologies, Inc.
   d. Wilkins; Zurn Plumbing Products Group.

2. Minimum Operating-Pressure Rating: 150 psig.

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3. Combination fitting of copper alloy and ferrous materials.
4. Insulating materials suitable for natural gas.
5. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

C. Dielectric-Flange Kits:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Advance Products & Systems, Inc.
   b. Calpico Inc.
   c. Central Plastics Company.
   d. Pipeline Seal and Insulator, Inc.

2. Minimum Operating-Pressure Rating: 150 psig.
3. Companion-flange assembly for field assembly.
4. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or PE bolt sleeves, phenolic washers, and steel backing washers.
5. Insulating materials suitable for natural gas.
6. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

2.7 SLEEVES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

2.8 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Advance Products & Systems, Inc.
   b. Calpico Inc.
   c. Metraflex Company (The).
   d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe and sleeve.
3. Pressure Plates: Plastic.
4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one nut and bolt for each sealing element.

2.9 ESCUTCHEONS

A. General Requirements for Escutcheons: Manufactured wall and ceiling escutcheons and floor plates, with ID to fit around pipe or tube, and OD that completely covers opening.

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B. One-Piece, Deep-Pattern Escutcheons: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Escutcheons: With set screw.

1. Finish: Polished chrome-plated or rough brass.

D. Split-Casting, Cast-Brass Escutcheons: With concealed hinge and set screw.

1. Finish: Polished chrome-plated.

E. One-Piece, Floor-Plate Escutcheons: Cast-iron floor plate.

F. Split-Casting, Floor-Plate Escutcheons: Cast brass with concealed hinge and set screw.

PART 3 - EXECUTION

3.1 PREPARATION

A. Close equipment shutoff valves before turning off natural gas to premises or piping section.

B. Inspect natural-gas piping according to the International Fuel Gas Code to determine that natural-gas utilization devices are turned off in piping section affected.

C. Comply with the International Fuel Gas Code requirements for prevention of accidental ignition.

3.2 OUTDOOR PIPING INSTALLATION

A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Install underground, natural-gas piping buried at least 36 inches below finished grade. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

C. Install fittings for changes in direction and branch connections.

D. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.

E. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

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F. Install pressure gage downstream from each service regulator. Pressure gages are specified in Division 23 Section "Meters and Gages for HVAC Piping."

3.3 INDOOR PIPING INSTALLATION

A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Locate valves for easy access.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install escutcheons at penetrations of interior walls, ceilings, and floors.

1. New Piping:
    a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    b. Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
    c. Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-casting, cast-brass type with polished chrome-plated finish.
    d. Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
    e. Piping in Equipment Rooms: One-piece, cast-brass type.
    f. Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

K. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

L. Verify final equipment locations for roughing-in.

M. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

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N. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.

1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

O. Extend relief vent connections for line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

P. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

Q. Connect branch piping from top or side of horizontal piping.

R. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.

S. Do not use natural-gas piping as grounding electrode.

T. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

U. Install pressure gage upstream and downstream from each line regulator. Pressure gages are specified in Division 23 Section "Meters and Gages for HVAC Piping."

V. Install automatic gas shutoff valve furnished by food service equipment supplier.

W. Make final connection to gas-fired kitchen equipment furnished by food service equipment supplier.

3.4 VALVE INSTALLATION

A. Install manual gas shutoff valve at each gas-fired piece of equipment.

B. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

3.5 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:

1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
2. Cut threads full and clean using sharp dies.
3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.

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5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints:

1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
2. Bevel plain ends of steel pipe.

E. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hangers and supports specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
4. NPS 2-1/2 to NPS 3-1/2: Maximum span, 10 feet; minimum rod size, 1/2 inch.
5. NPS 4 and Larger: Maximum span, 10 feet; minimum rod size, 5/8 inch.

3.7 CONNECTIONS

A. Connect to utility's gas main according to utility's procedures and requirements.

B. Install piping adjacent to appliances to allow service and maintenance of appliances.

C. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.

D. Install pressure regulator at connection to gas-fired appliance and equipment as required to meet maximum gas pressure requirements of that particular device. Refer to equipment manufacturer recommendations for piping connections. Install regulators the greater of either 20 inches or 10 pipe diameters from the nearest fitting, elbow, or valve to the outlet of the regulator.

E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.8 LABELING AND IDENTIFYING

A. Comply with requirements in Division 23 Section "Identification for HVAC Piping and Equipment" for piping and valve identification.

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3.9 PAINTING

A. Comply with requirements in Division 09 painting Sections for painting interior and exterior natural-gas piping.

B. Paint exposed, exterior metal piping, valves, and piping specialties, except components with factory-applied paint or protective coating.

1. Color to be safety yellow .

C. Paint interior exposed metal piping, valves, and piping specialties, except components with factory-applied paint or protective coating.

1. Color to be safety yellow for exposed piping in mechanical rooms.
2. Color to match building wall/ceiling color for exposed piping in finished spaces.

3.10 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Test, inspect, and purge natural gas according to the International Fuel Gas Code and authorities having jurisdiction.

C. Natural-gas piping will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.11 OUTDOOR PIPING SCHEDULE

A. Underground natural-gas piping shall be one of the following:

1. PE pipe and fittings joined by heat fusion; terminated in an accessible location.
2. PE pipe and fittings joined by heat fusion, or mechanical couplings; service-line risers with tracer wire terminated in an accessible location.

B. Aboveground natural-gas piping shall be the following:

1. For NPS 2 and smaller, use steel pipe with malleable-iron fittings and threaded joints.
2. For NPS 2-1/2 and larger, use steel pipe with wrought-steel fittings and welded joints.

3.12 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG

A. Aboveground, branch piping NPS 1 and smaller shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.

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B. Aboveground, distribution piping shall be one of the following:

1. For NPS 2 and smaller, use steel pipe with malleable-iron fittings and threaded joints.
2. For NPS 2-1/2 and larger, use steel pipe with wrought-steel fittings and welded joints.

3.13 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Distribution piping valves for pipe sizes NPS 2 and smaller shall be one of the following:

1. Two-piece, full-port, bronze ball valves with bronze trim.
2. Bronze plug valve.

B. Distribution piping valves for pipe sizes NPS 2-1/2 and larger shall be one of the following:

1. Bronze plug valve.
2. Cast-iron, nonlubricated plug valve.

C. Valves in branch piping for single appliance shall be one of the following:

1. Two-piece, full-port, bronze ball valves with bronze trim.
2. Bronze plug valve.

END OF SECTION 23 1123

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SECTION 23 2300 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes refrigerant piping used for air-conditioning applications.

B. Related Sections include the following:

1. Division 23 Sections for smaller equipment furnished with refrigerant line sets.

1.2 PERFORMANCE REQUIREMENTS

A. Test Pressure for Refrigerant R-454B:

1. Suction Tubing for Refrigeration and Air-Conditioning Applications Other than Heat Pumps: 300 psig.
2. Suction Tubing for Heat-Pump Applications: 535 psig.
3. Hot-Gas and Tubing Lines: 535 psig.

1.3 ACTION SUBMITTALS

A. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.

1. Shop Drawing Scale: 1/4 inch equals 1 foot.
2. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

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1.6 QUALITY ASSURANCE

A. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

B. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.7 PRODUCT STORAGE AND HANDLING

A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

1.8 COORDINATION

A. Coordinate size and location of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

B. Coordinate size and location of equipment supports, and wall penetrations.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 280, Type ACR.

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

E. Brazing Filler Metals: AWS A5.8.

F. Flexible Connectors:

1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
2. End Connections: Socket ends.
3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch- long assembly.
4. Pressure Rating: Factory test at minimum 500 psig.
5. Maximum Operating Temperature: 250 deg F.

2.2 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; Type, Grade, and wall thickness as selected in Part 3 piping applications articles.

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B. Wrought-Steel Fittings: ASTM A 234/A 234M, for welded joints.

C. Steel Flanges and Flanged Fittings: ASME B16.5, steel, including bolts, nuts, and gaskets, bevel-welded end connection, and raised face.

D. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

E. Flanged Unions:

1. Body: Forged-steel flanges for NPS 1 to NPS 1-1/2 and ductile iron for NPS 2 to NPS 3. Apply rust-resistant finish at factory.
2. Gasket: Fiber asbestos free.
3. Fasteners: Four plated-steel bolts, with silicon bronze nuts. Apply rust-resistant finish at factory.
4. End Connections: Brass tailpiece adapters for solder-end connections to copper tubing.
5. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch- long assembly.
6. Pressure Rating: Factory test at minimum 400 psig.
7. Maximum Operating Temperature: 330 deg F.

F. Flexible Connectors:

1. Body: Stainless-steel bellows with woven, flexible, stainless-steel-wire-reinforced protective jacket
2. End Connections:

    a. NPS 2 and Smaller: With threaded-end connections.
    b. NPS 2-1/2 and Larger: With flanged-end connections.

3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch- long assembly.
4. Pressure Rating: Factory test at minimum 500 psig.
5. Maximum Operating Temperature: 250 deg F.

2.3 VALVES AND SPECIALTIES

A. Diaphragm Packless Valves:

1. Body and Bonnet: Forged brass or cast bronze; globe design with straight-through or angle pattern.
2. Diaphragm: Phosphor bronze and stainless steel with stainless-steel spring.
3. Operator: Rising stem and hand wheel.
4. Seat: Nylon.
5. End Connections: Socket, union, or flanged.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 275 deg F.

B. Packed-Angle Valves:

1. Body and Bonnet: Forged brass or cast bronze.
2. Packing: Molded stem, back seating, and replaceable under pressure.
3. Operator: Rising stem.

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4. Seat: Nonrotating, self-aligning polytetrafluoroethylene.
5. Seal Cap: Forged-brass or valox hex cap.
6. End Connections: Socket, union, threaded, or flanged.
7. Working Pressure Rating: 500 psig.
8. Maximum Operating Temperature: 275 deg F.

C. Check Valves:

1. Body: Ductile iron, forged brass, or cast bronze; globe pattern.
2. Bonnet: Bolted ductile iron, forged brass, or cast bronze; or brass hex plug.
3. Piston: Removable polytetrafluoroethylene seat.
4. Closing Spring: Stainless steel.
5. Manual Opening Stem: Seal cap, plated-steel stem, and graphite seal.
6. End Connections: Socket, union, threaded, or flanged.
7. Maximum Opening Pressure: 0.50 psig.
8. Working Pressure Rating: 500 psig.
9. Maximum Operating Temperature: 275 deg F.

D. Service Valves:

1. Body: Forged brass with brass cap including key end to remove core.
2. Core: Removable ball-type check valve with stainless-steel spring.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Copper spring.
5. Working Pressure Rating: 500 psig.

E. Solenoid Valves: Comply with ARI 760 and UL 429; listed and labeled by an NRTL.

1. Body and Bonnet: Plated steel.
2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Threaded.
5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter.
6. Working Pressure Rating: 400 psig.
7. Maximum Operating Temperature: 240 deg F.
8. Manual operator.

F. Safety Relief Valves: Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.

1. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.
2. Piston, Closing Spring, and Seat Insert: Stainless steel.
3. Seat Disc: Polytetrafluoroethylene.
4. End Connections: Threaded.
5. Working Pressure Rating: 400 psig.
6. Maximum Operating Temperature: 240 deg F.

G. Thermostatic Expansion Valves: Comply with ARI 750.

1. Body, Bonnet, and Seal Cap: Forged brass or steel.

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2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
3. Packing and Gaskets: Non-asbestos.
4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
5. Suction Temperature: 40 deg F.
6. Superheat: Adjustable or nonadjustable as required by application.
7. End Connections: Socket, flare, or threaded union.
8. Working Pressure Rating: 700 psig or 450 psig as required by application.

H. Hot-Gas Bypass Valves: Comply with UL 429; listed and labeled by an NRTL.

1. Body, Bonnet, and Seal Cap: Ductile iron or steel.
2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
3. Packing and Gaskets: Non-asbestos.
4. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
5. Seat: Polytetrafluoroethylene.
6. Equalizer: Internal or external as required by application.
7. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter.
8. End Connections: Socket.
9. Set Pressure: As required by application.
10. Throttling Range: Maximum 5 psig.
11. Working Pressure Rating: 500 psig.
12. Maximum Operating Temperature: 240 deg F.

I. Straight-Type Strainers:

1. Body: Welded steel with corrosion-resistant coating.
2. Screen: 100-mesh stainless steel.
3. End Connections: Socket or flare.
4. Working Pressure Rating: 500 psig.
5. Maximum Operating Temperature: 275 deg F.

J. Angle-Type Strainers:

1. Body: Forged brass or cast bronze.
2. Drain Plug: Brass hex plug.
3. Screen: 100-mesh monel.
4. End Connections: Socket or flare.
5. Working Pressure Rating: 500 psig.
6. Maximum Operating Temperature: 275 deg F.

K. Moisture/Liquid Indicators:

1. Body: Forged brass.
2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
3. Indicator: Color coded to show moisture content in ppm.
4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
5. End Connections: Socket or flare.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 240 deg F.

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L. Replaceable-Core Filter Dryers: Comply with ARI 730.

1. Body and Cover: Painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets.
2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
3. Desiccant Media: Activated alumina or charcoal as required by application.
4. End Connections: Socket.
5. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
6. Maximum Pressure Loss: 2 psig.
7. Working Pressure Rating: 500 psig.
8. Maximum Operating Temperature: 240 deg F.

M. Permanent Filter Dryers: Comply with ARI 730.

1. Body and Cover: Painted-steel shell.
2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
3. Desiccant Media: Activated alumina or charcoal as required by application
4. End Connections: Socket.
5. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
6. Maximum Pressure Loss: 2 psig.
7. Working Pressure Rating: 500 psig.
8. Maximum Operating Temperature: 240 deg F.

N. Mufflers:

1. Body: Welded steel with corrosion-resistant coating.
2. End Connections: Socket or flare.
3. Working Pressure Rating: 500 psig.
4. Maximum Operating Temperature: 275 deg F.

O. Receivers: Comply with ARI 495.

1. Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
2. Comply with UL 207; listed and labeled by an NRTL.
3. Body: Welded steel with corrosion-resistant coating.
4. Tappings: Inlet, outlet, liquid level indicator, and safety relief valve.
5. End Connections: Socket or threaded.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 275 deg F.

P. Liquid Accumulators: Comply with ARI 495.

1. Body: Welded steel with corrosion-resistant coating.
2. End Connections: Socket or threaded.
3. Working Pressure Rating: 500 psig.
4. Maximum Operating Temperature: 275 deg F.

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2.4 REFRIGERANTS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Atofina Chemicals, Inc.
2. DuPont Company; Fluorochemicals Div.
3. Honeywell, Inc.; Genetron Refrigerants.
4. INEOS Fluor Americas LLC.

B. ASHRAE 34, R-22: Monochlorodifluoromethane.

C. ASHRAE 34, R-134a: Tetrafluoroethane.

D. ASHRAE 34, R-407C: Difluoromethane/Pentafluoroethane/1,1,1,2-Tetrafluoroethane.

E. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-134a

A. Suction Lines NPS 4 and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR or Type L, annealed-temper or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

B. Hot-Gas and Liquid Lines: Copper, Type ACR, Type K, or Type L, annealed-temper or drawn-temper tubing and wrought-copper fittings with soldered joints.

C. Safety-Relief-Valve Discharge Piping: Schedule 40, black-steel and wrought-steel fittings with welded joints, or copper Type ACR, Type K, or Type L, drawn-temper tubing and wrought-copper fittings with soldered joints.

3.2 PIPING APPLICATIONS FOR REFRIGERANT R-407C

A. Suction Lines NPS 4 and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, or Type L, annealed-temper or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

B. Hot-Gas and Liquid Lines: Copper, Type ACR, Type K, or Type L, annealed-temper or drawn-temper tubing and wrought-copper fittings with soldered joints.

C. Safety-Relief-Valve Discharge Piping: Schedule 40, black-steel and wrought-steel fittings with welded joints, or copper Type ACR, Type K, or Type L, drawn-temper tubing and wrought-copper fittings with soldered joints.

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3.3 PIPING APPLICATIONS FOR REFRIGERANT R-410A

A. Suction Lines NPS 4 and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, Type Kor Type L, annealed-temper or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

B. Hot-Gas and Liquid Lines:

1. NPS 5/8 and Smaller: Copper, Type ACR or Type L, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
2. NPS 3/4 to NPS 1 and Smaller: Copper, Type K, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
3. NPS 1-1/4 and Smaller: Copper, Type ACR, Type K or Type L, drawn-temper tubing and wrought-copper fittings with 95-5 tin-antimony soldered joints.
4. NPS 1-1/2 to NPS 2: Copper, Type ACR, Type K or Type L, drawn-temper tubing and wrought-copper fittings with Alloy HB soldered joints.
5. NPS 2 to NPS 4: Schedule 40, black-steel and wrought-steel fittings with welded joints.

C. Safety-Relief-Valve Discharge Piping:

1. NPS 5/8 and Smaller: Copper, Type ACR or Type L, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
2. NPS 3/4 to NPS 1 and Smaller: Copper, Type K, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
3. NPS 1-1/4 and Smaller: Copper, Type ACR, Type K, or Type L, drawn-temper tubing and wrought-copper fittings with 95-5 tin-antimony soldered joints.
4. NPS 1-1/2 to NPS 2: Copper, Type ACR, Type K, or Type L, drawn-temper tubing and wrought-copper fittings with Alloy HB soldered joints.
5. NPS 2 to NPS 4: Schedule 40, black-steel and wrought-steel fittings with welded joints.

3.4 VALVE AND SPECIALTY APPLICATIONS

A. Install valves in suction and discharge lines of compressor.

B. Install service valves for gage taps at inlet and outlet of hot-gas bypass valves and strainers if they are not an integral part of valves and strainers.

C. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.

D. Except as otherwise indicated, install valves on inlet and outlet side of filter dryers.

E. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at top.

F. Install thermostatic expansion valves as close as possible to distributors on evaporators.

1. Install valve so diaphragm case is warmer than bulb.
2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.

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3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

G. Install safety relief valves where required by ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.

H. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

I. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for device being protected:

1. Solenoid valves.
2. Thermostatic expansion valves.
3. Hot-gas bypass valves.
4. Compressor.

J. Install filter dryers in liquid line between compressor and thermostatic expansion valve[**, and in the suction line at the compressor**].

K. Install flexible connectors at compressors.

3.5 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Refer to Division 23 Sections "Instrumentation and Control for HVAC" and "Sequence of Operation" for solenoid valve controllers, control wiring, and sequence of operation.

K. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

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L. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Division 08 Section "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

M. Install refrigerant piping in protective conduit where installed belowground.

N. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

O. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps and double risers to entrain oil in vertical runs.
4. Liquid lines may be installed level.

P. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

Q. Install pipe sleeves at penetrations in exterior walls and floor assemblies.

R. Seal penetrations through fire and smoke barriers according to Division 07 Section "Penetration Firestopping."

S. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

T. Install sleeves through floors, walls, or ceilings, sized to permit installation of full-thickness insulation.

U. Seal pipe penetrations through exterior walls according to Division 07 Section "Joint Sealants" for materials and methods.

V. Identify refrigerant piping and valves according to Division 23 Section "Identification for HVAC Piping and Equipment."

3.6 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."

D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

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E. Threaded Joints: Thread steel 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. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry-seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

F. Steel pipe can be threaded, but threaded joints must be seal brazed or seal welded.

G. Welded Joints: Construct joints according to AWS D10.12/D10.12M.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.7 HANGERS AND SUPPORTS

A. Hanger, support, and anchor products are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:

1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 1/4 inch.
2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch.
3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.
4. NPS 1-1/4: Maximum span, 96 inches; minimum rod size, 3/8 inch.
5. NPS 1-1/2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
6. NPS 2: Maximum span, 96 inches; minimum rod size, 3/8 inch.

D. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
2. NPS 2-1/2: Maximum span, 11 feet; minimum rod size, 3/8 inch.
3. NPS 3: Maximum span, 12 feet; minimum rod size, 3/8 inch.
4. NPS 4: Maximum span, 14 feet; minimum rod size, 1/2 inch.

E. Support multifloor vertical runs at least at each floor.

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3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.

    a. Fill system with nitrogen to the required test pressure.
    b. System shall maintain test pressure at the manifold gage throughout duration of test.
    c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
    d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.9 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Install core in filter dryers after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
4. Charge system with a new filter-dryer core in charging line.

3.10 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:

1. Open shutoff valves in condenser water circuit.
2. Verify that compressor oil level is correct.
3. Open compressor suction and discharge valves.
4. Open refrigerant valves except bypass valves that are used for other purposes.
5. Check open compressor-motor alignment and verify lubrication for motors and bearings.

E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

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END OF SECTION 23 2300

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SECTION 23 3113 - METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes metal ducts for air-distribution systems.

B. Related Sections include the following:

1. Division 23 Section "Nonmetal Ducts" for roof mounted phenolic pre-insulated duct system.
2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors, turning vanes, flexible ducts, and flexible connectors.

1.2 SYSTEM DESCRIPTION

A. Duct system design, as indicated, has been used to select size and type of air-moving and -distribution equipment and other air system components. Changes to layout or configuration of duct system must be specifically approved in writing by Architect/Engineer. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

1.3 ACTION SUBMITTALS

A. Product data for the following items:

1. Sealing Materials.
2. Duct Liner.

B. Duct Leakage Reports: Submit duct leakage test reports. The reports shall be certified proof that the systems have been leak tested, in accordance with this specification section and the referenced standards and are an accurate representation of the system leakage.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. NFPA Compliance:

1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

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1.6 DELIVERY, STORAGE, AND PROTECTION

A. Deliver sealant materials to site in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.

B. Store and handle sealant materials in compliance with manufacturers' recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SHEET METAL MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.

C. Aluminum Sheets: ASTM B 209, alloy 3003, temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

D. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts.

E. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

F. Bird Screen: 1/2 inch mesh, 16 gage galvanized wire.

2.3 DUCT LINER

A. Fibrous-Glass Liner: Comply with NFPA 90A or NFPA 90B and with NAIMA AH124.

1. Manufacturers:
   a. CertainTeed Corp.; Insulation Group.
   b. Johns Manville International, Inc.
   c. Knauf Fiber Glass GmbH.
   d. Owens Corning.

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2. Materials: ASTM C 1071; surfaces exposed to airstream shall be coated to prevent erosion of glass fibers.
   a. Thickness: 1 inch.
   b. Thermal Conductivity (k-Value): 0.26 at 75 deg F mean temperature.
   c. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.
   d. Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
   e. Mechanical Fasteners: Galvanized steel suitable for mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in duct.
      1) Tensile Strength: Indefinitely sustain a 50-lb- tensile, dead-load test perpendicular to duct wall.
      2) Fastener Pin Length: As required for thickness of insulation and without projecting more than 1/8 inch into airstream.

2.4 SEALANT MATERIALS

A. Water-Based Joint and Seam Sealant: Flexible, adhesive sealant, resistant to UV light when cured, UL 723 listed, and complying with NFPA requirements for Class 1 ducts.

1. For indoor applications, use adhesive that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Flanged Joint Mastic: One-part, acid-curing, silicone, elastomeric joint sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.

C. Flange Gaskets: Butyl rubber or EPDM polymer with polyisobutylene plasticizer.

2.5 HANGERS AND SUPPORTS

A. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
2. Exception: Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

B. Install structural steel members between building structure members as required for upper attachment of hangers and supports. Use members of size and strength required for span and load. The use of joist or truss bridging for hanging and supporting is prohibited.

C. Hanger Materials: Galvanized sheet steel or threaded steel rod.

1. Hangers Installed in Corrosive Atmospheres: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
2. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for steel sheet width and thickness and for steel rod diameters.
3. For exposed aluminum ductwork, provide matching stainless steel or aluminum support materials.

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D. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

E. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

2.6 RECTANGULAR DUCT FABRICATION

A. Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" and complying with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.

1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure class.
2. Deflection: Duct systems shall not exceed deflection limits according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

B. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 0.0359 inch thick or less, with more than 10 sq. ft. of nonbraced panel area unless ducts are lined.

2.7 APPLICATION OF LINER IN RECTANGULAR DUCTS

A. All sizes shown on the drawings for ducts which require duct liner shall be sizes inside the liner.

B. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.

C. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.

D. Butt transverse joints without gaps and coat joint with adhesive.

E. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.

F. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and standard liner product dimensions make longitudinal joints necessary.

G. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.

H. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

1. Fan discharges.
2. Intervals of lined duct preceding unlined duct.
3. Upstream edges of transverse joints in ducts where air velocities are greater than 2500 fpm (12.7 m/s) or where indicated.

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I. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.8 ROUND AND FLAT-OVAL DUCT AND FITTING FABRICATION

A. Spiral Duct Manufacturers:

1. Eastern Sheet Metal.
2. SET Duct.
3. LaPine Metal Products.
4. McGill AirFlow Corporation.
5. SEMCO Incorporated.

B. Round, Longitudinal-Seam Ducts: Fabricate 12 inch and smaller ducts and drops to diffusers of galvanized steel according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

C. Round, Spiral Lock-Seam Ducts: Fabricate 13 inch and larger ducts of galvanized steel according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

D. Flat-Oval, Spiral Lock -Seam Ducts: Fabricate supply ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

E. Duct Joints:

1. Ducts up to 20 Inches in Diameter: Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.
2. Ducts 21 to 72 Inches in Diameter: Three-piece, gasketed, flanged joint consisting of two internal flanges with sealant and one external closure band with gasket.

F. 90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," with metal thicknesses specified for longitudinal-seam straight ducts.

G. Diverging-Flow Fittings: Fabricate with reduced entrance to branch taps and with no excess material projecting from fitting onto branch tap entrance.

H. Fabricate elbows using die-formed, gored, pleated, or mitered construction. Bend radius of die-formed, gored, and pleated elbows shall be 1-1/2 times duct diameter. Unless elbow construction type is indicated, fabricate elbows as follows:

1. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.
2. Round Mitered Elbows: Welded construction with metal thickness equal to or greater than that of ducts.
3. Flat-Oval Mitered Elbows: Welded construction with same metal thickness as longitudinal-seam flat-oval duct. Furnish with turning vanes.
4. 90-Degree, 2-Piece, Mitered Elbows: Use only for supply systems or for material-handling Class A or B exhaust systems and only where space restrictions do not permit using radius elbows. Fabricate with single-thickness turning vanes.

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5. Round Elbows 8 Inches and Less in Diameter: Fabricate die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30 and 60 degrees only. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
6. Round Elbows 9 through 14 Inches in Diameter: Fabricate with gored construction, unless space restrictions require mitered elbows. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
7. Round Elbows Larger Than 14 Inches in Diameter and All Flat-Oval Elbows : Fabricate gored elbows unless space restrictions require mitered elbows.
8. Die-Formed Elbows for Sizes through 8 Inches in Diameter and All Pressures 0.040 inch thick with 2-piece welded construction.
9. Round Gored-Elbow Metal Thickness: Same as metal thickness or greater than that of ducts.
10. Flat-Oval Elbow Metal Thickness: Same as metal thickness or greater than that of ducts.

PART 3 - EXECUTION

3.1 DUCTWORK CONSTRUCTION

A. Provide ductwork constructed in accordance with SMACNA Duct Construction Standards but no less than the static pressure classification as indicated below. Fabricate ductwork that will have less leakage than the percentage of system design air flow as indicated below. Test all ductwork for leakage, unless otherwise noted, in accordance with SMACNA HVAC Air Duct Leakage Test Manual and the following.

1. VAV Supply Air Ductwork (AHU/ERU to Terminal Units)
   a. Duct Construction Static Pressure Class: +6-inch wg.
   b. SMACNA Seal Class: A.
   c. Percent Leakage of System Design Air Flow: 2 percent.
   d. Testing Static Pressure: +6-inch wg.

2. VAV Supply Air Ductwork (Terminal Units to Diffusers)
   a. Duct Construction Static Pressure Class: +1-inch wg.
   b. SMACNA Seal Class: C.
   c. Percent Leakage of System Design Air Flow: 3 percent.
   d. Testing Static Pressure: No testing required.

3. Supply Air Ductwork (AHU to Diffusers)
   a. Duct Construction Static Pressure Class: +3-inch wg.
   b. SMACNA Seal Class: B.
   c. Percent Leakage of System Design Air Flow: 3 percent.
   d. Testing Static Pressure: +3-inch wg.

4. Return Air Ductwork (from Grille to AHU)
   a. Duct Construction Static Pressure Class: -3-inch wg.
   b. SMACNA Seal Class: B.
   c. Percent Leakage of System Design Air Flow: 5 percent.
   d. Testing Static Pressure: -3-inch wg.

5. Exhaust Air Ductwork (To fans)
   a. Duct Construction Static Pressure Class: -2-inch wg.
   b. SMACNA Seal Class: B.

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c. Percent Leakage of System Design Air Flow: 5 percent.
d. Testing Static Pressure: No testing required..
e. Duct Construction Static Pressure Class: -1-inch wg.
f. SMACNA Seal Class: C.
g. Percent Leakage of System Design Air Flow: 5 percent.
h. Testing Static Pressure: No testing required.

6. Exhaust Air Ductwork (From inline ceiling fans)
   a. Duct Construction Static Pressure Class: +1-inch wg.
   b. SMACNA Seal Class: C.
   c. Percent Leakage of System Design Air Flow: 5 percent.
   d. Testing Static Pressure: No testing required.

7. Relief Air Ductwork
   a. Duct Construction Static Pressure Class: +1-inch wg.
   b. SMACNA Seal Class: C.
   c. Percent Leakage of System Design Air Flow: 5 percent.
   d. Testing Static Pressure: No testing required.

8. Outside Air Ductwork
   a. Duct Construction Static Pressure Class: -1-inch wg.
   b. SMACNA Seal Class: C.
   c. Percent Leakage of System Design Air Flow: 5 percent.
   d. Testing Static Pressure: No testing required.

9. Transfer Air Ductwork
   a. Duct Construction Static Pressure Class: -1/2-inch wg.
   b. SMACNA Seal Class: C.
   c. Percent Leakage of System Design Air Flow: 5 percent.
   d. Testing Static Pressure: No testing required.

3.2 DUCT APPLICATIONS

A. All ducts shall be galvanized steel except as follows:

1. Shower Room Exhaust Ducts:

   a. Aluminum, with seams and laps arranged on top of duct.

3.3 DUCT INSTALLATION

A. Construct and install ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.

B. Install round and flat-oval ducts in lengths not less than 12 feet unless interrupted by fittings.

C. Install ducts with fewest possible joints.

D. Install fabricated fittings for changes in directions, size, and shape and for connections.

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E. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12 inches, with a minimum of 3 screws in each coupling.

F. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.

J. Coordinate layout with suspended ceiling, fire and smoke-control dampers, lighting layouts, and similar finished work.

K. Seal all joints and seams. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws.

L. Electrical Equipment Spaces: Route ducts to avoid passing through transformer vaults and electrical equipment spaces and enclosures.

M. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and are exposed to view, conceal spaces between construction openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap openings on 4 sides by at least 1-1/2 inches.

N. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions, install appropriately rated fire dampers, sleeves, and firestopping sealant. Fire and smoke dampers are specified in Division 23 Section "Air Duct Accessories." Firestopping materials and installation methods are specified in Division 07 Section "Penetration Firestopping."

O. Paint interiors of metal ducts, that do not have duct liner, for 24 inches upstream of registers and grilles. Apply one coat of flat, black, latex finish coat over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 09 painting Sections.

P. Coordinate duct installations with installation of accessories, dampers, coil frames, equipment, controls and other associated work of ductwork system. Install duct mounted control dampers supplied by Temperature Control Installer.

Q. At ends of ducts which are not connected to equipment or air distribution devices at time of ductwork installation, provide temporary closure of polyethylene film or other covering which will prevent entrance of dust and debris until time connections are to be completed.

R. Where indicated, install wire mesh bird screen grilles mounted in a removable frame.

3.4 DUCT CLEANLINESS REQUIREMENTS

A. Protect duct interiors from the elements and foreign materials in accordance with the following SMACNA's "Duct Cleanliness for New Construction." Guidelines:

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1. Intermediate Level.

3.5 SEAM AND JOINT SEALING

A. All ductwork shall be suitably cleaned and prepared, and sealant applied in strict accordance with manufacturer's instructions. Manufacturer's recommendations for cure time shall be followed before pressure testing is begun. Any additional paint or coatings must conform to manufacturer's specifications. Seal duct seams and joints as follows:

1. Pressure Classifications Greater Than 3 Inches Water Gage: All transverse joints, longitudinal seams, and duct penetrations (SMACNA Seal Class A).
2. Pressure Classification 2 and 3 Inches Water Gage: All transverse joints and longitudinal seams (SMACNA Seal Class B).
3. Pressure Classification Less than 2 Inches Water Gage: Transverse joints only (SMACNA Seal Class C).

B. Seal ducts and leak test where indicated before external insulation is applied.

3.6 HANGING AND SUPPORTING

A. Support ductwork with support systems indicated in SMACNA "HVAC Duct Construction Standards".

B. Support horizontal ducts within 24 inches of each elbow and within 48 inches of each branch intersection.

C. Support vertical ducts at maximum intervals of 16 feet and at each floor.

D. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.

E. Install powder-actuated concrete fasteners after concrete is placed and completely cured.

1. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

3.7 CONNECTIONS

A. Make connections to equipment with flexible connectors according to Division 23 Section "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

C. Louver Plenums: Fabricate of heavy gauge sheet metal material in compliance with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

1. Fabricate with sloped bottom surface.
2. Apply two coats of fire retardant, bitumastic waterproofing material to interior surfaces of bottom and lower half of sides.

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3.8 FIELD QUALITY CONTROL

A. Provide duct leakage testing in accordance with SMACNA HVAC Air/Duct Leakage Test Manual and prepare test reports.

B. Disassemble, reassemble, and seal segments of the systems as required to accommodate leakage testing, and as required for compliance with test requirements.

C. Conduct tests, in the presence of the Architect/Engineer, at static pressures equal to the maximum design pressure of the system or the section being tested. If pressure classifications are not indicated, test entire system at the maximum system design pressure. Do not pressurize systems above the maximum design operating pressure. Give 3 days' advanced notice for testing.

D. Remake leaking joints as required and apply sealants to achieve specified maximum allowable leakage.

E. Seal and leak test externally insulated ducts prior to insulation installation.

F. Provide Leakage Testing on ductwork located in inaccessible locations (underslab, in walls and chases, etc.) before final covering is performed.

END OF SECTION 23 3113

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SECTION 23 3115 - HVAC AIR-DISTRIBUTION SYSTEM CLEANING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes cleaning reused existing HVAC air-distribution equipment, ducts, plenums, and system components.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PREPARATION

A. Use the existing service openings, as required for proper cleaning, at various points of the HVAC system for physical and mechanical entry and for inspection.

B. Comply with NADCA ACR 2006, "Guidelines for Constructing Service Openings in HVAC Systems" Section.

3.2 CLEANING

A. Comply with NADCA ACR 2006.

B. Remove visible surface contaminants and deposits from within the HVAC system.

C. Systems and Components to Be Cleaned:

1. Air devices for supply and return air.
2. Ductwork:
    a. Supply-air ducts, including turning vanes and reheat coils, to the air-handling unit.
    b. Return-air ducts to the air-handling unit.
    c. Exhaust-air ducts.
3. Air-Handling Units:
    a. Interior surfaces of the unit casing.
    b. Coil surfaces compartment.
    c. Condensate drain pans.
    d. Fans, fan blades, and fan housings.
4. Filters and filter housings.

D. Collect debris removed during cleaning. Ensure that debris is not dispersed outside the HVAC system during the cleaning process.

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E. Particulate Collection:

1. For particulate collection equipment, include adequate filtration to contain debris removed. Locate equipment downwind and away from all air intakes and other points of entry into the building.
2. HEPA filtration with 99.97 percent collection efficiency for particles sized 0.3 micrometer or larger shall be used where the particulate collection equipment is exhausting inside the building,

F. Control odors and mist vapors during the cleaning and restoration process.

G. Mark the position of manual volume dampers and air-directional mechanical devices inside the system prior to cleaning. Restore them to their marked position on completion of cleaning.

H. System components shall be cleaned so that all HVAC system components are visibly clean. On completion, all components must be returned to those settings recorded just prior to cleaning operations.

I. Clean all air-distribution devices, registers, grilles, and diffusers.

J. Clean visible surface contamination deposits according to NADCA ACR 2006 and the following:

1. Clean air-handling units, airstream surfaces, components, condensate collectors, and drains.
2. Ensure that a suitable operative drainage system is in place prior to beginning wash-down procedures.
3. Clean evaporator coils, reheat coils, and other airstream components.

K. Duct Systems:

1. Create service openings in the HVAC system as necessary to accommodate cleaning.
2. Mechanically clean duct systems specified to remove all visible contaminants so that the systems are capable of passing the HVAC System Cleanliness Tests (see NADCA ACR 2006).

L. Debris removed from the HVAC system shall be disposed of according to applicable Federal, state, and local requirements.

M. Mechanical Cleaning Methodology:

1. Source-Removal Cleaning Methods: The HVAC system shall be cleaned using source-removal mechanical cleaning methods designed to extract contaminants from within the HVAC system and to safely remove these contaminants from the facility. No cleaning method, or combination of methods, shall be used that could potentially damage components of the HVAC system or negatively alter the integrity of the system.
    a. Use continuously operating vacuum-collection devices to keep each section being cleaned under negative pressure.
    b. Cleaning methods that require mechanical agitation devices to dislodge debris that is adhered to interior surfaces of HVAC system components shall be equipped to safely remove these devices. Cleaning methods shall not damage the integrity of HVAC system components or damage porous surface materials such as duct and plenum liners.

2. Cleaning Mineral-Fiber Insulation Components:
    a. Fibrous-glass thermal or acoustical insulation elements present in equipment or ductwork shall be thoroughly cleaned with HEPA vacuuming equipment while the HVAC system is

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under constant negative pressure and shall not be permitted to get wet according to NADCA ACR 2006.

b. Cleaning methods used shall not cause damage to fibrous-glass components and will render the system capable of passing the HVAC System Cleanliness Tests (see NADCA ACR 2006).

c. Fibrous materials that become wet shall be discarded and replaced.

N. Coil Cleaning:

1. Measure static-pressure differential across each coil.
2. See NADCA ACR 2006, "Coil Surface Cleaning" Section. Type 1, or Type 1 and Type 2, cleaning methods shall be used to render the coil visibly clean and capable of passing Coil Cleaning Verification (see applicable NADCA ACR 2006).
3. Coil drain pans shall be subject to NADCA ACR 2006, "Non-Porous Surfaces Cleaning Verification." Ensure that condensate drain pans are operational.
4. Electric-resistance coils shall be de-energized, locked out, and tagged before cleaning.
5. Cleaning methods shall not cause any appreciable damage to, cause displacement of, inhibit heat transfer, or cause erosion of the coil surface or fins, and shall comply with coil manufacturer's written recommendations when available.
6. Rinse thoroughly with clean water to remove any latent residues.

3.3 RESTORATION

A. Restore and repair HVAC air-distribution equipment, ducts, plenums, and components according to NADCA ACR 2006, "Restoration and Repair of Mechanical Systems" Section.

B. Comply with Section 23 3113 "Metal Ducts" and Section 23 3300 "Air Duct Accessories" for duct materials, accessories, and hardware required for Work of this Section.

C. Ensure that closures do not hinder or alter airflow.

D. New closure materials, including insulation, shall match opened materials and shall have removable closure panels fitted with gaskets and fasteners.

END OF SECTION 23 3115

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SECTION 23 3300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Backdraft and pressure relief dampers.
2. Manual volume dampers.
3. Fire dampers.
4. Combination fire and smoke dampers.
5. Flange connectors.
6. Duct silencers.
7. Turning vanes.
8. Duct-mounted access doors.
9. Flexible connectors.
10. Flexible ducts.

B. Related Sections:

1. Division 23 Section "Instrumentation and Control for HVAC" for motorized control dampers and damper actuators.
2. Division 23 Section "HVAC Gravity Ventilators" for roof-mounted ventilator caps.
3. Division 28 Section "Fire Detection and Alarm" for duct-mounted fire and smoke detectors.

1.2 ACTION SUBMITTALS

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

1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.

B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
   a. Special fittings.
   b. Fire-damper, smoke-damper, combination fire- and smoke-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
   c. Wiring Diagrams: For power, signal, and control wiring.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

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1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

1.5 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.
2. Exposed-Surface Finish: Mill phosphatized.

C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2D finish for concealed applications and No. 4 for exposed applications.

D. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

E. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.

F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.2 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Air Balance Inc.; a division of Mestek, Inc.
   b. American Warming and Ventilating; a division of Mestek, Inc.
   c. Flexmaster U.S.A., Inc.
   d. Greenheck.

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e. McGill AirFlow LLC.
f. METALAIRE, Inc.
g. Nailor Industries Inc.
h. Pottorff.
i. Ruskin Company.
j. Trox USA Inc.
k. Vent Products Company, Inc.

2. Standard leakage rating, with linkage outside airstream.
3. Suitable for horizontal or vertical applications.
4. Frames:
   a. Hat-shaped, galvanized-steel channels, 0.064-inch minimum thickness.
   b. Mitered and welded corners.
   c. Flanges for attaching to walls and flangeless frames for installing in ducts.

5. Blades:
   a. Multiple or single blade.
   b. Parallel- or opposed-blade design.
   c. Stiffen damper blades for stability.
   d. Galvanized-steel, 0.064 inch thick.

6. Blade Axles: Galvanized steel.
7. Bearings:
   a. Oil-impregnated bronze or molded synthetic.
   b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

8. Tie Bars and Brackets: Galvanized steel.

B. Standard, Aluminum, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Air Balance Inc.; a division of Mestek, Inc.
   b. American Warming and Ventilating; a division of Mestek, Inc.
   c. Flexmaster U.S.A., Inc.
   d. McGill AirFlow LLC.
   e. METALAIRE, Inc.
   f. Nailor Industries Inc.
   g. Ruskin Company.
   h. Vent Products Company, Inc.

2. Standard leakage rating, with linkage outside airstream.
3. Suitable for horizontal or vertical applications.
4. Frames: Hat-shaped, 0.10-inch- thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts.
5. Blades:
   a. Multiple or single blade.
   b. Parallel- or opposed-blade design.
   c. Stiffen damper blades for stability.
   d. Blades: Aluminum sheet or extruded aluminum.

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6. Blade Axles: Galvanized steel.
7. Bearings:
   a. Oil-impregnated bronze or molded synthetic.
   b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
8. Tie Bars and Brackets: Aluminum.

C. Damper Hardware:

1. Locking manual quadrant calibrated to show damper position.
2. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
3. Include center hole to suit damper operating-rod size.
4. Include elevated platform for insulated duct mounting.

2.3 FIRE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Air Balance Inc.; a division of Mestek, Inc.
2. Arrow United Industries; a division of Mestek, Inc.
3. Cesco Products; a division of Mestek, Inc.
4. Greenheck Fan Corporation.
5. McGill AirFlow LLC.
6. METALAIRE, Inc.
7. Nailor Industries Inc.
8. NCA Manufacturing, Inc.
9. Pottorff.
10. Ruskin Company.
11. Vent Products Company, Inc.
12. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Type: Static; rated and labeled according to UL 555 by an NRTL.

C. Fire Rating: 1-1/2 hours.

D. Frame: Curtain type with blades outside airstream except when located behind grille where blades may be inside airstream; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.

E. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.

1. Minimum Thickness: 0.052 or 0.138 inch thick, as indicated, and of length to suit application.
2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.

F. Mounting Orientation: Vertical or horizontal as indicated.

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G. Blades: Roll-formed, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.

H. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

I. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

2.4 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Air Balance Inc.; a division of Mestek, Inc.
2. Cesco Products; a division of Mestek, Inc.
3. Greenheck Fan Corporation.
4. Nailor Industries Inc.
5. Pottorff.
6. Ruskin Company.

B. Type: Static; rated and labeled according to UL 555 and UL 555S by an NRTL.

C. Fire Rating: 1-1/2 hours.

D. Frame: Multiple-blade type; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.

E. Heat-Responsive Device: Electric resettable link and switch package, factory installed, rated.

F. Smoke Detector: Integral, factory wired for single-point connection.

G. Blades: Roll-formed, horizontal, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.

H. Leakage: Class II.

I. Rated pressure and velocity to exceed design airflow conditions.

J. Mounting Sleeve: Factory-installed, 0.052-inch- thick, galvanized sheet steel; length to suit wall or floor application.

K. Damper Motors: Two-position action.

L. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.
3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.

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4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
6. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
7. Electrical Connection: 115 V, single phase, 60 Hz.

M. Accessories:

1. Auxiliary switches for signaling fan control or position indication.
2. Test and reset switches, remote mounted.

2.5 FLANGE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Nexus PDQ; Division of Shilco Holdings Inc.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gage and Shape: Match connecting ductwork.

2.6 DUCT SILENCERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Industrial Noise Control, Inc.
2. McGill AirFlow LLC.
3. Ruskin.
4. Kinetics
5. Vibro-Acoustics.
6. Aerosonics
7. Price-HVAC

B. General Requirements:

1. Factory fabricated.
2. Fire-Performance Characteristics: Adhesives, sealants, packing materials, and accessory materials shall have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested according to ASTM E 84.
3. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

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4. The dynamic insertion loss in dB for silencers shall not be less than that shown on the Duct Silencer Schedule at the face air velocity of +1,000 fpm (+ indicates airflow in the same direction as attenuation).
5. Duct silencers shall not produce self-noise power levels in dB re 10^{-12} watts that exceed those shown on the Duct Silencer Schedule.
6. Duct silencers static pressure drop shall not exceed those indicated on the duct silencer schedule for the scheduled airflow velocity and location shown.

C. Shape:

1. Rectangular straight with splitters or baffles.
2. Round straight with center bodies or pods.
3. Rectangular elbow with splitters or baffles.
4. Round elbow with center bodies or pods.

D. Rectangular Silencer Outer Casing: ASTM A 653/A 653M, G90, galvanized sheet steel, 0.034 inch thick.

E. Round Silencer Outer Casing: ASTM A 653/A 653M, G90, galvanized sheet steel.

1. Sheet Metal Thickness for Units up to 24 Inches in Diameter: 0.034 inch thick.
2. Sheet Metal Thickness for Units 26 through 40 Inches in Diameter: 0.040 inch thick.
3. Sheet Metal Thickness for Units 42 through 52 Inches in Diameter: 0.052 inch thick.
4. Sheet Metal Thickness for Units 54 through 60 Inches in Diameter: 0.064 inch thick.

F. Inner Casing and Baffles: ASTM A 653/A 653M, G90 galvanized sheet metal, 0.034 inch thick, and with 1/8-inch- diameter perforations.

G. Connection Sizes: Match connecting ductwork unless otherwise indicated.

H. Principal Sound-Absorbing Mechanism:

1. Dissipative type with fill material.
   a. Fill Material: Inert, mold-resistant, and vermin- and moisture-proof fibrous material.

I. Fabricate silencers to form rigid units that will not pulsate, vibrate, rattle, or otherwise react to system pressure variations. Do not use mechanical fasteners for unit assemblies.

1. Lock form and seal or continuously weld joints.

J. Accessories:

1. Factory-installed end caps to prevent contamination during shipping.

K. Source Quality Control: Test according to ASTM E 477.

2.7 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.

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3. METALAIRE, Inc.
4. SEMCO Incorporated.
5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."

D. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

2.8 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Warming and Ventilating; a division of Mestek, Inc.
2. Cesco Products; a division of Mestek, Inc.
3. Ductmate Industries, Inc.
4. Flexmaster U.S.A., Inc.
5. Greenheck Fan Corporation.
6. McGill AirFlow LLC.
7. Nailor Industries Inc.
8. Pottorff.
9. Ruskin.
10. Ventfabrics, Inc.
11. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-10, "Duct Access Doors and Panels," and 2-11, "Access Panels - Round Duct."

C. Rectangular Ductwork Applications:

1. Door:
   a. Double wall, rectangular.
   b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
   c. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
   d. Fabricate doors airtight and suitable for duct pressure class.
2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:
   a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
   b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
   c. Access Doors up to 24 by 24 Inches: Three hinges and two compression latches with outside and inside handles.

D. Round Ductwork Applications:

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1. Sandwich Type for Uninsulated Ductwork: Oval shaped inner and outer plates connected by bolt fasteners and compression springs with hand knobs for compression fit in duct sidewall.
   a. Provide doors with insulated inner plate for installation in pre-insulated double wall ductwork.

2. Rectangular Type for Insulated Ductwork: Same as specified for rectangular ductwork application with field or factory installed rectangular tap.

E. Pressure Relief Access Door:

1. Door and Frame Material: Galvanized sheet steel.
2. Door: Single wall for uninsulated duct applications and double wall with insulation fill for insulated duct applications with metal thickness applicable for duct pressure class.
3. Operation: Open outward for positive-pressure ducts and inward for negative-pressure ducts.
4. Doors close when pressures are within set-point range.
5. Hinge: Continuous piano.
6. Latches: Cam.
7. Seal: Neoprene or foam rubber.
8. Insulation Fill: 1-inch- thick, fibrous-glass or polystyrene-foam board.
9. Factory set at pressure settings indicated below:
   a. Spring clips rated at 3-inch wg negative and 5-inch wg positive for VAV applications.
   b. Spring clips rated at 2-inch wgnegative and 3-inch wg positive for constant volume systems.

2.9 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Ventfabrics, Inc.
4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to 2 strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd..
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq. yd..
2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.

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3. Service Temperature: Minus 50 to plus 250 deg F.

2.10 FLEXIBLE DUCTS

A. Insulated, Flexible Duct (Type F-1): UL 181, Class 1, acoustically rated, woven fiberglass fabric with flame resistant coated core supported by helically wound, spring-steel wire; fibrous-glass insulation (R-4.2); bi-directional reinforced metallized vapor-barrier film.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Themaflex Model M-KC or comparable product by the following:
   a. Flexmaster U.S.A., Inc.

2. Positive Pressure Rating: 16-inch wg positive for sizes 4 to 10 Inches, 10-inch wg positive for sizes 12 to 16 Inches.
3. Maximum Air Velocity: 6000 fpm.
4. Temperature Range: Minus 20 to plus 250 deg F.
5. Insulation R-value: R-4.2

B. Flexible Duct Connectors:

1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action or nylon strap in sizes 3 through 18 inches, to suit duct size.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts.

B. Install duct accessories of galvanized-steel materials in galvanized-steel ducts.

C. Install turning vanes in all square or rectangular 90 degree elbows. All mitered flat oval duct elbows shall have turning vanes installed.

D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

E. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.
2. Install aluminum volume dampers in aluminum ducts.

F. Set dampers to fully open position before testing, adjusting, and balancing.

G. Install fire and fire/smoke dampers according to UL listing.

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H. Connect ducts to duct silencers rigidly.

1. Do not locate duct silencers within one duct diameter from fan discharge/intake openings, elbows, or takeoffs.
2. When elbows precede duct silencer by less than 3 duct widths (as measured in the elbow plane), splitters should be parallel to the plane of the elbow turn.

I. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. On both sides of duct coils.
2. At outdoor-air intakes and mixed-air plenums.
3. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
4. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
    a. For fire or smoke dampers located in ducts with no other air path between AHU outlet and damper, install pressure relief access doors upstream of fire or smoke dampers.
5. At each change in direction and at maximum 50-foot spacing.
6. Upstreamand downstream from turning vanes.
7. Upstream or downstream from duct silencers.
8. Upstream and downstream of duct mounted airflow monitor devices.
9. At duct mounted smoke detectors.
10. Control devices requiring inspection.
11. Elsewhere as indicated.

J. Access Door Minimum Sizes:

1. Two-Hand or Inspection Access: 12 by 12 inches.
2. Head and Shoulders Access: 20 by 16 inches.
3. Body Access: 24 by 24 inches.
4. For ducts less than 12 by 12 inches

K. Install flexible connectors to connect ducts to equipment.

L. Install flexible ducts as follows:

1. Install flexible ducts at accessible concealed locations only.
2. Connect terminal units to high velocity supply ducts with maximum 18-inch lengths of flexible duct Type F-1, clamped or strapped in place. Flexible ducts are for alignment purposes only. Do not use flexible ducts to change directions.
3. Connect diffusers to ducts directly or with maximum 36-inch lengths of flexible duct Type F-1, clamped or strapped in place. Flexible ducts are for alignment purposes only. Do not use flexible ducts to change directions.
    a. Where flex is used to connect supply air diffusers, provide “Flex-Rite” elbow support to ensure proper radius.

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3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.

END OF SECTION 23 3300

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SECTION 23 3423 - HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. In-line centrifugal fans.

1.2 PERFORMANCE REQUIREMENTS

A. Operating Limits: Classify according to AMCA 99.

1.3 ACTION SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:

1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound-power ratings.
3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
4. Material thickness and finishes, including color charts.
5. Dampers, including housings, linkages, and operators.
6. Roof curbs.
7. Fan speed controllers.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.

C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

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D. UL Standard: Power ventilators shall comply with UL 705.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.

B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

1.8 COORDINATION

A. Coordinate size and location of structural-steel support members.

B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

C. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

PART 2 - PRODUCTS

2.1 IN-LINE CENTRIFUGAL FANS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck.
2. Loren Cook Company.
3. Penn -Barry.

B. Description: In-line, direct -driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, mounting brackets, and accessories.

C. Housing: Square galvanized steel or aluminum with inlet and outlet flanges, removable access panels, and support brackets adaptable to floor, side wall, or ceiling mounting.

D. Direct-Driven Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.

E. Belt-Driven Units: Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.

F. Fan Wheels: Aluminum, welded to aluminum hub.

G. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.

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2. Fan Guards: 1/2- by 1-inch mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.
3. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.
4. Vibration Isolators:
   a. Type: Elastomeric hangers.
   b. Static Deflection: 1 inch.

2.2 MOTORS

A. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

B. Enclosure Type: Totally enclosed, fan cooled.

2.3 SOURCE QUALITY CONTROL

A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Support suspended circulation fans from structure using structural steel framing. Install factory furnished field installed control components.

C. Secure roof-mounted ventilators to roof curbs with cadmium-plated hardware.

D. Provide curb adapters as required for new fans installed on existing curbs.

E. Support suspended units from structure using threaded steel rods and spring hangers having a static deflection of 1 inch. Vibration-control devices are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

F. Install units with clearances for service and maintenance.

G. Label units according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

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3.2 KILN EXHAUST VENTILATION SYSTEM INSTALLATION

A. Install system components level and plumb in accordance with manufacturer's instructions.

B. Install units with clearances for service and maintenance.

C. Field cut flexible hose to shortest length permissible.

D. Provide Type B double wall vent duct through roof with roof thimble and gooseneck end bird screen.

3.3 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Air Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Adjust damper linkages for proper damper operation.
5. Verify lubrication for bearings and other moving parts.
6. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
7. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
8. Shut unit down and reconnect automatic temperature-control operators.
9. Remove and replace malfunctioning units and retest as specified above.

B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.5 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Refer to Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

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C. Lubricate bearings.

END OF SECTION 23 3423

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SECTION 23 3713 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes louvers, and diffusers, registers, and grilles.

B. Related Sections:

1. Division 08 Section "Louvers and Vents" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
2. Division 23 Section "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

B. Samples for Initial Selection: For louvers with factory-applied color finishes.

C. Samples for Verification: For diffusers, registers, and grilles, in manufacturer's standard sizes to verify color selected.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following:

1. Grilles, Registers and Diffusers:

a. Price.
b. Tuttle and Bailey.
c. Titus.
d. Nailor.

2. Louver Manufacturers:

a. All-Lite Architectural Products.
b. American Warming and Ventilating.
c. Greenheck Fan Corp.

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d. Ruskin Company.

2.2 DIFFUSERS

A. General: Provide manufacturer's standard diffusers where shown; of size, shape, capacity and type as listed on diffuser schedule, with accessories and finishes as indicated.

1. Diffuser Faces:
   a. Square: Square housing; core of square concentric louvers; square or round duct connection.
   b. Rectangular: Rectangular housing; core of rectangular concentric louvers; square or round duct connection.
   c. Panel: Square or rectangular housing extended to form panel to fit in ceiling system module; core of square or rectangular concentric louvers; square or round duct connection.
   d. Slot: Aluminum continuous single or multiple slot with plenum and extended frame to fit in ceiling system module. Provide full coverage 1/2-inch thick coated erosion resistant insulation liner inside plenum.

2. Diffuser Mountings
   a. Surface: Diffuser housing at duct, wall or ceiling surface with gasketed perimeter flange.
   b. Lay-In: Diffuser housing sized to fit between ceiling exposed suspension tee bars and rest on top surface of tee bar.

2.3 GRILLES AND REGISTERS

A. General: Provide manufacturer's standard grilles and registers where shown; of size, shape, capacity and type as listed on schedule, with accessories and finishes as indicated.

1. Register and Grille Materials:
   a. Steel Construction: Manufacturer's standard stamped sheet steel frame and adjustable blades.
   b. Aluminum Construction: Manufacturer's standard extruded aluminum frame and adjustable blades.

2.4 LOUVERS

A. Horizontal, Sightproof, Drainable-Blade Louvers:

1. Louver Depth: 5 inches.
2. Frame and Blade Nominal Thickness: Not less than 0.080 inch.
3. Mullion Type: Concealed
4. Louver Performance Ratings:
5. Free Area: Not less than 8.3 sq. ft. for 48-inch- wide by 48-inch- high louver.
6. Air Performance: Not more than 0.10-inch wg static pressure drop at 550-fpm free-area intake velocity.
7. Screen: Aluminum 1/2-inch- square mesh, 0.063-inch wire bird screen on interior face.

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8. Fabrication: Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
9. Finish: As selected by Architect using an RAL designation.

2.5 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 DIFFUSER, REGISTER, AND GRILLE INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

1. Locate slot diffusers as indicated on general construction drawings. Locate units along one side of acoustical ceiling modules.

C. Install diffusers, registers, and grilles with airtight connections to ducts.

D. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

3.2 LOUVER INSTALLATION

A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Protect unpainted galvanized and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

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F. Restore louvers damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

END OF SECTION 23 3713

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SECTION 23 3723 - HVAC GRAVITY VENTILATORS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following types of roof-mounting intake and relief ventilators:

1. Goosenecks.

B. Related Sections include the following:

1. Division 08 Section "Louvers and Vents" for ventilator assemblies provided as part of the general construction.
2. Division 23 Section "HVAC Power Ventilators" for roof-mounting exhaust fans.

1.2 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5 or T-52.

B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming or as otherwise recommended by metal producer for required finish.

C. Galvanized-Steel Sheet: ASTM A 653/A 653M, G90 zinc coating, mill phosphatized.

D. Fasteners: Same basic metal and alloy as fastened metal or 300 Series stainless steel, unless otherwise indicated. Do not use metals that are incompatible with joined materials.

1. Use types and sizes to suit unit installation conditions.

E. Factory Coating: Factory applied baked enamel paint; color to be selected by Architect from manufacturers standard finishes.

2.2 GOOSENECKS

A. Factory or shop fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 5-5; with a minimum of 0.052-inch- thick, galvanized-steel sheet.

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B. Roof Curbs: Galvanized-steel sheet; with mitered and welded corners; 1-1/2-inch-(40-mm-) thick, rigid fiberglass insulation adhered to inside walls; and 1-1/2-inch(40-mm) wood nailer. Size as required to fit roof opening and ventilator base. Provide with level top and bottom to match roof slope.

1. Configuration: Self-flashing with mounting flange.
2. Overall Height: Refer to drawing detail.

C. Bird Screening: Galvanized-steel, 1/2-inch- square mesh, 0.041-inch wire.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install gravity ventilators level, plumb, and at indicated alignment with adjacent work.

B. Secure gravity ventilators to roof curbs with cadmium-plated hardware. Use concealed anchorages where possible.

C. Secure gravity ventilators to roof curbs with cadmium-plated hardware. Use concealed anchorages where possible. Refer to Division 07 Section "Roof Accessories" for installation of roof curbs.

D. Install goosenecks on curb base where throat size exceeds 9 by 9 inches.

E. Install gravity ventilators with clearances for service and maintenance.

F. Install concealed gaskets, flashings, joint fillers, and insulation as installation progresses. Comply with Division 07 Section "Joint Sealants" for sealants applied during installation.

G. Label gravity ventilators according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

H. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

I. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

J. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories.

K. Adjust damper linkages for proper damper operation.

END OF SECTION 23 3723

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SECTION 23 7413 - PACKAGED, OUTDOOR, CENTRAL-STATION AIR-HANDLING UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes packaged, outdoor, central-station air-handling units (rooftop units) with the following components and accessories:

1. Direct-expansion cooling.
2. Hot-gas reheat.
3. Economizer outdoor- and return-air damper section.
4. Integral, space temperature controls.
5. Roof curbs.

1.2 DEFINITIONS

A. DDC: Direct-digital controls.

B. ECM: Electrically commutated motor.

C. Outdoor-Air Refrigerant Coil: Refrigerant coil in the outdoor-air stream to reject heat during cooling operations and to absorb heat during heating operations. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.

D. Outdoor-Air Refrigerant-Coil Fan: The outdoor-air refrigerant-coil fan in RTUs. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.

E. RTU: Rooftop unit. As used in this Section, this abbreviation means packaged, outdoor, central-station air-handling units. This abbreviation is used regardless of whether the unit is mounted on the roof or on a concrete base on ground.

F. Supply-Air Fan: The fan providing supply air to conditioned space. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.

G. Supply-Air Refrigerant Coil: Refrigerant coil in the supply-air stream to absorb heat (provide cooling) during cooling operations and to reject heat (provide heating) during heating operations. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.

1.3 ACTION SUBMITTALS

A. Product Data: Include manufacturer's technical data for each RTU, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring.

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1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Special warranty specified in this Section.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish one set of extra filters for each unit that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1.7 QUALITY ASSURANCE

A. ARI Compliance:

1. Comply with ARI 210/240 and ARI 340/360 for testing and rating energy efficiencies for RTUs.
2. Comply with ARI 270 for testing and rating sound performance for RTUs.

B. NFPA Compliance: Comply with NFPA 90A and NFPA 90B.

C. UL Compliance: Comply with UL 1995.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace components of RTUs that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Compressors: Not less than five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. AAON, Inc.
2. Carrier.
3. Daikin/McQuay.

B. Inner Casing Fabrication Requirements: Galvanized steel.

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C. General Fabrication Requirements for Casings: Formed and reinforced insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed.

D. Exterior Casing Material: Galvanized steel with factory-painted finish, with pitched roof panels and knockouts with grommet seals for electrical and piping connections and lifting lugs.

E. Casing Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.

1. Materials: ASTM C 1071, Type I.
2. Thickness: 1/2 inch.
3. Liner materials shall have air-stream surface coated with an erosion and temperature-resistant coating or faced with a plain or coated fibrous mat or fabric.
4. Liner Adhesive: Comply with ASTM C 916, Type I.

F. Condensate Drain Pans: Non-corrosive material complying with ASHRAE 62.1. Drain Connections to be Threaded nipple.

2.2 FANS

A. Direct-Driven Supply-Air Fans: Double width,, centrifugal; with permanently lubricated, motor resiliently mounted in the fan inlet with variable frequency drives. Aluminum or painted-steel wheels, and galvanized- or painted-steel fan scrolls.

B. Condenser-Coil Fan: Propeller, mounted on shaft of permanently lubricated motor.

C. Relief-Air Fan: Propeller, shaft mounted on permanently lubricated motor.

D. Fan Motor: Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

2.3 COILS

A. General Requirements for Coil Section:

1. Comply with ARI 410.
2. Fabricate coil section to allow removal and replacement of coil for maintenance and to allow in-place access for service and maintenance of coil(s).
3. Coils shall not act as structural component of unit.

B. Connections: Provide factory installed piping connection points outside of unit casing and ready for field connections; with casing penetration points sealed against leakage for unit's rated pressure.

C. Condenser Coils:

1. Condenser coils shall use Micro-Channel coil technology. Coil shall have a series of flat tubes containing a series of multiple, parallel flow micro-channels layered between the refrigerant manifolds. Micro-channel coils shall consist of a two-pass arrangement. Coils shall be factory leak and pressure tested.

D. Supply-Air Refrigerant Coil:

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1. Aluminum-plate fin and seamless copper tube in steel casing with equalizing-type vertical distributor.
2. Coil Split: Interlaced.
3. Condensate Drain Pan: Galvanized steel with corrosion-resistant coating formed with pitch and drain connections.

E. Hot-Gas Reheat Refrigerant Coil: Aluminum-plate fin and seamless copper tube in steel casing with equalizing-type vertical distributor.

2.4 REFRIGERANT CIRCUIT COMPONENTS

A. Compressor: Hermetic, scroll, mounted on vibration isolators; with internal overcurrent and high-temperature protection, internal pressure relief, and crankcase heater.

B. Refrigeration Specialties:

1. Refrigerant: R-454B.
2. Expansion valve with replaceable thermostatic element.
3. Refrigerant filter/dryer.
4. Manual-reset high-pressure safety switch.
5. Automatic-reset low-pressure safety switch.
6. Minimum off-time relay.
7. Automatic-reset compressor motor thermal overload.
8. Brass service valves installed in compressor suction and liquid lines.
9. Low-ambient kit high-pressure sensor.

2.5 AIR FILTRATION

A. Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.

1. Pleated: Minimum 90 percent arrestance, and MERV 13.

2.6 DAMPERS

A. Outdoor- and Return-Air Mixing Dampers: Parallel- or opposed-blade galvanized-steel dampers mechanically fastened to cadmium plated for galvanized-steel operating rod in reinforced cabinet. Connect operating rods with common linkage and interconnect linkages so dampers operate simultaneously.

1. Damper Motor: Modulating with adjustable minimum position.
2. Relief-Air Damper: Gravity actuated or motorized, as required by ASHRAE/IESNA 90.1, with bird screen and hood.

2.7 ELECTRICAL POWER CONNECTION

A. Provide for single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in overcurrent protection.

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2.8 CONTROLS

A. Basic Unit Controls: Control-voltage transformer.

B. DDC Controller:

1. Controller shall have volatile-memory backup.
2. Safety Control Operation:

a. Smoke Detectors: Stop fan and close outdoor-air damper if smoke is detected. Provide additional contacts for alarm interface to fire alarm control panel.
b. Fire Alarm Control Panel Interface: Provide control interface to coordinate with operating sequence described in Division 28 Section "Fire Detection and Alarm."
c. Low-Discharge Temperature: Stop fan and close outdoor-air damper if supply air temperature is less than 40 deg F.
d. Defrost Control for Condenser Coil: Pressure differential switch to initiate defrost sequence.

3. Occupied Periods Refrigerant Circuit Operation: Cycle or stage compressors, and operate hot-gas bypass if applicable to match compressor output to cooling load to maintain discharge temperature and humidity. Cycle condenser fans to maintain maximum hot-gas pressure. Operate low-ambient control kit to maintain minimum hot-gas pressure.

4. Hot-Gas Reheat-Coil Operation:

a. Occupied Periods: Humidistat opens hot-gas valve to provide hot-gas reheat, and cycles compressor.
b. Unoccupied Periods: Reheat not required.

C. Interface Requirements for HVAC Instrumentation and Control System:

1. Interface relay for scheduled operation.
2. Interface relay to provide indication of fault at the central workstation and diagnostic code storage.
3. Provide BACnet compatible interface for central HVAC control workstation for the following:

a. Adjusting set points.
b. Monitoring supply fan start, stop, and operation.
c. Inquiring data to include outdoor-air damper position, supply- and room-air temperature.
d. Monitoring occupied and unoccupied operations.

2.9 ACCESSORIES

A. Duplex, 115-V, ground-fault-interrupter outlet with 15-A overcurrent protection. Include transformer if required. Outlet shall be energized even if the unit main disconnect is open.

B. Coil guards of painted, galvanized-steel wire.

2.10 ROOF CURBS

A. Materials: Galvanized steel with corrosion-protection coating, watertight gaskets, and factory-installed wood nailer; complying with NRCA standards.

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1. Curb Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.

    a. Materials: ASTM C 1071, Type I or II.
    b. Thickness: 1-1/2 inches.

2. Application: Factory applied with adhesive and mechanical fasteners to internal surface of curb.

    a. Liner Adhesive: Comply with ASTM C 916, Type I.
    b. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.
    c. Liner materials applied in this location shall have air-stream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service air velocity.
    d. Liner Adhesive: Comply with ASTM C 916, Type I.

B. Curb Height: 18 inches.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of RTUs.

B. Examine roughing-in for RTUs to verify actual locations of piping and duct connections before equipment installation.

C. Examine roofs for suitable conditions where RTUs will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Roof Curb: Install on roof structure, level and secure. Install RTUs on curbs and coordinate roof penetrations and flashing with roof construction.

3.3 CONNECTIONS

A. Install condensate drain, minimum connection size, with trap and route down to roof.

B. Install piping adjacent to RTUs to allow service and maintenance.

C. Duct installation requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:

1. Install ducts to termination at top of roof curb.
2. Remove roof decking only as required for passage of ducts.

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3. Connect supply ducts to RTUs with flexible duct connectors specified in Division 23 Section "Air Duct Accessories."
4. Install return-air duct continuously through roof structure.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. After installing RTUs and after electrical circuitry has been energized, test units for compliance.
2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

3.6 CLEANING AND ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions.

B. After completing system installation and testing, adjusting, and balancing RTU and air-distribution systems, clean filter housings and install new filters.

3.7 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain RTUs. Provide half day of training and video recording of training content for Owner’s future use.

END OF SECTION 23 7413

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SECTION 28 3100 - FIRE DETECTION AND ALARM

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. Failure to consult these documents shall not relieve the Contractor of the requirements therein.

1.2 SUMMARY

A. This Section includes fire alarm systems with manual stations, detectors, signal equipment, controls, and devices.

B. Architectural engineer shall provide general code compliant fire alarm layouts so that the contractor may reasonably estimate scope, cost and general rough-in requirements.

C. Related Sections include the following:

1. Division 08 Section "Door Hardware".

D. Allowances: Allowances affect the Work of this Section. Refer to Division 01 Section "Allowances" for procedures for allowances.

1. Allowance - Fire Alarm Devices: Provide a lump sum allowance in the amount of onefive thousand dollars ($51000.00) to cover the cost for additional fire alarm pull stations, smoke detectors or audio/visual signals required by the Authority Having Jurisdiction.

1.3 DEFINITIONS

A. FACP: Fire alarm control panel.

B. LED: Light-emitting diode.

C. Definitions in NFPA 72 apply to fire alarm terms used in this Section.

D. NICET: National Institute for Certification in Engineering Technologies.

1.4 SYSTEM DESCRIPTION

A. General: Digital-addressable system with manual and automatic alarm initiation; automatic sensitivity control of certain smoke detectors; and multiplexed signal transmission dedicated to fire alarm service only.

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1.5 SUBMITTALS

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

B. Shop Drawings:

1. Shop Drawings shall be prepared by persons with the following qualifications:
   a. Trained and certified by manufacturer in fire alarm system design.
   b. Fire alarm certified by NICET, minimum Level III.

2. Wiring Diagrams: Detail wiring and differentiate between manufacturer-installed and field-installed wiring. Include diagrams for equipment and for system with all terminals and interconnections identified.
3. Battery: Sizing calculations.
4. Floor Plans: Indicate final outlet locations and routings of raceway connections.
5. Alarm Characteristics: Indicate the visual strobe candela and audible sound level requirements to satisfy NFPA 72 and the Authority having jurisdiction.
6. Device Address List: Coordinate with final system programming.
7. System Operation Description: Detailed description for this Project, including method of operation and supervision of each type of circuit and sequence of operations for manually and automatically initiated system inputs and outputs. Manufacturer's standard descriptions for generic systems are not acceptable.
8. Ductwork Coordination Drawings: Plans, sections, and elevations of ducts, drawn to scale and coordinating the installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, the detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer’s written recommendations.
9. Voice/Alarm Signaling Service: Equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.

C. Operating Instructions: For mounting at the FACP.

D. Installer Certificates: Signed by manufacturer certifying that installers comply with requirements.

E. Field Test Reports: Indicate and interpret test results for compliance with performance requirements. Comply with NFPA 72.

F. Maintenance Data: For fire alarm systems to include in maintenance manuals specified in Division 01. Comply with NFPA 72.

G. Submissions to Authorities Having Jurisdiction: In addition to distribution requirements for Submittals specified in Division 01 Section "Submittal Procedures," make an identical submission to authorities having jurisdiction, (Department of Labor & Economic Growth, Office of Fire Safety, P.O. Box 30254, Lansing, Michigan, 48909). Include copies of annotated Contract Drawings as needed to depict component locations to facilitate review. Resubmit if required to make clarifications or revisions to obtain approval. On receipt of comments from authorities having jurisdiction, submit them to Architect for review.

H. Certificate of Completion: Comply with NFPA 72.

I. Comply with NFPA 20 for fire pump installations.

J. Inspector’s qualifications for the smoke control system.

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K. Smoke control system's test results.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is a trained and certified representative of the FACP manufacturer for both installation and maintenance of units required for this Project.

B. Manufacturer Qualifications: A firm experienced in manufacturing systems similar to those indicated for this Project and with a record of successful in-service performance. Per the requirements of the Michigan Bureau of Fire Services (or local AHJ) all of the following must be met.

1. Manufacturer shall be responsible for layout of new and/or alterations to existing fire alarm equipment, specialties, and accessories, and repair and servicing of equipment shall be performed only by a qualified installer experienced in such work; with a minimum of 5 previous projects similar in size and scope to this project; be familiar with all precautions required; and has complied with all the requirements of the authority having jurisdiction. Manufacturer shall provide all equipment required to meet the sequence of operations required by the code. Coordinate system design with architectural and mechanical systems including, but not limited to door holds, smoke dampers and duct detectors required for a code compliant system.
2. Manufacturer/installer shall follow project specifications and standards to provide a complete code compliant system installation. It is the general contractor or construction manager's responsibility to provide supervision to all subcontractors to ensure a proper installation according to the code and project specifications.
3. Installer's responsibilities include designing, fabricating, and installing fire alarm systems and providing professional engineering services needed to assume engineering responsibility.
4. Certifying Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a NICET Level III or IV certified layout technician.

C. Source Limitations: Obtain fire alarm system components through one source from a single manufacturer.

D. Compliance with Local Requirements: Comply with applicable building code, local ordinances and regulations, and requirements of authorities having jurisdiction.

E. Comply with NFPA 72.

1.7 SEQUENCING AND SCHEDULING

A. Existing Fire Alarm Equipment: Maintain fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service and label existing fire alarm equipment "NOT IN SERVICE" until removed from the building.

B. Equipment Removal: After acceptance of the new fire alarm system, remove existing disconnected fire alarm equipment and restore damaged surfaces.

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PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Edwards Systems Technology; Unit of General Signal.
2. Simplex
3. Honeywell
4. Fire Lite Alarms, Inc.

2.2 FUNCTIONAL DESCRIPTION OF SYSTEM

A. Control of System: By the FACP.

B. System Supervision: Automatically detect and report open circuits, shorts, and grounds of wiring for initiating device, signaling line, and notification-appliance circuits.

C. Priority of Signals: Automatic alarm response functions resulting from an alarm signal from one device are not altered by subsequent alarm, supervisory, or trouble signals. An alarm signal is the highest priority. Supervisory and trouble signals have second- and third-level priority. Higher-priority signals take precedence over signals of lower priority, even when the lower-priority condition occurs first. Annunciate and display all alarm, supervisory, and trouble signals regardless of priority or order received.

D. Noninterference: A signal from one device shall not prevent the receipt of signals from other devices.

E. System Reset: All devices are manually resettable from the FACP after initiating devices are restored to normal.

F. Transmission to Remote Alarm Receiving Station: Automatically route alarm, supervisory, and trouble signals to a remote alarm station by means of a digital alarm communicator transmitter and telephone lines.

G. System Alarm Capability during Circuit Fault Conditions: System wiring and circuit arrangement prevent alarm capability reduction when a single ground or open circuit occurs in an initiating device circuit, signal line circuit, or notification-appliance circuit.

H. Loss of primary power at the FACP initiates a trouble signal at the FACP. The FACP indicates when the fire alarm system is operating on the secondary power supply.

I. Basic Alarm Performance Requirements: Unless otherwise indicated, operation of a manual station, automatic alarm operation of a smoke or flame or heat detector, or operation of a sprinkler flow device initiates the following:

1. Notification-appliance operation.
2. Identification at the FACP and the remote annunciator of the device originating the alarm.
3. Transmission of an alarm signal to the remote alarm receiving station.

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4. Unlocking of electric door locks in designated egress paths.
5. Release of fire and smoke doors held open by magnetic door holders.
6. Shutdown of fans and other air-handling equipment serving area when alarm was initiated.
7. Closing of smoke dampers in air ducts of system serving area where alarm was initiated.
8. Open normally closed contact tied to lighting control system to turn on emergency lighting.
9. Recording of the event in the system memory.

J. Alarm Silencing, System Reset and Indication: Controlled by switches in the FACP.

1. Silencing-switch operation halts alarm operation of notification appliances and activates an "alarm silence" light. Display of identity of the alarm zone or device is retained.
2. Subsequent alarm signals from other devices reactivate notification appliances until silencing switch is operated again.

K. Elevator (when building is equipped) shall be connected to fire alarm system to allow for voice communication to fire fighter control panel from inside elevator. Provide all code compliant components, relays, wiring, programing and anything else necessary for a code compliant system. Coordinate elevator contractor and AHJ.

L. Smoke detection for detectors with alarm verification initiates the following:

1. Audible and visible indication of an "alarm verification" signal at the FACP.
2. Activation of a listed and approved "alarm verification" sequence at the FACP and the detector.
3. Recording of the event in the system memory.
4. General alarm if the alarm is verified.
5. Cancellation of the FACP indication and system reset if the alarm is not verified.

M. Remote Detector Sensitivity Adjustment: Manipulation of controls at the FACP causes the selection of specific addressable smoke detectors for adjustment, display of their current status and sensitivity settings, and control of changes in those settings. Same controls can be used to program repetitive, scheduled, automated changes in sensitivity of specific detectors. Sensitivity adjustments and sensitivity-adjustment schedule changes are recorded in system memory.

N. Removal of an alarm-initiating device or a notification appliance initiates the following:

1. A "trouble" signal indication at the FACP and the annunciator for the device or zone involved.
2. Recording of the event in the system memory.
3. Transmission of trouble signal to remote alarm receiving station.

O. Printout of Events: On receipt of the signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble), and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also print system reset event, including the same information for device, location, date, and time. Commands initiate the printout of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.

P. FACP Alphanumeric Display: Plain-English-language descriptions of alarm, supervisory, and trouble events; and addresses and locations of alarm-initiating or supervisory devices originating the report. Display monitoring actions, system and component status, system commands, programming information, and data from the system's historical memory.

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2.3 MANUAL PULL STATIONS

A. Description: Fabricated of metal or plastic, and finished in red with molded, raised-letter operating instructions of contrasting color.

1. Double-action mechanism requires two actions, such as a push and a pull, to initiate an alarm. Break glass/plastic stations are not acceptable.
2. Station Reset: Key or wrench operated; double pole, double throw; switch rated for the voltage and current at which it operates.
3. Integral Addressable Module: Arranged to communicate manual-station status (normal, alarm, or trouble) to the FACP.

2.4 SMOKE DETECTORS

A. General: Include the following features:

1. Operating Voltage: 24-V dc, nominal.
2. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
3. Plug-in Arrangement: Detector and associated electronic components are mounted in a module that connects in a tamper-resistant manner to a fixed base with a twist-locking plug connection. Terminals in the fixed base accept building wiring.
4. Integral Visual-Indicating Light: LED type. Indicates detector has operated.
5. Sensitivity: Can be tested and adjusted in-place after installation.
6. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
7. Remote Controllability: Unless otherwise indicated, detectors are analog-addressable type, individually monitored at the FACP for calibration, sensitivity, and alarm condition, and individually adjustable for sensitivity from the FACP.

B. Photoelectric Smoke Detectors: Include the following features:

1. Sensor: LED or infrared light source with matching silicon-cell receiver.
2. Detector Sensitivity: Between 2.5 and 3.5 percent/foot smoke obscuration when tested according to UL 268A.
3. Integral Thermal Detector: Fixed-temperature type with 135 deg F setting.

C. Beam-Type Smoke Detector: Each detector consists of a separate transmitter and receiver with the following features:

1. Adjustable Sensitivity: More than a six-level range, minimum.
2. Linear Range of Coverage: 330 feet , minimum.
3. Tamper Switch: Initiates trouble signal at the central FACP when either transmitter or receiver is disturbed.
4. Separate Color-Coded LEDs: Indicate normal, alarm, and trouble status. Any detector trouble, including power loss, is reported to the central FACP as a composite "trouble" signal.
5. Detectors with prism reflectors are not acceptable.

D. Duct Smoke Detector: Photoelectric type.

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1. Photoelectric Smoke Detectors:
   a. Sensor: LED or infrared light source with matching silicon-cell receiver.
   b. Detector Sensitivity: Between 2.5 and 3.5 percent/foot smoke obscuration when tested according to UL 268A.

2. UL 268A listed, operating at 24-V dc, nominal.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
4. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. The fixed base shall be designed for mounting directly to the air duct. Provide terminals in the fixed base for connection to building wiring.
5. Self-Restoring: Detectors shall not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type. Indicating detector has operated and power-on status.
7. Sampling Tubes: Design and dimensions as recommended by manufacturer for the specific duct size, air velocity, and installation conditions where applied.
8. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit. Motor shutdown wiring by Temperature Control Supplier.

2.5 OTHER DETECTOR

A. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F or rate of rise of temperature that exceeds 15 deg F per minute, unless otherwise indicated.

1. Mounting: Plug-in base, interchangeable with smoke detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.

B. Carbon Monoxide Detector: Provide in all boiler rooms and any other rooms required by code. Provide UL listed carbon monoxide detector connected and monitored by fire alarm system.

2.6 NOTIFICATION APPLIANCES

A. Description: Equip for mounting as indicated and have screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly.

B. Chimes, High-Level Output: Vibrating type, 81 dB minimum rated output.

C. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Horns produce a sound-pressure level of 90 dB, measured 10 feet from the horn. Beige or Ivory color.

1. Where installed in sleeping areas, provide square wave signal with fundamental frequency of 520 Hz +- 10% per NFPA-72

D. Visible Alarm Devices: Xenon strobe lights listed under UL 1971 with clear or nominal white polycarbonate lens. Mount lens on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch high letters on the lens. Beige or Ivory color.

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1. Rated Light Output: 15, 30, 75, or 110 candela, as required to satisfy NFPA 72 requirements.
2. Strobe Leads: Factory connected to screw terminals.
3. Strobes shall be sychronized.

E. Voice/Tone Speakers:

1. High-Range Units: Rated 2 to 15 W.
2. Low-Range Units: Rated 1 to 2 W.
3. Mounting: Flush, semirecessed, surface, or surface-mounted; bi-directional as indicated.
4. Matching Transformers: Tap range matched to the acoustical environment of the speaker location.

F. Fire Connection Strobe: Provide all required connections to the strobe/horn associated with the fire fighters hose connection on the exterior of the building. Provide 120V power from nearest panel for devices provided by sprinkler system supplier. Connect to emergency power when available.

2.7 REMOTE DEVICE LOCATION-INDICATING LIGHTS AND IDENTIFICATION PLATES

A. Description: LED indicating light near each smoke detector that may not be readily visible, and each sprinkler water-flow switch and valve-tamper switch. Light is connected to flash when the associated device is in an alarm or trouble mode. Lamp is flush mounted in a single gang wall plate. A red, laminated, phenolic-resin identification plate at the indicating light identifies, in engraved white letters, device initiating the signal and room where the smoke detector or valve is located. For water-flow switches, the identification plate also designates protected spaces downstream from the water-flow switch.

2.8 PROGRAMMER/TESTOR

A. Provide a programmer/testor for any fire alarm system requiring such a device for programming and maintenance of signal initiation devices. Furnish unit complete with carrying case and instructions.

2.9 CENTRAL FACP

A. Cabinet: Lockable steel enclosure. Arrange interior components so operations required for testing or for normal maintenance of the system are performed from the front of the enclosure. If more than one unit is required to form a complete control panel, fabricate with matching modular unit enclosure to accommodate components and to allow ample gutter space for field wiring and interconnecting panels.

1. Identify each enclosure with an engraved, red, laminated, phenolic-resin nameplate with lettering not less than 1 inch high. Identify individual components and modules within cabinets with permanent labels.
2. Mounting: Flush.

B. Alarm and Supervisory Systems: Separate and independent in the FACP. Alarm-initiating zone boards consist of plug-in cards. Construction requiring removal of field wiring for module replacement is unacceptable.

C. Control Modules: Include types and capacities required to perform all functions of fire alarm systems. Provide 20% spare signal capacity for future alarm devices.

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D. Indications: Local, visible, and audible signals announce alarm, supervisory, and trouble conditions. Each type of audible alarm has a different sound.

E. Resetting Controls: Prevent the resetting of alarm, supervisory, or trouble signals while the alarm or trouble condition still exists.

F. Alphanumeric Display and System Controls: Arranged for interface between human operator at the FACP and addressable system components, including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Display: Liquid-crystal type, 40 (small projects) or 80 (large projects) characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.

G. Alphanumeric Display and System Controls: Arranged for interface between human operator at the FACP and addressable system components, including annunciation, supervision, and control.

1. Display: A minimum of 80 characters; alarm, supervisory, and component status messages; and indicate control commands to be entered into the system for control of smoke detector sensitivity and other parameters.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.

H. Instructions: Printed or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.10 NOTIFICATION APPLIANCE CIRCUIT (NAC) EXTENDER PANELS

A. Provide NAC panels as required to support notification appliances.

B. Provide layout of proposed NAC panel locations prior to installation.

2.11 REMOTE ANNUNCIATOR

A. Description: Duplicate annunciator functions of the FACP for alarm, supervisory, and trouble indications. Also duplicate manual switching functions of the FACP, including acknowledging, silencing, reset, and test.

1. Mounting: Flush cabinet, NEMA 250, Class 1.

B. Display Type and Functional Performance: Alphanumeric display same as the FACP. Controls with associated LEDs permit acknowledging, silencing, resetting, and testing functions for alarm, supervisory, and trouble signals identical to those in the FACP.

C. Where main FACP is installed in electrical room, remote annunciator panel shall be capable of making voice announcements.

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2.12 EMERGENCY POWER SUPPLY

A. General: Components include lead acid battery, charger, and an automatic transfer switch.

1. Battery Nominal Life Expectancy: 20 years, minimum.

B. Battery Capacity: Comply with NFPA 72.

1. Magnetic door holders are not served by emergency power. Magnetic door holders are released when normal power fails.

C. Battery Charger: Solid-state, fully automatic, variable-charging-rate type. Provide capacity for 150 percent of the connected system load while maintaining batteries at full charge. If batteries are fully discharged, the charger recharges them completely within four hours. Charger output is supervised as part of system power supply supervision.

D. Integral Automatic Transfer Switch: Transfers the load to the battery without loss of signals or status indications when normal power fails.

2.13 ADDRESSABLE INTERFACE DEVICE

A. Description: Microelectronic monitor module listed for use in providing a multiplex system address for listed fire and sprinkler alarm-initiating devices with normally open contacts.

2.14 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Listed and labeled under UL 864 and NFPA 72.

B. Functional Performance: Unit receives an alarm, supervisory, or trouble signal from the FACP panel, and automatically captures one or two telephone lines and dials a preset number for a remote central station. When contact is made with the central station(s), the signal is transmitted. The unit supervises up to two telephone lines. Where supervising two lines, if service on either line is interrupted for longer than 45 seconds, the unit initiates a local trouble signal and transmits a signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. When telephone service is restored, unit automatically reports that event to the central station. If service is lost on both telephone lines, the local trouble signal is initiated.

C. Contractor to confirm with other trades or owner the type of transmitter to provide. Provide Voice Over IP type dialler in installations where VOIP systems are in place.

D. Secondary Power: Integral rechargeable battery and automatic charger. Battery capacity is adequate to comply with NFPA 72 requirements.

E. Self Test: Conducted automatically every 24 hours with report transmitted to central station.

2.15 WIRE

A. Non-Power-Limited Circuits: Copper conductors with 600-V rated, 75 deg C, color-coded insulation.

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1. Low-Voltage Circuits: No. 16 AWG, minimum.
2. Line-Voltage Circuits: No. 12 AWG, minimum.

B. Power-Limited Circuits: NFPA 70, Types FPL, FPLR, or FPLP, as recommended by manufacturer.

2.16 BREAKER LOCK DEVICE

A. Provide breaker circuit lockout device on branch circuits feeding any fire alarm equipment including fire alarm panels and NAC panels. Utilize Elock fire alarm circuit lockout kit #ELOCK-FA and a red placard indicating “FIRE ALARM / EMERGENCY CIRCUIT INSIDE”.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Install fire alarm system in accordance with manufacturer’s installation drawings and instructions.

B. Connecting to Existing Equipment: Verify that existing fire alarm system is operational before making changes or connections.

1. Connect new equipment to the existing control panel in the existing part of the building.
2. Expand, modify, and supplement the existing control equipment as necessary to extend the existing control functions to the new points. New components shall be capable of merging with the existing configuration without degrading the performance of either system.

C. Manual Pull Stations: Mount semiflush in recessed back boxes.

D. Ceiling-Mounted Smoke Detectors: Not less than 4 inches from a side wall to the near edge. For exposed solid-joist construction, mount detectors on the bottom of joists. On smooth ceilings, install not more than 30 feet apart in any direction.

E. Wall-Mounted Smoke Detectors: At least 4 inches, but not more than 12 inches, below the ceiling.

F. Smoke Detectors near Air Registers: Install no closer than 60 inches.

G. Duct Smoke Detectors: Comply with manufacturer's written instructions.

1. Verify that each unit is listed for the complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
2. Install sampling tubes so they extend the full width of the duct.

H. Audible Alarm-Indicating Devices: Install chimes and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Combine audible and visible alarms at the same location into a single unit.

I. Visible Alarm-Indicating Devices: Install adjacent to each alarm chime or alarm horn.

J. Device Location-Indicating Lights: Locate in public space near the device they monitor.

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K. Horn/strobe at Fire Fighter's Hose Connection: Connect horn/strobe located on the exterior of the building associated with the sprinkler system.

L. FACP: Surface mount with tops of cabinets not more than 72 inches above the finished floor.

M. Annunciator: Install with the top of the panel not more than 60 inches above the finished floor.

N. Provide smoke detectors where required for all FACP and NAC panels.

O. Provide power to all FACP and NAC panels. Connect to emergency power when available.

3.2 WIRING INSTALLATION

A. Install wiring according to the following:

1. NECA 1.
2. TIA/EIA 568-A.

B. Wiring Method: Install wiring in metal raceway according to Division 26 Section "Raceway and Boxes for Electrical Systems."

1. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated raceway system. This system shall not be used for any other wire or cable**.**

C. Wiring Method:

1. Install wiring in raceways except in accessible ceiling spaces and in gypsum-board partitions where cable wiring method may be used. Route the fire alarm cable in cable tray system when available. Wiring run in ceiling space where there is no tray or conduit, support independently of other systems with dedicated low voltage rings / hooks. No zip ties or support from other systems or conduits allowed.
2. Conceal cables and raceways except in unfinished spaces.
3. Cables and raceways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable.
4. Fire-Rated Cables: Use of 2-hour fire-rated fire alarm cables, NFPA 70 Types MI and CI, is not permitted.
5. Signaling Line Circuits: Power-limited fire alarm cables shall not be installed in the same cable or raceway as signaling line circuits.

D.

E. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by the manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

F. Cable Taps: Use numbered terminal strips in junction, pull and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.

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G. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and a different color-code for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.

H. Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signal from other floors.

I. Wiring to Remote Alarm Transmitting Device: 1-inch conduit between the FACP and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

J. Provide handle clamps on all circuit breakers feeding fire alarm system components. Handle clamps shall lock the circuit breaker in the “ON” position.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals according to Division 26 Section Identification for Electrical Systems."

B. Install instructions frame in a location visible from the FACP.

C. Install circuit breaker lockout kit and plackard on panels indicating where emergency fire alarm circuits are fed from.

3.4 GROUNDING

A. Ground the FACP and associated circuits; comply with IEEE 1100. Install a #8 AWG ground wire from main service ground to the FACP.

B. Ground cable shields and equipment according to system manufacturer's written instructions to eliminate shock hazard and to minimize, to the greatest extent possible, ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

C. Signal Ground Terminal: Locate at main equipment rack or cabinet. Isolate from power system and equipment grounding.

D. Install grounding electrodes of type, size, location, and quantity as indicated. Comply with installation requirements in Division 26 Section "Grounding and Bonding for Electrical Systems."

E. Ground equipment and conductor and cable shields. For audio circuits, minimize, to the greatest extent possible, ground loops, common-mode returns, noise pickup, cross talk, and other impairments. Provide 5-ohm ground at main equipment location. Measure, record, and report ground resistance.

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3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and connections and to supervise pretesting, testing, and adjustment of the system. Report results in writing.

B. Pretesting: After installation, align, adjust, and balance the system and perform complete pretesting. Determine, through pretesting, the compliance of the system with requirements of Drawings and Specifications. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new ones, and retest until satisfactory performance and conditions are achieved. Prepare forms for systematic recording of acceptance test results.

C. Report of Pretesting: After pretesting is complete, provide a letter certifying the installation is complete and fully operable, including the names and titles of witnesses to preliminary tests.

D. Final Test Notice: Provide a minimum of 10 days' notice in writing when the system is ready for final acceptance testing.

E. Minimum System Tests: Test the system according to procedures outlined in NFPA 72. Minimum required tests are as follows:

1. Verify the absence of unwanted voltages between circuit conductors and ground.
2. Test all conductors for short circuits using an insulation-testing device.
3. With each circuit pair, short circuit at the far end of the circuit and measure the circuit resistance with an ohmmeter. Record the circuit resistance of each circuit on record drawings.
4. Verify that the control unit is in the normal condition as detailed in the manufacturer's operation and maintenance manual.
5. Test initiating and indicating circuits for proper signal transmission under open circuit conditions. One connection each should be opened at not less than 10 percent of initiating and indicating devices. Observe proper signal transmission according to class of wiring used.
6. Test each initiating and indicating device for alarm operation and proper response at the control unit. Test smoke detectors with actual products of combustion.
7. Test the system for all specified functions according to the approved operation and maintenance manual. Systematically initiate specified functional performance items at each station, including making all possible alarm and monitoring initiations and using all communications options. For each item, observe related performance at all devices required to be affected by the item under all system sequences. Observe indicating lights, displays, signal tones, and annunciator indications.
8. Test Both Primary and Secondary Power: Verify by test that the secondary power system is capable of operating the system for the period and in the manner specified.
9.

F. Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets Specifications and complies with applicable standards.

G. Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log. Submit log on the satisfactory completion of tests.

H. Tag all equipment, stations, and other components at which tests have been satisfactorily completed.

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I. Provide certification of the fire alarm installation. Submit required documents to the Michigan Department of Labor & Economic Growth, Office of Fire Safety.

3.6 CLEANING AND ADJUSTING

A. Cleaning: Remove paint splatters and other spots, dirt, and debris. Touch up scratches and marred finish to match original finish. Clean unit internally using methods and materials recommended by manufacturer.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel as specified below:

1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, adjusting, and maintaining equipment and schedules. Provide a minimum of 8 hours' training.
2. Training Aid: Use the approved final version of the operation and maintenance manual as a training aid.
3. Schedule training with Owner, through Architect, with at least seven days' advance notice.

3.8 ON-SITE ASSISTANCE

A. Occupancy Adjustments: When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels, controls, and sensitivities to suit actual occupied conditions. Provide up to three requested visits to Project site for this purpose.

END OF SECTION 28 3100

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