

PROJECT MANUAL FOR

Cassia Hospital Pharmacy Remodel (for USP 797)

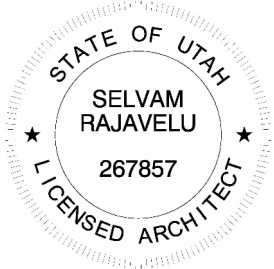
1501 Hiland Avenue
Burley, Idaho 83318

for

INTERMOUNTAIN HEALTHCARE

Construction Documents

April 2021



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AIA® Document A701™ – 2018

Instructions to Bidders

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

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

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

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- 8 **ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS**

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

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

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

ARTICLE 1 DEFINITIONS

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

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

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

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

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

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

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

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

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

ARTICLE 2 BIDDER'S REPRESENTATIONS

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

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

ARTICLE 3 BIDDING DOCUMENTS

§ 3.1 Distribution

§ 3.1.1 Bidders shall obtain complete Bidding Documents, as indicated below, from the issuing office designated in the advertisement or invitation to bid, for the deposit sum, if any, stated therein.

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

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

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

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

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

§ 3.2 Modification or Interpretation of Bidding Documents

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

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

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

§ 3.3 Substitutions

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

§ 3.3.2 Substitution Process

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

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

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

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

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

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

§ 3.4 Addenda

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

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

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

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

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

ARTICLE 4 BIDDING PROCEDURES

§ 4.1 Preparation of Bids

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

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

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

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

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

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

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

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

§ 4.2 Bid Security

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

(Insert the form and amount of bid security.)

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

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

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

§ 4.3 Submission of Bids

§ 4.3.1 A Bidder shall submit its Bid as indicated below:

(Indicate how, such as by website, host site/platform, paper copy, or other method Bidders shall submit their Bid.)

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

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

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

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

§ 4.4 Modification or Withdrawal of Bid

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

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

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

(State the terms and conditions, such as Bid rank, for returning or retaining the bid security.)

ARTICLE 5 CONSIDERATION OF BIDS

§ 5.1 Opening of Bids

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

§ 5.2 Rejection of Bids

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

§ 5.3 Acceptance of Bid (Award)

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

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

ARTICLE 6 POST-BID INFORMATION

§ 6.1 Contractor's Qualification Statement

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

§ 6.2 Owner's Financial Capability

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

§ 6.3 Submittals

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

- .1 a designation of the Work to be performed with the Bidder's own forces;
- .2 names of the principal products and systems proposed for the Work and the manufacturers and suppliers of each; and
- .3 names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for the principal portions of the Work.

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

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

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

ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND

§ 7.1 Bond Requirements

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

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

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

§ 7.1.4 Unless otherwise indicated below, the Penal Sum of the Payment and Performance Bonds shall be the amount of the Contract Sum.

(If Payment or Performance Bonds are to be in an amount other than 100% of the Contract Sum, indicate the dollar amount or percentage of the Contract Sum.)

§ 7.2 Time of Delivery and Form of Bonds

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

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

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

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

ARTICLE 8 ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS

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

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

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

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

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

- .5 Drawings

Number	Title	Date	
.6	Specifications		
Section	Title	Date	Pages

.7 Addenda:

Number	Date	Pages
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.8 Other Exhibits:

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

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

The Sustainability Plan:

Title	Date	Pages
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Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages
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.9 Other documents listed below:

(List here any additional documents that are intended to form part of the Proposed Contract Documents.)



AIA® Document G704™ – 2017

Certificate of Substantial Completion

PROJECT: <i>(name and address)</i>	CONTRACT INFORMATION: Contract For: Date:	CERTIFICATE INFORMATION: Certificate Number: 001 Date:
OWNER: <i>(name and address)</i>	ARCHITECT: <i>(name and address)</i>	CONTRACTOR: <i>(name and address)</i>

The Work identified below has been reviewed and found, to the Architect’s best knowledge, information, and belief, to be substantially complete. Substantial Completion is the stage in the progress of the Work when the Work or designated portion is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use. The date of Substantial Completion of the Project or portion designated below is the date established by this Certificate.
(Identify the Work, or portion thereof, that is substantially complete.)

ARCHITECT <i>(Firm Name)</i>	SIGNATURE	PRINTED NAME AND TITLE	DATE OF SUBSTANTIAL COMPLETION
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WARRANTIES

The date of Substantial Completion of the Project or portion designated above is also the date of commencement of applicable warranties required by the Contract Documents, except as stated below:
(Identify warranties that do not commence on the date of Substantial Completion, if any, and indicate their date of commencement.)

WORK TO BE COMPLETED OR CORRECTED

A list of items to be completed or corrected is attached hereto, or transmitted as agreed upon by the parties, and identified as follows:
(Identify the list of Work to be completed or corrected.)

The failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents. Unless otherwise agreed to in writing, the date of commencement of warranties for items on the attached list will be the date of issuance of the final Certificate of Payment or the date of final payment, whichever occurs first. The Contractor will complete or correct the Work on the list of items attached hereto within () days from the above date of Substantial Completion.

Cost estimate of Work to be completed or corrected: \$

The responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work, insurance, and other items identified below shall be as follows:
(Note: Owner’s and Contractor’s legal and insurance counsel should review insurance requirements and coverage.)

The Owner and Contractor hereby accept the responsibilities assigned to them in this Certificate of Substantial Completion:

CONTRACTOR <i>(Firm Name)</i>	SIGNATURE	PRINTED NAME AND TITLE	DATE
OWNER <i>(Firm Name)</i>	SIGNATURE	PRINTED NAME AND TITLE	DATE

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AIA[®] Document G706A[™] – 1994

Contractor's Affidavit of Release of Liens

PROJECT: <i>(Name and address)</i>	ARCHITECT'S PROJECT NUMBER:	OWNER: <input type="checkbox"/>
TO OWNER: <i>(Name and address)</i>	CONTRACT FOR:	ARCHITECT: <input type="checkbox"/>
	CONTRACT DATED:	CONTRACTOR: <input type="checkbox"/>
		SURETY: <input type="checkbox"/>
		OTHER: <input type="checkbox"/>

STATE OF:
COUNTY OF:

The undersigned hereby certifies that to the best of the undersigned's knowledge, information and belief, except as listed below, the Releases or Waivers of Lien attached hereto include the Contractor, all Subcontractors, all suppliers of materials and equipment, and all performers of Work, labor or services who have or may have liens or encumbrances or the right to assert liens or encumbrances against any property of the Owner arising in any manner out of the performance of the Contract referenced above.

EXCEPTIONS:

SUPPORTING DOCUMENTS ATTACHED HERETO:

1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.
2. Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.

CONTRACTOR: *(Name and address)*

BY:

(Signature of authorized representative)

(Printed name and title)

Subscribed and sworn to before me on this date:

Notary Public:

My Commission Expires:

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AIA® Document G707™ – 1994

Consent Of Surety to Final Payment

PROJECT: *(Name and address)*

ARCHITECT'S PROJECT NUMBER:

OWNER:

CONTRACT FOR:

ARCHITECT:

TO OWNER: *(Name and address)*

CONTRACT DATED:

CONTRACTOR:

SURETY:

OTHER:

In accordance with the provisions of the Contract between the Owner and the Contractor as indicated above, the
(Insert name and address of Surety)

on bond of
(Insert name and address of Contractor)

, SURETY,

hereby approves of the final payment to the Contractor, and agrees that final payment to the Contractor shall
not relieve the Surety of any of its obligations to
(Insert name and address of Owner)

, CONTRACTOR,

as set forth in said Surety's bond.

, OWNER,

IN WITNESS WHEREOF, the Surety has hereunto set its hand on this date:
(Insert in writing the month followed by the numeric date and year.)

(Surety)

(Signature of authorized representative)

(Printed name and title)

Attest:
(Seal):

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UTILITIES SHUTDOWN REQUEST (Utilities & Emergency Egress, Etc.)

Project Name:	Project Name Address Address	Contractor:	Contractor Contact Name Phone Number
Owner:	IHC Health Services, Inc.	Contractor(s)/ Subcontractor(s) Performing Work:	Contractor Contact Name Phone Number
FD&C PM:	PM Name		
Start of Impairment:	Date Time	End of Impairment:	Date Time

IMPAIRMENT REQUIREMENTS

The Utilities Shutdown Request **MUST** be approved by Facility Management 3 working days (min.) before work begins.

Facility Management **MUST** be notified when work is ready to begin and when work is complete.

Facility Management and Contractor(s) will reactivate system(s) at approved times and **MUST** be notified if impairments need to be extended.

SECTION 1 – IMPAIRED INFORMATION TO BE COMPLETED BY CONTRACTOR

AREA(S) AFFECTED (Building, Floor, Area/Department, Users, Devices, etc.)

Text

TYPE OF SHUTDOWN (CHECK ALL THAT APPLY)

<input type="checkbox"/> Electrical	<input type="checkbox"/> Emergency Power* <input type="checkbox"/> Main Switch Gear* <input type="checkbox"/> Individual Panel	<input type="checkbox"/> Single Breaker <input type="checkbox"/> Fire Alarm System* <input type="checkbox"/> _____
<input type="checkbox"/> Plumbing	<input type="checkbox"/> Sewer Stock <input type="checkbox"/> Vent <input type="checkbox"/> Hot Water Domestic	<input type="checkbox"/> Cold Water Domestic <input type="checkbox"/> Steam Line <input type="checkbox"/> _____
<input type="checkbox"/> Sprinkler	<input type="checkbox"/> Riser* <input type="checkbox"/> Individual Heat <input type="checkbox"/> Horizontal Mains/Areas	<input type="checkbox"/> Valves* <input type="checkbox"/> _____
<input type="checkbox"/> Medical Gas	<input type="checkbox"/> Compressed Air <input type="checkbox"/> Oxygen <input type="checkbox"/> Nitrous Oxide	<input type="checkbox"/> Vacuum <input type="checkbox"/> Special Mix Gas <input type="checkbox"/> Zone Valve Boxes <input type="checkbox"/> _____

<input type="checkbox"/> Mechanical	<input type="checkbox"/> Chilled Water	<input type="checkbox"/> Hot Water	<input type="checkbox"/> VAV's
	<input type="checkbox"/> Steam	<input type="checkbox"/> Compressor	<input type="checkbox"/> Electrical Disconnects
	<input type="checkbox"/> Glycol	<input type="checkbox"/> Condenser	<input type="checkbox"/> _____

* Requires Fire Alarm & Security Coordination

FACILITY PERMITS

****Above Ceiling**

****Hot Work**

****Infection Control Risk Control (ICRA)**

****Other** _____

** Completed forms must be attached

PERCENT OF IMPAIRMENT (For partial impairment, attach a list showing the area, smoke head, fire suppression system etc. that will be impaired)

Text

REASON FOR IMPAIRMENT

Text

COMMENTS

Text

ATTACHMENTS

1. *3_Pre-Construction GC Detailed Shutdown Plan_Template.xlsx*
2. *Facility Site Area Floor Plan*

SECTION 2 – TO BE COMPLETED BY FACILITY MANAGEMENT

1. Will fire alarm be taken off line for any amount of time? Yes _____ No _____
If Yes, Facility Management must review and sign. _____
2. Will this impairment extend more than 4 hours? Yes _____ No _____
If Yes, a fire watch must be implemented, Intermountain Healthcare Safety Officer and Insurance Provider must be notified.
3. Department Managers of impaired areas notified:
Facility Management: _____ Date: _____
FD&C Project Manager: _____ Date: _____

Above Ceiling Work Permit

**Standards Referenced: NFPA 101 2012; NFPA 30 2012; NFPA 45 2011; NFPA 99 2012

Facility Name:
Requestor Name:
Company/Dept:
Contact Phone:

Permit No.:
Project No.:
Work/PO No.:

Start Date: Start Time:
End Date: End Time:

Exact Location of Work:

Description of Work:

Will ANY penetrations be made in walls, roof, floor or ceilings? Yes No

Will wiring or data cabling be installed or modified? Yes No

Type of Wiring

- | | |
|---|---|
| <input type="checkbox"/> Communication | <input type="checkbox"/> HVAC |
| <input type="checkbox"/> Door Control | <input type="checkbox"/> Security |
| <input type="checkbox"/> Low or High Voltage Electrical | <input type="checkbox"/> Telephone |
| <input type="checkbox"/> Fiber Optic | <input type="checkbox"/> Television |
| <input type="checkbox"/> Fire Alarm | <input type="checkbox"/> Other - <input type="text"/> |

Will fixtures, appliances, duct work or equipment be installed? Yes No

How will the work be supported?

- | | |
|---|--|
| <input type="checkbox"/> Fastened to deck or structure | <input type="checkbox"/> New cable tray |
| <input type="checkbox"/> Fastened to wall | <input type="checkbox"/> New pipe rack or conduit rack |
| <input type="checkbox"/> Existing cable tray | <input type="checkbox"/> Other - <input type="text"/> |
| <input type="checkbox"/> Existing pipe rack or conduit rack | |

Intermountain Point of Contact: POC Phone:
Print Name Clearly

Site Pre-Inspection

Intermountain Representative: Requestor:
Print Name Clearly Print Name Clearly

Notes or Observations (if any):

Site Post-Inspection

Intermountain Representative: Requestor:
Print Name Clearly Print Name Clearly

- No unsealed penetrations observed All installations properly supported

Notes or Observations (if any):

Intermountain Review and Approval of Work

Intermountain Representative: Date:
Signature

Why do we have to do this?

Because more people die of smoke inhalation in fires than die of fires in fires.
Because 6% of all TJC findings at Intermountain are penetrations in smoke or fire barriers.

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Hot Work Permit



Facility Name:

Requestor Name:

Company/Dept:

Contact Phone:

Permit No.:

Project No.:

Start Date:

End Date:

Work / PO No.:

Start Time:

End Time:

Exact Location of Work:

Description of Work:

Heat Sources

- Gas Torch Grinder Arc Welder Drill Chemical
 Other -

Will work require disabling fire detection or suppression systems? Yes No

Will systems be disabled longer than 4 hours in any 24 hours? Yes No

Will work generate smoke, odors or fumes? Yes No

Establishing The Work Area

- | | |
|--|--|
| <input type="checkbox"/> 35' space clear of combustibles | <input type="checkbox"/> Appropriate fire extinguishers on hand |
| <input type="checkbox"/> Fire blankets or protective mats in place | <input type="checkbox"/> Confined space permit on hand or not needed |
| <input type="checkbox"/> Space is well-ventilated | <input type="checkbox"/> Atmosphere tested non-explosive |
| <input type="checkbox"/> Signage and barricades in place | <input type="checkbox"/> Welding shields are in place as needed |
| <input type="checkbox"/> Safety observer on hand | <input type="checkbox"/> Fire watch arranged for |
| <input type="checkbox"/> Other precautions: <input type="text"/> | |

Intermountain Point of Contact: POC Phone:

Emergency Phone Number:

Upon Conclusion of Work

Name of Fire Watch Personnel: Supervisor:

- Fire watch was kept for 60 minutes after hot work was complete
 No sign of smoke or fire was detected during fire watch

Notes or Observations (if any):

Intermountain Review and Approval of Work

Intermountain Point of Contact: Date:

Why do we have to do this?

- Because more people die of smoke inhalation in fires than die of fires in fires.
- Because 6% of all TJC findings at Intermountain are penetrations in smoke or fire barriers.

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Intermountain Healthcare

Facilities Management

Infection Control Work Permit

** Standards Referenced: EC 02.06.05; Guidelines for Design and Construction of Health Care Facilities 2010

PeopleSoft Project # or Job Name:

Project Start Date:

Project Manager:

Estimated Completion Date:

Contractor Performing Work:

Need to Relocate Patients?

Yes No

Affected Department Supervisor Signature:

Date Signed:

Environmental Services Supervisor Signature:

Date Signed:

Infection Preventionist Signature:

Date Signed:

Construction Activity Class (see Page 2 and 3 for Classification Table):

Class I

Class II

Class III

Class IV

Specific Areas to be Affected by This Work:

Initials:

Date:

Exceptions or Additions to This Permit:

Initials:

Date:

Request and Approval:

Permit Request By:

Printed Name:

Permit Approved By:

Printed Name:

Signature:

Signature:

Date:

Date:

Construction Activity Class Worksheet

Complete Steps 1 through 3, then see Step 4.

1. Determine Construction Activity Type:

<input type="checkbox"/>	Type A:	<p>Inspection and non-invasive activities</p> <p>Includes, but not limited to:</p> <ul style="list-style-type: none"> - ceiling tile replacement limited to 1 tile per 50 sf. - painting or wall covering, without sanding - finish electrical and minor plumbing work - activities that do not generate dust or require cutting walls or access to ceilings for other than
<input type="checkbox"/>	Type B:	<p>Small scale, short duration activities that create minimal dust and disruption to patient population via noise, vibration, odors or ventilation systems</p> <p>Includes, but not limited to:</p> <ul style="list-style-type: none"> - installing telephone or computer cabling - access to chase or mechanical spaces
<input type="checkbox"/>	Type C:	<p>Generates moderate or high levels of dust or requires demolition or removal of ANY fixed building components or assemblies</p> <p>Includes, but not limited to:</p> <ul style="list-style-type: none"> - sanding walls to remove paint or wall coverings - removal of floor coverings, ceiling tiles or casework - new wall construction or major cabling activities
<input checked="" type="checkbox"/>	Type D:	<p>Major demolition or construction that creates major disruption, i.e. noise, dust, vibration, odor, or mechanical systems</p> <p>Includes, but not limited to:</p> <ul style="list-style-type: none"> - heavy demolition or removal of a complete cabling system - new construction or buildout of shelled space

2. Determine Infection Control Risk Group:

<input type="checkbox"/> Lowest	<input type="checkbox"/> Medium	<input type="checkbox"/> High	<input checked="" type="checkbox"/> Highest
<ul style="list-style-type: none"> - Office areas - Admitting - Meeting rooms - Education centers - Copy centers - Fitness centers - Gift shops - Mail rooms - Plant engineering - EVS - etc. 	<ul style="list-style-type: none"> - Behavioral health - EEG / EKG - Outpatient clinics - Outpatient pharmacy - Outpatient labs - Physical therapy - Sleep labs - Employee health - Materials management - Clinical engineering - etc. 	<ul style="list-style-type: none"> - Cafeteria - Snack bar - Food services - Imaging services - Nuclear medicine - Radiology - Physical therapy pools - Wound clinic - etc. 	<ul style="list-style-type: none"> - Nursing units - ER / ED - Cancer services - Cath labs - Central processing - Infusion clinic - ICU / NICU / CCU - Isolation rooms - Operating rooms - Pharmacy - Lab / Pathology - Endoscopy - etc.

3. Find the Construction Class on the matrix below:

		Construction Activity Type			
		Type A	Type B	Type C	Type D
IC Risk Group	Lowest	Class I	Class II	Class II	Class III
	Medium	Class I	Class II	Class III	Class IV
	High	Class I	Class II	Class IV	Class IV
	Highest	Class II	Class IV	Class IV	Class IV

4. Follow the appropriate Infection Control Protocols below:

During Construction

Upon Completion

Class I	<ul style="list-style-type: none"> - Perform work using methods to minimize raising dust or tracking dust into other areas. - Immediately replace ceiling tile upon completion of inspection. 	<ul style="list-style-type: none"> - Clean work area.
Class II	<ul style="list-style-type: none"> - All measures for Class I work. - Use active dust control measures. - Use water mist to control dust while cutting. - Seal doors, ducts, vents and HVAC units. - Place dust control mats at entries to work area; keep them clean and effective. - Remove debris only in tightly covered containers. 	<ul style="list-style-type: none"> - All measures for Class I work. - Wipe all horizontal surfaces with disinfectant. - Remove final debris only in tightly covered containers. - Vacuum using HEPA filtered vacuum; mop with disinfectant as appropriate. - Remove all seals from doors, ducts, vents and HVAC units.
Class III	<ul style="list-style-type: none"> - All measures for Class II work. - Construct barriers to prevent dust and other contaminant migration prior to beginning work. - Maintain negative air pressure in work space using HEPA filtration units. 	<ul style="list-style-type: none"> - All measures for Class II work. - Remove construction barriers only after all needed inspections are complete and passed. - Remove construction barriers in a manner that minimizes the spread of dust and debris.
Class IV	<ul style="list-style-type: none"> - All measures for Class III work. - Seal all pipes, conduits and penetrations. - Construct and use anteroom for all entry to work area; HEPA vacuum all personnel, or have them change clothing before they leave the work area. - All personnel wear shoe covers while in the work area and remove them before entering the hospital. 	<ul style="list-style-type: none"> - All measures for Class III work.

Additional Requirements For This Area:

Initials:

Date:

Other Considerations for Work Impact

1. Identify the risk levels of adjacent spaces:

Above				Below				Lateral				Lateral				Front				Other											
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
Lowest	Medium	High	Highest	Lowest	Medium	High	Highest	Lowest	Medium	High	Highest	Lowest	Medium	High	Highest	Lowest	Medium	High	Highest	Lowest	Medium	High	Highest	Lowest	Medium	High	Highest	Lowest	Medium	High	Highest

2. Identify likely outages and their effects: plumbing, medical gas, ventilation, electrical, etc.:

3. Describe specific containment measures to be used:

4. Describe specific risks associated with water damage:

5. Describe noise and vibrations that will impact patient care areas and how you will mitigate that:

6. Identify the project work hours - avoiding patient care impact when possible:

7. Do plans allow for sufficient isolation/negative airflow rooms? Yes No

8. Do plans allow for sufficient hand washing sinks per AIA guidelines? Yes No

9. Do plans allow for sufficient access to clean and soiled utility rooms? Yes No

10. Describe the Project Communication Plan for traffic patterns, EVS, etc.:

11. Describe the Project Monitoring Plan for infection control, safety, etc.:



Intermountain Healthcare

Facilities Management

Interim Life Safety Measures Work Permit

**** Standards Referenced: LS 01.02.01; NFPA 101 2000 Sections 9.6.1.8, 9.7.6.1**

PeopleSoft Project # or Job Name:

Project Start Date:

Project Manager:

Estimated Completion Date:

Contractor Performing Work:

Need to Relocate Patients?

Yes No

Affected Department Supervisor Signature:

Date Signed:

Environmental Services Supervisor Signature:

Date Signed:

Environment of Care Manager Signature:

Date Signed:

Affected Life Safety Systems

Fire Detection
 Fire Suppression
 Fire or Smoke Barriers
 Egress

Specific Areas to be Affected by This Work:

Initials:

Date:

Exceptions or Additions to This Permit:

Initials:

Date:

Request and Approval:

Permit Request By:

Printed Name:

Permit Approved By:

Printed Name:

Signature:

Signature:

Date:

Date:

Fire Detection, Suppression and Barrier Systems

Yes No

- Will individual smoke or heat detectors be out of service longer than 4 hours?
- Will fire alarm panel be out of service or in "test" mode longer than 4 hours?
- Will fire alarm circuits be out of service longer than 4 hours?
- Will fire alarm communication lines be out of service longer than 4 hours?

If "yes" to any of the above, detail the interim life safety measures to be taken below:

Yes No

- Will covers be placed on any smoke or heat detectors?

If "yes" list the devices to be covered and when the covers will be removed:

On conclusion of work, check box to indicate that all covers have been removed.

Yes No

- Will any component of the uppression system be out of service longer than 4 hours?

If "yes," detail the interim life safety measures to be taken below:

Yes No NA

- Will any floor, wall or ceiling be penetrated?
- If "yes" above, is the floor, wall or ceiling a rated assembly?

If "yes," detail the interim life safety measures to be taken below:

Egress Integrity

Yes No

- Will any portion of the work obstruct a means of egress?
- Will any portion of the work alter a means of egress?
- Will any portion of the work obstruct, impair or remove egress signage?
- Will any portion of the work obstruct, impair or remove egress lighting?

If "yes," detail the interim life safety measures to be taken below:

Maintaining a Safe Work Environment

Yes

No

- Will a Hot Work Permit be needed?
- Will a Confined Space Entry Permit be needed?
- Will an Above Ceiling Work Permit be needed?
- Will air quality monitoring be required on site?

Workplace Safety Guidelines

- Access to the work site is restricted to authorized personnel only.
- All personnel wear appropriate PPE while on site.
- All personnel have had a site safety briefing and know where emergency services are located.
- Tobacco use is strictly prohibited on the work site.
- Chemical safety data sheets and safety stations are available to all personnel on site.
- The work site is maintained in a clean and orderly state at all times.
- All tools are unplugged and power turned off at the end of each work day.
- All tools, including extension cords and ladders are in safe operating condition.
- Any temporary structures or partitions are built smoke tight and of non-combustible materials.
- Intermountain Healthcare is notified of any fire system shut down before work begins.

Workplace Safety Guidelines for Long-Duration Projects

- Fire alarm and temporary suppression systems will be tested monthly.
- At least 1 fire drill will be conducted per shift per month.

Describe the Project Communication Plan for traffic patterns, EVS, etc.:

Describe the Project Monitoring Plan for life safety measures:

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APPLICATION AND CERTIFICATION FOR PAYMENT

To Owner: IHC Health Services, Inc. Owner Project #: Owner Project #
36 South State Street Application #: 1
Salt Lake City, UT 84111 Application Date: 12/1/2018
From Contractor: Contractor Name Architect Name Address Address
City, State, Zip City, State, Zip
Via A/E:
Contract Invoice #: 1
Project Name: Project Name Contract Date: 12/17/2016

CONTRACTOR'S APPLICATION FOR PAYMENT

Application is made for payment, as shown below, in connection with the Contract. The Continuation Sheet is attached.

Table with 2 columns: Description and Amount. Rows include: 1. Original Contract Sum (\$100.00), 2. Total Contract Change By Change Orders (\$0), 3. Current Contract Sum (\$100.00), 4. Total Completed & Stored To Date (\$75.00, 75.00%), 5. Retention (5.1-5.6), 6. Total Earned Less Retainage (\$71.25), 7. Less Previous Certificates For Payments (\$0, 0.00%), 8. Current Payment Due (\$23.75, 23.75%), 9. Balance To Finish, Plus Retention (\$76.25, 76.25%).

CONTRACTOR'S CONTRACTOR NAME

The undersigned Contractor certifies that to the best of the Contractor's knowledge, information and belief the Work covered by this Application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by the Contractor for Work for which previous Certificates for Payment were issued and payments received from the Owner, and that current payment shown herein is now due.

By: John Doe Date: 12/31/2018

State of:
Subscribed and sworn to before me this ___ day of ___
Notary Public:
My Commission Expires: ___

A/E'S CERTIFICATE FOR PAYMENT

In accordance with the Contract Documents, based upon on-site observations and the data comprising the application, the A/E certifies to the Owner that to the best of the A/E's knowledge, information and belief the Work has progressed as indicated, the quality of the Work is in accordance with the Contract Documents, and the Contractor is entitled to payment of the Amount Certified.

Amount Certified: \$23.75

A/E: By: Date:

This Certificate is not negotiable. The amount certified is payable only to the Contractor named herein. Issuance, payment and acceptance of payment are without prejudice to any rights of the Owner or Contractor under this Contract.

Approved by FD&C PM 1, 2: (Signature) (Date)

Change Order Summary table with columns: Description, Amount. Rows: Total Changes Approved in Previous Months By Owner (\$), Total Approved Changes This Month (\$), Total Contract Change By Change Orders (\$).

1 For major capital projects, FD&C Project Manager to sign. 2 Intermountain's "Monthly Pay Application Checklist" must be submitted by PM with Contractor's Application & Certification for Payment before processing. 3 Contractor has verified the work associated with the "Current Payment Due" and has attached all relevant invoices and backup information with this application & certification for payment.



CONTINUATION SHEET
Application and Certification for Payment,
 Containing Contractor's signed certification is attached.

Project Name: Project Name
Owner Project #: Owner Project #
Application #: 1

Application Date: 12/1/2018
Period To: 12/31/2018
Contractor Invoice #: 1

A Item No.	B Description of Work	C Original Contract Sum (CM/GC Pre-Construction Fee; Contract Buyouts)	D Total Contract Change By Change Orders	E Current Contract Sum (C + D)	F Work Completed		G Materials Presently Stored This Period (Not in For G)	H Total Completed and Stored Through This Period (F + G + H)	I % (I / E)	J Balance To Finish (E - I)	K This Period Retention (G + H * 5%)	L Total Retention Withheld (I * 5%)	M This Period Retention Released	N Total Retention Released	O Current Payment Due ³ (G + H - L + N)	P
					From Previous Applications	This Period In Place										
00001	Enter Description of Work	\$ 100.00	\$ -	\$ 100.00	\$ 50.00	\$ 25.00	\$ -	\$ 75.00	75%	\$ 25.00	\$ 1.25	\$ 3.75	\$ -	\$ -	\$ -	23.75
00002		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
00003		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
00004		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
00005		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
00006		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
00007		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
00008		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
00009		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
00010		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
00011		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
00012		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
00013		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
00014		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
00015		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
00016		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
00017		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
00018		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
00019		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
00020		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
00021		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
00022		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
00023		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
00024		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
00025		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
00026		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
00027		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
00028		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
00029		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Intermountain Project Grand Totals		\$ 100.00	\$ -	\$ 100.00	\$ 50.00	\$ 25.00	\$ -	\$ 75.00	75%	\$ 25.00	\$ 1.25	\$ 3.75	\$ -	\$ -	\$ -	23.75

A/E SUPPLEMENTAL INSTRUCTIONS
ASI # 001

Project Name:	Project Name Address Address	A/E:	Architect
Bid Package:	1.0X	Date:	Date Issued
Owner:	IHC Health Services, Inc.	ASI Page Count:	XX
Intermountain Project #:	Project ID #	ASI Prepared By:	Name
FD&C PM:	PM Name	Contractor:	Contractor
ASI Description:	Description		

Reason For Change (Required):

- A/E Error
 A/E Omission
 A/E Request
 GC Request
 Owner/FD&C Request
 Functional Request
 Unknown Condition

The Work shall be executed in accordance with the following supplemental instructions, which interpret the Contract Documents or order minor changes in the Work without change in Construction Costs, Contract Sum and/or Contract Time.

If the Contractor believes that a change in Construction Costs, Contract Sum, and/or Contract Time is warranted, the Contractor shall submit written notice in the form of a Proposed Change Order (PCO) substantiating such claim to the A/E. The claim shall be made in accordance with the provisions of the Contract Documents. The Owner's authorization is required prior to proceeding with any Work which will incur additional cost and/or time.

DETAILED DESCRIPTION:

Text

ATTACHMENTS:

Text

Approved by FD&C¹:

 (Signature)

 (Date)

¹ For major capital projects, FD&C Project Manager to sign.
 For local facility managed projects, local facility Project Manager to sign.

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CONSTRUCTION CHANGE DIRECTIVE

CCD # 001

Project Name:	Project Name Address Address	A/E:	Architect
Bid Package:	1.0X	Date:	Date Issued
Owner:	IHC Health Services, Inc.	CCD Page Count:	XX
Intermountain Project #:	Project ID #	CCD Prepared By:	Name
FD&C PM:	PM Name	Contractor:	Contractor
CCD Subject:	Subject		

Reason For Change (Required):

- A/E Error
 A/E Omission
 A/E Request
 GC Request
 Owner/FD&C Request
 Functional Request
 Unknown Condition

ESTIMATED CHANGE IN CONSTRUCTION COSTS, CONTRACT SUM, OR CONTRACT TIME:

\$

In order to expedite the work and avoid or minimize delays in the work which may affect the contract sum and/or contract time, the Contract Documents are hereby amended as described below. Proceed with this work promptly. Submit final costs for work involved and change in Contract Time (if any as a Proposed Change Order), for inclusion in a subsequent Change Order, per the General Conditions.

All work shall be in accordance with the terms, stipulations and conditions of the original Contract Documents.

DESCRIBE BRIEFLY ANY PROPOSED CHANGES:

Text

ATTACHMENTS:

Text

Approved by FD&C PM¹:

_____ (Signature)

_____ (Date)

Approved by FD&C Exec. Director²:

_____ (Signature)

_____ (Date)

¹ For major capital projects, FD&C Project Manager to sign.

For local facility managed projects, local facility Project Manager to sign.

² For major capital projects, FD&C Design & Construction Exec. Director to sign when the charge exceeds \$200,000 as outlined in "Construction Change Order Procedure".

For local facility managed projects, System Construction Director to sign when the charge exceeds \$25,000 as outlined in "Approval Authority Capital Expenditures Policy".

PROPOSED CHANGE ORDER

PCO # 001

Project Name:	Project Name Address Address	Contractor:	Contractor
Bid Package:	1.0X	PCO Issue Date:	Date Issued
Owner:	IHC Health Services, Inc.	PCO Page Count:	XX
Intermountain Project #:	Project ID #	PCO Prepared By:	Name
FD&C PM:	PM Name	A/E:	Architect

*Once this document is executed the Contractor is authorized to proceed with the work described below and to include this PCO in a Change Order for A/E and Owner approval.

PCO Description: **Description**

Reference: **Reference ASI, RFI, PR, CCD change document this PCO is in response to.**

Reason For Change (Required):

- *A/E Error
 *A/E Omission
 A/E Request
 GC Request
 Owner/FD&C Request
 Functional Request
 Unknown Condition
 **Facility

*If A/E Error or A/E Omission is checked, the Contractor is to provide pricing delta (bid cost vs. C.O. cost) to determine A/E responsibility.

**If Facility is checked, the Facility and FD&C PM are to determine the Facility's cost responsibility, including design fees and the Facility representative is to initial the PCO or provide email acknowledgement of financial commitment and attach to PCO. FD&C PM to coordinate with Capital Finance on facility reimbursement once PCO is signed.

PCO Details:

*A/E is responsible for \$_____. Agreed to if PCO is signed.
 **Facility is responsible for \$_____. Agreed to if PCO is signed.

Item	Subcontractor	Description	Amount
-	-	Enter Description	\$
		PCO Subtotal	\$
		Contractors Fee (5%) per the contract	\$
		Total Cost of this PCO Request	\$

Contractor:

Contractor Firm
Contractor Rep. Name - Title

Architect:

Architect Firm
Architect Rep. Name - Title

Intermountain Healthcare:

IHC Health Services, Inc.
Owners' Rep. – PM Name

Signature

Date

Signature

Date

FD&C Project Manager¹

Date

FD&C Director²

Date

¹ For major capital projects, FD&C Project Manager to sign.*
For local facility managed projects, local facility Project Manager to sign.*

² For major capital projects, Executive Director, Design & Construction to sign when the charge exceeds \$200,000 as outlined in the "Construction Change Order Procedure".
For local facility managed projects, System Construction Director to sign when the charge exceeds \$25,000 as outlined in the "Approval Authority Capital Expenditures Policy".

*** PM signatures are required for all PCO's prior to work commencing.**

PROPOSAL REQUEST

PR # 001

Project Name:	Project Name Address Address	A/E:	Architect
Bid Package:	1.0X	Date:	Date Issued
Owner:	IHC Health Services, Inc.	PR Page Count:	XX
Intermountain Project #:	Project ID #	PR Prepared By:	Name
FD&C PM:	PM Name	Contractor:	Contractor
PR Description:	Description		

Reason For Change (Required):

- A/E Error
 A/E Omission
 A/E Request
 GC Request
 Owner/FD&C Request
 Functional Request
 Unknown Condition

Please submit a fully itemized list of Construction Costs, with supporting documentation, for any changes in the Construction Costs, Contract Sum, and/or Contract Time incidental to the proposed modifications to the Contract Documents.

THIS IS NOT A CHANGE ORDER, A CONSTRUCTION CHANGE DIRECTIVE OR A NOTICE TO PROCEED WITH THE WORK DESCRIBED IN THE PROPOSED MODIFICATIONS.

DESCRIPTION:

Text

ATTACHMENTS:

Text

Requested by: _____
 (Signature) (Printed Name and Title) (Date)

Approved by FD&C PM¹: _____
 (Signature) (Date)

¹ For major capital projects, FD&C Project Manager to sign.
 For local facility managed projects, local facility Project Manager to sign.

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REQUEST FOR INFORMATION

RFI # 001

Project Name:	Project Name Address Address	Contractor:	Contractor
Bid Package:	1.0X	Date:	Date Issued
Owner:	IHC Health Services, Inc.	RFI Page Count:	XX
Intermountain Project #:	Project ID #	RFI Prepared By:	Name
FD&C PM:	PM Name	Architect:	Architect
RFI Description:	Description		
Cross Reference:	ASI #, Drawing Info, etc.	RFI Response Date Requested:	Date

Contractor Attestation (Required checkbox): *The undersigned Contractor has reviewed the Contract Documents and is unable to locate this requested information within the Contract Documents. This RFI requests information, direction, or clarification for this specific item.*

Contractor Signature: *Signature* **Date:** *Date*

QUESTION:

Text

RESPONSE:

Text

A/E Response By:	Name	Date:	Date
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A/E PM Acknowledgement:	Name	Date:	Date
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FUNCTIONAL CHANGE REQUEST

FCR # 001

Project Name:	Project Name Address Address	A/E:	Architect
Bid Package:	1.0X	Date:	Date Issued
Owner:	IHC Health Services, Inc.	PR Page Count:	XX
Intermountain Project #:	Project ID #	PR Prepared By:	Name
FD&C PM:	PM Name	Contractor:	Contractor
Request Description:	Description		

Please submit a fully itemized list of Construction Costs, with supporting documentation, for any changes in the Construction Costs, Contract Sum, and/or Contract Time incidental to the proposed modifications to the Contract Documents.

This form must be signed & approved by the FD&C PM prior to Contractor proceeding with pricing.

THIS IS NOT A CHANGE ORDER, A CONSTRUCTION CHANGE DIRECTIVE OR A NOTICE TO PROCEED WITH THE WORK DESCRIBED IN THE PROPOSED MODIFICATIONS.

REASON FOR REQUEST:

Text

BUSINESS CASE JUSTIFICATION:

Text

Requester: _____
 (Signature) (Printed Name and Title) (Date)

Operations Management Approval: _____
 (Signature) (Printed Name and Title) (Date)

Approved by FD&C PM¹: _____
 (Signature) (Date)

¹ For major capital projects, FD&C Project Manager to sign.
 For local facility managed projects, local facility Project Manager to sign.

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PERSONNEL OVERTIME APPROVAL FORM

Project Name: Project Name
 Address
 City, State, Zip

Owner: IHC Health Services, Inc.

**Intermountain
Project #:**

FD&C PM:

Contractor:

Employee or position:

Job Title:

Salaried Employee: (Check box if yes)

Hourly Rate:

Invoice Period:

Contractor requests Owner's approval of employee overtime for the Project as originally specified in the Contract. The proposed overtime and the reasons for the request are specified below. The proposed overtime will be deemed approved by Owner at the time this request form is duly executed on behalf of Owner in the space provided below.

OVERTIME JUSTIFICATION:

Contractor:
 Contractor Firm
 Contractor Rep. Name - Title

Owner:
IHC Health Services, Inc.
FD&C Project Manager

Signature _____ Date _____

Signature _____ Date _____

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Contractor Orientation

Intermountain Healthcare Facilities Management

This orientation is to be read to all workers by the Facility Manager or designee, and a copy is to be given to each worker on the job site.

Safety on the Job Site

Your Safety

Unsafe acts will not be tolerated on the job site. We want you to be as healthy and whole when you go home, as you were when you arrived.

Appropriate PPE will be worn at all times while working on the job site. Ladders and other equipment will be used properly.

Always use the proper lock-out/tag-out (LOTO) procedures and equipment to ensure that you and others are protected from hazardous energy while working. Be aware that energized systems in healthcare facilities can be complex, and your work may affect others in remote areas of the facility. Coordinate any LOTO activity with the Facility Manager and other affected trades.

The Safety of Others

Nothing you do should put others in danger or harm them in any way. Be thoughtful and deliberate about safety.

Your Behavior on the Job Site

How You Should Act

You should come to work with a clean body in clean clothes. You should come to work sober. Attempting to work while under the influence of any drugs or alcohol – even if they are prescribed – can be dangerous to you and others, and is cause for immediate removal from the job site.

Be considerate of others. Remember that others may take offense at things you do, even when you mean no harm. Avoid doing or saying things that may bother or upset others.

No music, no smoking, no cursing, no shouting, no leering, no fighting, no racially or culturally insensitive comments, no suggestive or offensive comments, no propositions, and no soliciting are permitted while you are on the job site.

Phones, Cameras, and Other Communication or Recording Devices

You should not carry on personal communication or phone conversations while on the job site.

You must NEVER photograph, or video or audio record ANYTHING or ANYONE on Intermountain Healthcare property. This will not be tolerated, and in some cases this may violate the law. If work needs to be photographed, have your supervisor or the facilities team on site take the pictures.

On this job site, the person who authorizes photography or recording is: _____.

Where You Should Be on the Property

Parking

Park only in the location identified by the Facility Manager in your orientation. Parking personal vehicles in any other location may result in their removal.

On this job site, the parking location is: _____.

Smoking

Smoking is not allowed on any Intermountain property. If you need to smoke, vape, or use tobacco in other ways, you must leave the property and return when you're done.

Drugs are never allowed.

Break Time

Take breaks only in areas identified by the Facility Manager in your orientation. During breaks do not engage in loud conversation or use offensive language.

On this job site, the break location is: _____.

Meals

The Facility Manager will tell you in your orientation if you are permitted to use the facility cafeteria and dining room during your meal time. Take meals only in areas identified by the Facility Manager in your orientation.

Never take breaks in public areas meant for patients and their guests.

On this job site, the meal location is: _____.

On this job site, the break location is: _____.

When You Should Be on the Property

When you are working, or on the property for work you should not arrive earlier than is necessary for you to assemble your tools and equipment for the day. Arriving very early and 'hanging around' is not permitted. Your supervisor will tell you what time you should arrive at work.

When you are done with the work day, and your tools and equipment are cleaned and put away, and your job site is clean, you should leave the property directly. Staying on the job site after work is not permitted.

Of course, if you are a patient, or are visiting one of our patients, you are always welcome in the public areas of the facility. Do not visit the job site unless you are here for work.

We ask you that while you are here you remember that you may be seen by others as representing your company or ours, and to please comport yourself accordingly.

How a Healthcare Facility May Be Different from Other Jobs Sites

People

The people who come to our hospitals and other facilities come because they feel sick, hurt, scared, or sad. They don't come to see us when everything is going fine. They want to feel safe and comfortable and confident that everything will be better soon.

Many of them are sensitive to noise, dust, fumes, odors, and vibrations. Please do everything you can to control these irritants.

The procedures we do in our facilities frequently require quiet and stillness. Please be sensitive to this and be ready to accommodate requests to stop work briefly or move to a different area of the facility to continue working.

Building Systems

The structure of our hospitals and other facilities is intended to actively work to protect our staff, patients, and visitors in the event of an emergency. This means that you must be very careful about how your work impacts other systems and parts of the building. Some of the rules are strange, but all are important.

Certain walls are intended to stop smoke or fire from spreading because when our buildings catch fire we cannot leave. We continue to care for our patients, perform surgeries, help birth babies, and provide emergency medical care. When working around or through these walls – “rated assemblies” – it is critical that you do so properly.

A pre-inspection by a member of the facility's maintenance team of the area you'll be working in is required so that you can understand where rated assemblies are, and how you must treat them. This also gives you an opportunity to identify existing conditions for which you may not be responsible.

A post-inspection by a member of the facility's maintenance team of the work you've done is required so that you can demonstrate that you've complied with all requirements for maintaining the integrity of our protective rated assemblies.

On this job site, the contact for fire stopping materials is: _____.

Along with rated assemblies, our facilities have very sensitive fire and smoke detection systems, as well as automatic sprinkler systems. If your activities will cause dust or vibration or impact, be aware and mitigate any adverse effect you may have on these systems.

On this job site, the contact for fire alarm systems is: _____.

If your work interrupts or disables any portion of the building's life safety systems, including fire alarm, fire suppression, and emergency egress, you may be required to implement interim life safety measures.

On this job site, the contact for interim life safety is: _____.

Much of our air is exhausted to the outside. If you are working around exhaust fans, you must know what areas the exhaust is coming from. Some exhausts are laden with radioactive elements. Some carry infectious diseases and other germs. Your supervisor will tell you about these areas.

On this job site, the hazardous exhaust areas are: _____.

Many of our patients depend on clean and fresh outside air to be provided to them. Smoking on roofs or around air intakes is strictly forbidden for this reason. If you must operate equipment on roofs or around air intakes, be certain to coordinate your work with the Facility Manager.

On this job site, the sensitive air intakes are: _____.

Much of our equipment may start without notice. Take care to avoid being harmed by unexpected starts, or unexpected discharges of steam, hot water, or chemicals. Unless you are authorized to be working around this equipment you should stay out of these spaces.

All work above the ceiling requires an Above Ceiling Work Permit, and all hot work requires a Hot Work Permit.

On this job site, the contact for Above Ceiling Work Permits is: _____.

On this job site, the contact for Hot Work Permits is: _____.

Infection Control

Because many of our patients are ill, there is a chance that you will be exposed to germs. There is also a chance that you will expose our patients to germs you've brought from outside the hospital. We do our best to keep our physical environment clean and to control all infectious matter.

You can protect yourself by ensuring that your vaccinations are current, and by only going in places you are authorized to go. Wash or sanitize your hands frequently – especially after using the restroom and before eating. Never eat food anywhere except where you are told to have meal breaks. The Plumber's Rule No. 3 applies to everyone in healthcare: Don't bite your fingernails!

Your work may require an Infection Control Risk Assessment. The Facility Manager will help you determine when that is, and will help you through the process. This process helps identify the best ways to keep you and our patients safe from infections and other impediments to healing. Once the assessment is done, be certain to abide by all of its conditions.

On this job site, the infection control contact is: _____.

A Clean Job Site

Throughout the work day, you will be responsible to maintain a reasonably clean job site. This makes it a safer place for you to work. It makes it a safer place for others to work, as well.

At the end of each work day, you will be responsible to leave all materials in an orderly state, remove all waste, scrap, and debris from the site, and leave the area broom clean. All potential hazards will be secured and made as safe as possible.

All construction waste and debris must be disposed of properly. Never use toilets or floor drains for this purpose. Cover all carts while moving debris through the facility, and use tacky mats to control dust tracking over floors.

Our Expectation of Workmanship

It doesn't matter if you're a ventilation mechanic, an electrician, a painter, or a plumber. It doesn't matter if you're installing carpet, or ceiling tiles, or kitchen equipment, or cabinetry. Every piece of our facilities is in place to support the lifesaving and healing work we do.

The hard reality is that someone's life will literally depend on the quality of the workmanship you put into the jobs you do in Intermountain Healthcare facilities.

And it's another hard reality that someone you care for may very likely come to the facilities you helped build. Please do the kind of job you'd trust your loved one's life to.

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CONSTRUCTION SAFETY REQUIREMENTS

- I. Outside Contractors and Intermountain Construction Employees performing construction activities on occupied Intermountain Healthcare property shall meet the following requirements. Stand-alone, new construction sites are not covered by these requirements. Outside Contractors will meet additional qualifications through the Supply Chain Organization Supplier Credentialing Procedure.
 - a. No work will be performed in any Intermountain Facility without prior approval and coordination with the accountable Facility Engineering Manager or Director.
 - b. Each outside contractor will have a Safety Program that complies with 29 CFR 1926 Subpart C. The Safety Program will be in writing.
 - c. Any chemical brought onto Intermountain Property must meet the following requirements:
 - i. Approved by the facility's Chemical Safety Officer,
 - ii. Accompanied by a current material safety data sheet,
 - iii. Stored in accordance with the chemical manufacturer's safety requirements in the appropriate labeled container.
 - iv. Where the chemical quantity is restricted for Healthcare Occupancies by NFPA 30 or other standards, it is the contractor's responsibility to provide for off-site storage.
 - v. The Contractor is responsible to comply with Intermountain's Hazardous Materials policy.
 - vi. The Contractor is responsible for the removal of all chemicals from Intermountain Property and for proper disposal in accordance with applicable laws and regulations.
 - d. No work will be performed without the completion of an Interim Life Safety and Infection Control Risk Assessment. These risk assessments will cover each phase of the construction project.
 - e. In existing facilities, an Asbestos inspection and any necessary abatement will be conducted prior to any renovation or remodel per the Hazmat policy.
 - f. Where work will cause noise or vibration, an assessment will be made following facility procedures to mitigate potential hazards to patients.
 - g. Above the Ceiling Permits
 - i. The Contractor will follow each facility's procedure for obtaining an above the ceiling work permit.
 - ii. No work will be performed prior to obtaining this permit.
 - h. Hot Work Permits
 - i. The Contractor will obtain a Hot Work Permit from Facilities Engineering prior to performing any hot work.
 - ii. The Contractor will provide a continuous and qualified fire watch for the duration and location specified by the Facility Engineering Director.
 - i. Confined Space Permits
 - i. The contractor will coordinate with the Intermountain Facility Engineering Director to assure that all requirements are met and a permit is completed prior to entering a permit required confined space.

- j. Control of Airborne Contaminants
 - i. The contractor will control all airborne dusts, mists, fumes, and vapors such that there is no exposure to Intermountain employees, patients, or visitors. This includes the generation of contaminants outside the building.
 - ii. If necessary, work will be conducted after hours to minimize potential exposures to staff, patients, and members of the public.
- k. Personal Protective Equipment.
 - i. PPE for head, eye, face, hand, foot, and respiratory protection is the responsibility of the contractor, and will be provided and worn as necessary for the exposure, except as follows:
 - 1. Hard Hats and Safety Glasses are required to be worn at all times when in the construction area. Hard hats may be removed when working in areas where the suspended ceiling grid has been completely installed.
 - ii. Fall Protection is the responsibility of the contractors and shall meet all 29 CFR 1926 requirements of the applicable Subparts.

RESPONSIBILITY MATRIX

Updated January 5, 2021

The following list identifies the majority of the items that are to be included in the capital project build-out. All Owner items need to be coordinated with A/E (Design Team), Contractor, and Owner (Facility Design & Construction and Supply Chain Facility Equipment Planners). For OFOI or OFCI items, Contractor is required to track equipment on construction schedule and to notify Owner of required delivery times taking into account for equipment lead times.

ITEM	OWNER/VENDOR	NOTES	ADDITIONAL NOTES		
			Data	Power	Backlog
OFOI - (Owner Furnished / Owner Installed) (Coordinate location of items with Owner and track within construction schedule)					
Art	Owner / Owner (Alpine Art)	All artwork to be coordinated with Dan Kohler. Provide power to required artwork.			
Brochure Racks	Owner / Owner	Contractor to provide proper backing.			
Chart Racks	Owner / Owner (Midwest)	Contractor to provide proper backing.			
Copiers, fax	Owner / Owner	A/E to locate where copy/fax/printer is not visual clutter.	Yes	Yes	
Cup Dispensers	Owner / Owner				
Exam Tables	Owner / Owner			Yes	
Systems Furniture (including demountable partitions)	Owner / Owner (Midwest & Steelcase)	Coordinate modesty panels with elec. outlets. Sit/Stand desks to have modesty panel on front. Attention to be given to cord management. A/E to coordinate data and power with Midwest.	Yes	Yes	
Receptionist Desk	Owner / Owner (Midwest & Steelcase)	Owner furnished, Owner installed are noted on the drawings. The remaining desks are provided by the contractor.	Yes	Yes	
Moveable Metal Shelving	Owner / Owner				
Recliners / Draw Chairs	Owner / Owner				
Signage - Exterior	Owner / Owner (IG Group, YESCO)	Provide power and data to required exterior signage. Provide circuits for above ceiling signs. Coordinate thru-wall conduit sleeves with weather barrier. A/E to coordinate traffic signage and Contractor to install. Intermountain Logo Signs - (2) 20A Circuits - May vary. InstaCare and other Signs - (1) 20 A Circuits - May vary.	Yes	Yes	Yes
Signage - Interior (including Code Signage)	Owner / Owner (Scribbley, Hightech)	Provide power to required signage. Contractor to track in schedule and notify Owner for when Code Required signage is required to be installed.			
Radiology Equipment	Owner / Owner (See subject matter expert list)	A/E responsible to coordinate final site equipment drawings into Construction Documents from Owner's Vendor.	Yes	Yes	
Clinical Garbage Cans (Clinical, Office, PT, Etc.)	Owner / Owner				
Computers, Printers, Scanners, Keyboards, Mice, etc.	Owner / Owner	In-ceiling & wall mounts, conduits and boxes mounted by Contractor. Computers to be All-in-One, typ. in IMG exam rooms.	Yes	Yes	Yes
Televisions, Digital Projectors, similar devices, etc.	Owner / Owner	These items to be provided by Owner, but A/E to coordinate locations and infrastructure. Contractor to refer to OFCI section.	Yes	Yes	Yes
Keyboard Trays	Owner / Owner				
PACS	Owner / Owner				
Magnetic Marker Boards, Cork Boards, Huddle Boards, Idea Tracking Boards, etc.	Owner / Owner (Midwest)	A/E to coordinate location with Owner.			Yes
Emergency Evacuation Medical Sled (Med Sled)	Owner / Owner	A/E to coordinate location with Owner.			
Supply Area Panels	Owner / Owner	Contractor to provide proper backing, coordinate with Owner.			Yes
Audio/Video (AV)	Owner / Owner	Intermountain SCO will source & supply the A/V system including specialized cabling (e.g. HDMI, etc). Refer to CFCL section for Contractor requirements. A/E to identify locations on drawings, coordinate with Owner. Contractor to provide infrastructure, back boxes, conduits, pathways and cabling (from wall side back).	Yes	Yes	
Nurse Notification Call (NNC) System & Devices (Hospital Campus)	Owner / Owner (Hillrom)	Hospital local facility team to work with Supply Chain Facility Equipment Planning team to contract directly with Nurse Notification Call (NNC) system vendor (Hillrom) for devices, equipment, monitors, etc. A/E to coordinate with Owner and Hillrom for all NNC infrastructure required to support the device locations and types designated by Hillrom on their site specific drawings. Hillrom site specific drawings to be coordinated and included in the A/E Contract Documents. Contractor to provide all infrastructure including conduits, back boxes, cabling (e.g. home-runs to RCB, RCB to device, device to device, etc.), etc. for all NNC devices (e.g. RCB, GSR-10, room devices, etc.). The cabling for the NNC system will be coordinated and installed by the Contractor/Subcontractor (i.e. low voltage sub). Contractor to coordinate with Hillrom.	Yes; see CFCL	Yes; see CFCL	
Staff Assist Notification Call System & Devices (Medical Group Clinics on hospital campuses to match NNC system)	Owner / Owner (Hillrom)	Hospital local facility/IMG Ops team to work with Supply Chain Facility Equipment Planning team to contract directly with Staff Assist Notification Call system vendor (Hillrom) for devices, equipment, monitors, etc. (from wall side out). Staff Assist Notification system to be coordinated with Hospital Campus NNC system, as applicable, Medical Group Strategic Planner, and IMG Operations Officer. A/E to coordinate with Owner and Hillrom for all Staff Assist Notification Call system infrastructure required to support the device locations and types designated by Hillrom on their site specific drawings. Hillrom site specific drawings to be coordinated and included in the A/E Contract Documents. Contractor to provide all infrastructure including conduits, back boxes, cabling (e.g. home-runs to RCB, RCB to device, device to device, etc.), etc. for all NNC and Staff Assist Notification Call devices (e.g. RCB, GSR-10, etc.). The cabling for the NNC and Staff Assist Notification Call system will be coordinated and installed by the Contractor/Subcontractor (i.e. low voltage sub). Contractor to coordinate with Hillrom.	Yes; see CFCL	Yes; see CFCL	

Staff Assist Notification Call System & Devices (Stand-alone Medical Group Clinics)	Owner / Owner (Hillrom)	IMG Ops team to work with Supply Chain Facility Equipment Planning team to contract directly with Staff Assist Notification Call system vendor (Hillrom) for devices, equipment, monitors, etc. (from wall side out). Staff Assist Notification Call system to be coordinated with Medical Group Strategic Planner and Operations Officer. A/E to coordinate with Owner and Hillrom for all Staff Assist Notification Call system infrastructure required to support the device locations and types designated by Hillrom on their site specific drawings. Hillrom site specific drawings to be coordinated and included in the A/E Contract Documents. Contractor to provide all infrastructure including conduits, back boxes, cabling (e.g. home-runs to RCB, RCB to device, device to device, etc.), etc. for all Staff Assist Notification Call devices (e.g. RCB, GSR-10, etc.). The cabling for the Staff Assist Notification Call system will be coordinated and installed by the Contractor/Subcontractor (i.e. low voltage sub). Contractor to coordinate with Hillrom.	Yes; see CFCI	Yes; see CFCI	
Patient Monitoring System & Devices (Hospital Campus)	Owner / Owner	Hospital local facilities to work with Supply Chain Facility Equipment Planning team to contract directly with Patient Monitoring vendors for devices, equipment, monitors, etc. (from wall side out). A/E to identify locations on drawings, coordinate with Owner. Contractor to provide all infrastructure including conduits, back boxes, and home-run cabling from Patient Monitoring devices to TEC/TDR rooms that connect to Intermountain's network (Intermountain Siemon certified installer low voltage subcontractor to install). The Patient Monitoring system device to device cabling is by Vendor.	Yes	Yes	
IV Hangar	Owner / Owner	A/E to identify locations on drawings, coordinate with Owner. Backing to be coordinated, if required.			
Sharps Disposal Container	Owner / Owner (Stericycle)	A/E to identify locations on drawings, coordinate with Owner. Backing to be coordinated, if required.			
Infant/Pediatric Security System	Owner / Owner (Totguard)	A/E to identify locations on drawings. This system is to be coordinated with Owner, Women's and Children's Operations, Clinical Programs and Security.	Yes	Yes	
OFCI - (Owner Furnished / Contractor Installed) (Coordinate location of items with Owner and track within construction schedule)			Data	Power	Backing
Automated External Defibrillator (AED)	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner, A/E to coordinate recess, semi-recessed, or surface mount options with Owner.			Yes
Time Clocks	Owner / Contractor	Conduit and boxes by Contractor, Coordinate location with Owner.	Yes	Yes	
Paper Towel Dispensers	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			
Soap Dispensers	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			
Toilet Paper Dispensers	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			
Sanitary Napkin Dispensers/Receptacles	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			
Diaper Changing Station	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			Yes
Hand Sanitizer Dispensers (Avagard)	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			
Hall Intersection Mirrors	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			Yes
Diagnostic Board (Otoscope / Ophthalmoscope)	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.		Yes	
Stadiometers, Recessed Scales	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner; coordinate power.		Yes	
Procedure Lights	Owner / Contractor	A/E to coordinate with Owner and Owner's selected equipment Vendor; A/E to identify locations on drawings, coordinate with Owner; A/E to coordinate the design of the procedure light support structure into drawings. Contractor to provide and install procedure light support structure.		Yes	Yes
Scrub Sinks & Carriers	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner. Contractor to coordinate with Owner for ordering and for install coordination.			Yes
IV Track	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner. Backing to be coordinated, if required.			Yes
Boom Mounting Plates (Equipment, Lighting, Anesthesia)	Owner / Contractor	A/E to coordinate with Owner and Owner's selected equipment Vendor; A/E to identify boom locations on drawings, coordinate with Owner; A/E to coordinate the design of the boom support structure into drawings. Final site specific equipment drawings from Vendor to be coordinated with Construction Documents. Contractor to coordinate with Owner and install boom support structure and boom mounting plates. Contractor to coordinate with Owner for ordering and install of boom mounting plates.	Yes	Yes	Yes
OR Clocks	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner. Contractor to coordinate with Owner for ordering and install coordination.	Yes	Yes	Yes
Clinical Clocks	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner. Contractor to coordinate with Owner for ordering and install coordination.		Yes	Yes
Shower Curtains & Rods	Owner (Medline) / Contractor	A/E to identify locations on drawings, coordinate with Owner. Contractor to coordinate with Owner for ordering and install coordination.			
Cubicle Curtains & Tracks	Owner (Medline) / Contractor	A/E to identify locations on drawings, coordinate with Owner. Contractor to coordinate with Owner for ordering and install coordination.			
Digital Projector Mounts, TV Mounts, & Computer Mounts (Ergotron Brackets/Mounts, etc.)	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner. Contractor to coordinate with Owner for ordering and install coordination. In-ceiling & wall mounts, conduits and boxes provide and installed by Contractor A/E to coordinate A/V requirements. Contractor to pull required A/V cabling.	Yes	Yes	Yes
Radiation Protection Calculations and Certification	Owner / Contractor	A/E to coordinate with Owner in the design phase for coordinating with Medical Physicists Consultants or others, when required. Contractor to coordinate prior to Gyp. Bd. install.			Yes
Patient Lifts	Owner (Liko, subsidiary of Hillrom) / Contractor	A/E to identify locations on drawings, coordinate with Owner. A/E to design required support structure for Contractor to install for necessary Liko patient lift connections (e.g. pendant / rails / etc). Contractor to coordinate shop drawings and installation requirements prior with Liko. Connect to equipment branch if provided.		Yes	

Building Alarms / Medication Refrigerator Alarm / Pharmacy Alarm System	Owner / Contractor	A/E to identify locations and infrastructure on drawings, coordinate with Owner. Contractor to provide conduit and infrastructure into accessible ceiling for access from equipment and/or devices. Local Facility to contract with alarm company for alarm, wire, and monitoring.		Yes	
UPS (MRI, Data Room, CPU, or other similar equipment)	Owner / Contractor	A/E to identify equipment locations on drawings, coordinate with Owner.	Yes	Yes	Yes
iCentra Tracking Boards	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.	Yes	Yes	Yes
Distributed Antenna System (DAS) including Public Safety	Owner (DAS vendor selected and managed by Intermountain CTIS/Telecom) / Contractor	A/E to locate infrastructure on drawings to simplify the DAS install. Contractor to track on construction schedule and coordinate DAS install with Owner's Vendor.			
Alertus - Mass Notification System (Public Areas)	Owner (Alertus) / Contractor	A/E to identify locations on drawings, coordinate with Owner.	Yes	Yes	
CFCI - (Contractor Furnished / Contractor Installed)			Data	Power	Backing
Blinds/Shades (manual and powered)	Contractor / Contractor	A/E to identify locations on drawings, coordinate with Owner.		Yes	
Apron Hooks/Rack (Heavy Duty in Radiology)	Contractor / Contractor	A/E to identify locations on drawings, coordinate with Owner.			Yes
Communication Boards (e.g. Patient Rooms)	Contractor / Contractor	A/E to identify locations on drawings, coordinate with Owner.			Yes
Emergency Phones, Kiosks - Exterior	Contractor / Contractor	A/E to identify locations on drawings, coordinate with Owner. Conduit and boxes by Contractor.	Yes	Yes	Yes
Med Gas Certification	Contractor / Contractor (Mountain Medical)	Contractor to coordinate Vendor with Owner			
Emergency Shower Station / Eye Wash Station	Contractor / Contractor	A/E to identify locations on drawings, coordinate with Owner. These shall meet ANSI and Owner requirements.			
Fire Extinguishers	Contractor / Contractor	A/E to identify types and locations on drawings, coordinate with Owner. 10 lbs. minimum - refer to Intermountain Design Guidelines & Construction Standards.			Yes
Grab Bars (Rest rooms, Radiology, Exam rooms, etc.)	Contractor / Contractor	A/E to identify locations on drawings.			Yes
Coat Hooks (Rest rooms/showers, Exam rooms, Offices/Workstations only)	Contractor / Contractor	A/E to identify locations on drawings.			
Mirrors (Rest rooms, Exams, Radiology, Rehab, etc.)	Contractor / Contractor	A/E to identify locations on drawings, coordinate with Owner.			Yes
Pneumatic Tube Systems	Contractor / Contractor (SwissLog, Atreo Group, or other approved)	A/E to identify locations on drawings, coordinate with Owner. If SwissLog, verify pricing is per Intalere (Amerinet) Contract Agreement. Design assistance fees are included in this agreement.	Yes	Yes	
Plumbing Shrouds	Contractor / Contractor				
Security Cameras, Video Surveillance	Contractor / Contractor (AlphaCorp/Convergint)	A/E to identify locations on drawings, coordinate with Owner.	Yes		
Voice/Data Cabling (all horizontal cabling)	Contractor / Contractor (Cache Valley Elec., IES Commercial, Data Tech Professionals, Hunt Electric, and others listed in Intermountain Div. 27)	Refer to Division 27 in the Intermountain Design Guidelines and Construction Standards. Coordinate with Owner/User on connections, pairs of fiber/copper, conduits, inner-ducts, etc.	Yes		
Support Bracing/Structure for Radiology and similar equipment	Contractor / Contractor	A/E to coordinate with Owner and Owner's selected Radiology equipment Vendor; A/E to coordinate the design of the support bracing/structure into drawings. Final site specific equipment drawings from Vendor to be coordinated with Construction Documents. Contractor to coordinate with Owner for install of support structure.	Yes	Yes	Yes
Wall Protection (Incl. Bumper and Corner Guards)	Contractor / Contractor	A/E to identify locations on drawings, coordinate with Owner.			
Intrusion Detection	Contractor / Contractor	A/E to identify locations on drawings, coordinate with Owner.			
Access Control, Card Readers (Lenel)	Contractor / Contractor (AlphaCorp/Convergint)	A/E to identify locations on drawings, coordinate with Owner.			
Communication Cabling	Contractor / Contractor	A/E to identify locations on drawings, coordinate with Owner.			
TV System Distribution	Contractor / Contractor	A/E to identify locations on drawings, coordinate with Owner.			
Audio/Video (AV)	Contractor / Contractor	Intermountain SCO will source & supply the A/V system including specialized cabling (e.g. HDMI, etc). A/E to identify locations on drawings, coordinate with Owner. Contractor to provide infrastructure, back boxes, conduits, pathways and misc. cabling (from wall side back).	Yes	Yes	
Nurse Notification Call (NNC) System - Low Voltage Cabling (Hospital Campus)	Contractor / Contractor (Hillrom)	A/E to coordinate with Owner and Hillrom for all NNC infrastructure required to support the device locations and types designated by Hillrom on their site specific drawings. Hillrom site specific drawings to be coordinated and included in the A/E Contract Documents. Contractor to provide all infrastructure including conduits, back boxes, cabling (e.g. home-runs to RCB, RCB to device, device to device, etc.), etc. for all NNC devices (e.g. RCB, GSR-10, etc.). The cabling for the NNC system will be coordinated and installed by the Contractor/Subcontractor (i.e. low voltage sub). Contractor to coordinate with Hillrom.	Yes	Yes	
Staff Assist Notification Call System - Low Voltage Cabling (Medical Group Clinics on hospital campuses to match NNC system)	Contractor / Contractor (Hillrom)	A/E to coordinate with Owner and Hillrom for all Staff Assist Notification Call system infrastructure required to support the device locations and types designated by Hillrom on their site specific drawings. Hillrom site specific drawings to be coordinated and included in the A/E Contract Documents. Contractor to provide all infrastructure including conduits, back boxes, cabling (e.g. home-runs to RCB, RCB to device, device to device, etc.), etc. for all NNC and Staff Assist Notification Call devices (e.g. RCB, GSR-10, etc.). The cabling for the NNC and Staff Assist Notification Call system will be coordinated and installed by the Contractor/Subcontractor (i.e. low voltage sub). Contractor to coordinate with Hillrom.	Yes	Yes	
Staff Assist Notification Call System - Low Voltage Cabling (Stand-alone Medical Group Clinics)	Contractor / Contractor (Hillrom)	A/E to coordinate with Owner and Hillrom for all Staff Assist Notification Call system infrastructure required to support the device locations and types designated by Hillrom on their site specific drawings. Hillrom site specific drawings to be coordinated and included in the A/E Contract Documents. Contractor to provide all infrastructure including conduits, back boxes, cabling (e.g. home-runs to RCB, RCB to device, device to device, etc.), etc. for all Staff Assist Notification Call devices (e.g. RCB, GSR-10, etc.). The cabling for the Staff Assist Notification Call system will be coordinated and installed by the Contractor/Subcontractor (i.e. low voltage sub). Contractor to coordinate with Hillrom.	Yes	Yes	
Patient Monitoring System & Devices (Hospital Campus)	Contractor / Contractor	A/E to identify locations on drawings, coordinate with Owner. Contractor to provide all infrastructure including conduits, back boxes, and home-run cabling from Patient Monitoring devices to TEC/DR rooms that connect to Intermountain's network (Intermountain Siemon certified installer low voltage subcontractor to install). The Patient Monitoring system device to device cabling is by Vendor.	Yes	Yes	

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INTERMOUNTAIN HEALTHCARE
GENERAL CONDITIONS

January 2016

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ARTICLE 1 GENERAL PROVISIONS

1.1 BASIC DEFINITIONS

A/E. “A/E” means the person lawfully licensed to practice architecture or engineering or an entity lawfully practicing architecture or engineering identified as such in the A/E’s Agreement and is referred to throughout the Contract Documents as if singular in number. The term “A/E” also means the A/E’s representative and its subconsultants. When these General Conditions are part of a Contract in which the design professional is an interior designer, landscape subconsultant or other design professional, the term “A/E” as used in these General Conditions shall be deemed to refer to such design professional. A license is not required when the type of design professional is one which is not subject to a professional license, but such professional must meet the prevailing standards in the State of Utah for such practice. For projects where there is no A/E hired by Intermountain, the references in the General Conditions to A/E shall be deemed to refer to Intermountain as may be practicably applied.

A/E’s AGREEMENT. “A/E’s Agreement” means, unless the context requires otherwise, the agreement executed by the A/E and Intermountain for the Project.

ADDENDA. “Addenda” means the written or graphic instruments issued prior to the opening of Bids which clarify, correct or change the bidding documents or the Contract Documents.

ASI. “ASI” shall mean a Supplemental Instruction issued by the A/E to the Contractor which may result in clarifications or minor changes in the Work and does not affect the contract time or the contract amount.

BID. “Bid” means the offer of the bidder submitted on the prescribed form setting forth the proposed stipulated sum for the Work to be performed.

BONDS. “Bonds” mean the bid bond, performance and payment bonds and other instruments of security

CHANGE ORDER. “Change Order” means a written instrument signed by Intermountain and Contractor, stating their agreement for changes of the Contract as specified on the required Intermountain change order form.

CLAIM. “Claim” means a dispute, demand, assertion or other matter arising in connection with the Contract or the Project, whether submitted by Intermountain or the Contractor, including a Subcontractor at any tier subject to the provisions of these General Conditions. A requested amendment, requested change order, or a Construction Change Directive (CCD) is not Claim unless agreement cannot be reached and the procedures of these General Conditions are followed.

CM/GC. “CM/GC” means the Construction Manager/General Contractor, whether a person or entity, identified in the CM/GC Agreement, and is referred to throughout the Contract

Documents as if singular in number. The term “CM/GC” means the CM/GC or its authorized representative.

CM/GC AGREEMENT. “CM/GC Agreement” means, if applicable, the agreement executed by the CM/GC and Intermountain for the Project.

CONSTRUCTION CHANGE DIRECTIVE. A “Construction Change Directive” or “CCD” means a written order signed by Intermountain, directing a change in the Work and stating a proposed basis for adjustment, if any, in the Contract Sum or Contract Time, or both. Intermountain 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; even if it may impact the Contract Sum and Contract Time.

CONTRACT. The Contract Documents form the Contract for Construction. The term “Contract” represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the A/E and Contractor, (2) between Intermountain and a Subcontractor or (3) between any persons or entities other than Intermountain and Contractor. The Contract may be amended or modified only by (1) a written amendment executed by both Intermountain and Contractor, or (2) by a Modification.

CONTRACT DOCUMENTS. The term “Contract Documents” means the Contractor’s Agreement between Intermountain and Contractor (hereinafter referred to as “Contractor’s Agreement”), the Conditions of the Contract (General, Supplementary and other Conditions), the Drawings, Specifications, Addenda, other documents listed in the Contractor’s Agreement and Modifications issued after execution of the Contractor’s Agreement. The Contract Documents shall also include the bidding/proposal documents, including the Instructions to Bidders/Proposers, Notice to Contractors, the Bid/Proposal Form, and/or the response to the request for proposal, to the extent not in conflict with the other above-stated Contract Documents and other documents and oral presentations as part of the Selection which are documented as an attachment to the Contract.

CONTRACT SUM. The term “Contract Sum” means the Contract Sum as stated in the Contractor’s Agreement and, including authorized and signed adjustments to this agreement (modifications), is the total amount payable by Intermountain to the Contractor for performance of the Work under the Contract Documents.

CONTRACT TIME. “Contract Time,” unless otherwise provided in the Contract Documents, means the period of time, including authorized and signed adjustments (modifications), stated in the Contract Documents for Substantial Completion of the Work.

CONTRACTOR. The Contractor is the person or entity identified as such in the Contractor’s Agreement or the CM/GC Agreement, as applicable, and is referred to throughout the Contract Documents as if singular in number. The term “Contractor” means the Contractor or the Contractor’s authorized representative. 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 Contractor’s or CM/GC Agreement, as applicable.

CONTRACTOR’S AGREEMENT. “Contractor’s Agreement” means, unless the context requires otherwise, the stipulated sum agreement executed by the Contractor and Intermountain for the Project.

DAY. The term “day” or “days” as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

DEFECTIVE. “Defective” is an adjective which when modifying the word “Work” refers to Work that does not conform to the Contract Documents, or does not meet the requirements of any inspection, referenced standard, code, test or approval referred to in the Contract Documents, or has been damaged.

DIRECTOR. “Director” means Intermountain’s Director of Facility Planning and Development unless the context requires otherwise. Director may include a designee selected by the Director for the particular function referred to in the General Conditions.

DRAWINGS. The “Drawings” are the graphic and pictorial portions of the Contract Documents, wherever located and whenever issued, showing the design, location and dimensions of the Work, and generally include the drawings, elevations, sections, details, schedules and diagrams.

INTERMOUNTAIN. “Intermountain” means IHC Health Services, Inc. operating through its Department of Facility Planning and Development. Unless the context requires otherwise, Intermountain is the “Owner” as that term is commonly referred to in the construction industry.

INTERMOUNTAIN/OWNER’S REPRESENTATIVE. The “Intermountain Representative” or “Owner’s Representative” is the person (also referred to as the “Project Manager”) assigned by the Director to manage the Project and is the sole person authorized to act on behalf of Intermountain under this Agreement.

INSPECTION. The word “inspection” or its derivatives shall mean a review of the Project, including but not limited to a visual review of the Work completed to date to ascertain if the Work is in accordance with the Contract Documents, including all applicable building codes and construction standards.

INVITATION TO BID. “Invitation to Bid” means Intermountain’s solicitation or request to a contractor to provide a Bid.

MODIFICATION. A “Modification” is (1) a Change Order (2) Construction Change Directive or (3) ASI.

NOTICE TO PROCEED. A “Notice to Proceed” is a document prepared by Intermountain and by its terms authorizes the Contractor to commence Work on the Project. It is deemed issued

upon being sent by Intermountain to the Contractor's specified address within the Bid or Proposal.

PARTIAL USE. "Partial Use" means placing a portion of the Work in service for the purpose for which it is intended (or a related purpose) before reaching Substantial Completion for all the Work. This partial use does not constitute "substantial completion."

PRODUCT DATA. "Product Data" means 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.

PROJECT. The "Project" means the total construction of the Work performed under the Contract Documents.

PROJECT MANUAL (FOR CONSTRUCTION). The "Project Manual" is the volume of assembled Specifications for the Work and may include the bidding/proposal requirements, sample forms, General or Supplementary Conditions of the Contract.

PROPOSAL. "Proposal" means the A/E's or CM/GC's response to Intermountain's Request for Proposal.

PROPOSAL REQUEST OR "PR." A "Proposal Request" or "PR" is a proposal request filed with the Contractor for the purposes of seeking a proposal in order to resolve an issue as part of the Change Order or Contract Modification process.

PROPOSED CHANGE ORDER. A "Proposed Change Order" ("PCO"), is an informal request by the Contractor filed with Intermountain Representative, in an effort to commence the Contract Modification Process. It shall not be considered a "Claim." The PCO may be related to any potential, or actual delay, disruption, unforeseen condition or materials or any other matter in which the Contractor intends to seek additional monies or time.

REQUEST FOR INFORMATION or RFI. A "Request for Information" or "RFI" is a request filed by the Contractor with the A/E regarding any request for information, direction or clarification related to the Contract Documents, plans or specifications.

REQUEST FOR PROPOSAL or RFP. "Request for Proposal" or "RFP" means Intermountain's solicitation for A/E or CM/GC Proposals.

SALES TAX and/or USE TAX. Sales Tax and/or Use Tax, unless the context requires otherwise, shall mean the sales tax and/or use tax collected or to be collected by the Utah State Tax Commission and shall include any sales and/or use tax that the Utah State Tax Commission collects on behalf of any special district, local government or political subdivision. Intermountain is a sales-tax exempt entity for materials supplied to the Project and will provide a Utah State Tax Commission Exemption Certificate to the Contractor.

SAMPLES. "Samples" mean physical examples, which illustrate materials, equipment or workmanship and establishes standards by which the Work will be judged.

SHOP DRAWINGS. “Shop Drawings” means 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.

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

SUBCONTRACTOR. “Subcontractor” means the person or entity that has a direct contract with the Contractor, including any trade contractor or specialty contractor, or with another Subcontractor at any tier to provide labor or materials for the work but does not include suppliers who provide only materials, equipment or supplies to a contractor or subcontractor. Notwithstanding the foregoing, the text in which the term is used may provide for the exclusion of Subcontractors of other Subcontractors or the exclusion of suppliers. The term “Subcontractor” is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or authorized representative of the Subcontractor. The Term “Subcontractor” does not include a separate contractor or subcontractors of a separate contractor.

SUBSTANTIAL COMPLETION. Substantial Completion” is the date certified in accordance with Article 9.2 and means the date the Work or designated portion thereof is sufficiently complete, and any lack of completion or performance does not reasonably interfere with Intermountain’s intended use of the Project, in accordance with the Contract Documents so that Intermountain can occupy and use the Work for its intended use.

WORK. The term “Work” means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all labor, materials, equipment and services provided, or to be provided, by the Contractor to fulfill the Contractor’s obligations.

ARTICLE 2 INTERMOUNTAIN

2.1 INFORMATION AND SERVICES REQUIRED OF INTERMOUNTAIN

2.1.1 INTERMOUNTAIN’S REPRESENTATIVE. Intermountain shall designate an Intermountain Representative authorized to act in Intermountain’s behalf with respect to the Project. Intermountain or such authorized representative shall render decisions within a reasonable time pertaining to documents submitted by the A/E and/or Contractor in order to avoid a compensable delay in the orderly and sequential progress of the Project.

2.1.2 SPECIALISTS AND INSPECTORS. Intermountain will provide certified building inspection services in accordance with the adopted Building Codes. This includes ‘routine’ and ‘special’ inspections unless otherwise noted in the A/E Agreement. Intermountain may assign an inspector or specialist to note deviations from, or necessary adjustments to, the Contract Documents or to report deficiencies or defects in the Work. The inspector or specialist’s activities in no way relieve the Contractor of the responsibilities set forth in the Contract Documents.

2.1.3 SURVEYS AND LEGAL DESCRIPTION. Intermountain 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 review this information, including the surveys and any provided geotechnical studies, and compare such information with observable physical conditions and the Contract Documents.

2.1.4 PROMPT INFORMATION AND SERVICES. Upon receipt of a written request from the Contractor, Intermountain shall furnish information or services under Intermountain's control with reasonable promptness to avoid delay in the orderly progress of the Work.

2.1.5 COPIES OF DRAWINGS AND PROJECT MANUALS (FOR CONSTRUCTION). Unless otherwise provided in the Contract Documents, the Contractor will be furnished electronic copies of Drawings and Project Manuals for Contractor's use in connection with the execution of the Work for the Project.

2.1.6 OTHER DUTIES. The foregoing is in addition to other duties and responsibilities of Intermountain enumerated herein and especially those in respect to Article 2.2 (Construction by Intermountain or by Separate Contractors), Article 8 (Payments and Completion) and Article 10 (Insurance and Bonds).

2.2 CONSTRUCTION BY INTERMOUNTAIN OR BY SEPARATE CONTRACTORS

2.2.1 INTERMOUNTAIN'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS.

(1) **IN GENERAL.** Intermountain reserves the right to perform construction or operations related to the Project with Intermountain's own forces, and to award separate contracts in connection with other portions of the Project or other construction or operations on the site under Conditions of the Contract identical or substantially similar to these including those portions related to insurance and waiver or subrogation.

(2) **COORDINATION AND REVISIONS.** Intermountain shall provide for coordination of the activities of Intermountain's own forces and of each separate Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with other separate contractors and Intermountain in reviewing their construction schedules when directed to do so. The Contractor shall make any revisions to the construction schedule and Contract Sum deemed necessary after a joint review and agreement by Intermountain. The construction schedules shall then constitute the schedules to be used by the Contractor, separate contractors and Intermountain until subsequently revised.

2.2.2 MUTUAL RESPONSIBILITY

(1) **CONTRACTOR COORDINATION.** The Contractor shall afford Intermountain and separate contractor(s) a reasonable opportunity for delivery 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.

(2) **REPORTING PROBLEMS TO INTERMOUNTAIN.** If part of the Contractor's Work depends on work by Intermountain or a separate contractor, the Contractor

shall, prior to proceeding with that portion of the Work, promptly report in writing to Intermountain apparent defects in workmanship that would render it unsuitable for proper execution. Failure of the Contractor to make said report shall constitute an acknowledgment that Intermountain's or separate contractors completed or partially completed construction is fit and proper to receive the Contractor's Work, except as to defects in workmanship not then reasonably discoverable.

(3) **COSTS.** Costs caused by delays or by improperly timed activities or defective construction shall be borne by the responsible party in accordance with the procedures and provisions of the Contract Documents.

(4) **CONTRACTOR REMEDIAL WORK.** The Contractor shall promptly remedy damage caused by the Contractor to completed or partially completed Work or to property of Intermountain or separate contractors and subcontractors as provided in Article 6.

ARTICLE 3

A/E

3.1 A/E'S ADMINISTRATION OF THE CONTRACT

3.1.1 IN GENERAL. The A/E assists Intermountain with the administration of the Contract as described in the Contract Documents. The A/E shall have the authority to act on behalf of Intermountain only to the extent provided in the Contract Documents or A/E's Agreement.

3.1.2 SITE VISITS

(1) Site visits or inspections by the A/E, Intermountain or any Intermountain representative shall in no way limit or affect the Contractor's responsibility to comply with all the requirements and the overall design concept of the Contract Documents as well as all applicable laws, statutes, ordinances, resolutions, codes, rules, regulations, orders and decrees.

(2) **WRITTEN REPORT.** The A/E shall promptly submit to Intermountain a written report subsequent to each site visit.

3.1.3 COMMUNICATIONS FACILITATING CONTRACT ADMINISTRATION. Except as authorized by the Intermountain Representative or as otherwise provided in the Contract Documents, including these General Conditions, the A/E and Contractor shall communicate through the Intermountain Representative on issues regarding the timing of the Work, cost of the Work or scope of the Work. Contractor shall comply with communication policies agreed upon at any pre-construction meeting with Intermountain. Communications by and with the A/E sub-consultants shall be through the A/E. Communications by and with Subcontractors shall be through the Contractor. Communications by and with separate contractors shall be through Intermountain.

3.1.4 A/E MAY REJECT WORK, ORDER INSPECTION, TESTS. The A/E shall have the responsibility and authority to reject Work which, based upon the A/E's knowledge or what may be reasonably inferred from the A/E's site observations and review of data, does not conform to the Contract Documents. Whenever the A/E considers it necessary or advisable for implementation of the intent of the Contract Documents, the A/E shall have the responsibility and authority to require additional inspections or testing of the Work in accordance with the

provisions of the Contract Documents, whether or not such Work is fabricated, installed or completed, provided, however, the A/E must obtain Intermountain's prior written approval of any such additional inspections or testing. However, neither this authority of the A/E 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 A/E to the Contractor, Subcontractors, their agents or employees or other persons performing portions of the Work, including separate contractors. If the Contractor disputes the rejection of any Work and the correction thereof shall involve additional cost or time, it shall be Intermountain's option to accept such Work whether it be conforming or nonconforming.

3.1.5 A/E REVIEW CONTRACTOR'S SUBMITTALS

(1) Contractor shall submit shop drawings, product data, and samples and other submittals required by the Contract Documents to the A/E as required by the approved submittal schedule.

(2) The A/E shall review and approve or take other appropriate action upon Contractor's submittals such as Shop Drawings, Product Data and Samples, but only for the purpose of checking for conformance with the information and design concepts expressed in the Contract Documents. A/E action taken on a submittal shall not constitute a Modification of this Agreement.

(3) The A/E's action shall be taken no later than 15 days following A/E's receipt of the submittal, unless agreed to otherwise by Contractor and Intermountain, in order to avoid a delay in the Work of the Contractor or of separate contractors while allowing sufficient time in the A/E's professional judgment to permit adequate review.

(4) 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.

(5) The A/E's review of the Contractor's submittals shall not relieve the Contractor of the obligations under the Contract Documents.

(6) The A/E's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the A/E, of any construction means, methods, techniques, sequences or procedures.

(7) The A/E's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

(8) When professional certification of performance characteristics of materials, systems or equipment is required by the Contract Documents, the A/E shall be entitled to rely upon such certifications to establish that the materials systems or equipment will meet the performance criteria required by the Contract Documents.

3.2 OWNERSHIP AND USE OF A/E'S DRAWINGS, SPECIFICATIONS AND OTHER DOCUMENTS. All Drawings, Specifications and other documents prepared by the A/E are and shall remain the property of Intermountain, and Intermountain shall retain all common law, statutory and other reserved rights with respect thereto. Said documents were

prepared and are intended for use as an integrated set for the Project which is the subject of this Contractor's Agreement. The Contractor shall not modify or use Contract Documents on any other project without the prior written consent of Intermountain and A/E. Any such non-permissive use or modification, by Contractor, the Contractor's Subcontractors at any tier or anyone for whose acts the Contractor is liable, shall be at Contractor's sole risk. Contractor shall hold harmless and indemnify Intermountain from and against any and all claims, actions, suits, costs, damages, loss, expenses and attorney fees arising out of such non-permissive use or modification by the Contractor. The Contractor and Subcontractors are granted a limited license to use and reproduce applicable portions of the Drawings, Specifications and other documents prepared by the A/E appropriate to and for use in the execution of their Work under the Contract Documents. All copies made under this license shall bear the statutory copyright notice, if any, shown on the Drawings, Specifications and other documents prepared by the A/E. Submittals or distributions necessary to meet official regulatory requirements or for other purposes relating to completion of the Project are not to be construed as a publication in derogation of Intermountain's copyright or other reserved rights.

ARTICLE 4 CONTRACTOR

4.1 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

4.1.1 REVIEWING CONTRACT DOCUMENTS, INFORMATION, REPORTING ERRORS, INCONSISTENCIES OR OMISSIONS. The Contractor shall carefully study and compare the Contract Documents with each other and with information furnished by Intermountain pursuant to Article 2.1 hereinabove and shall at once report to Intermountain and A/E errors, inconsistencies or omissions discovered. The Contractor shall not be liable to Intermountain or A/E for damage resulting from errors, inconsistencies or omission in the Contract Documents, unless the Contractor recognized such error, inconsistency or omission or a Contractor of ordinary skill and expertise for the type of Work involved would have readily so recognized such error, inconsistency or omission, and the Contractor failed to report such to Intermountain and A/E. If the Contractor performs any construction activity without such notice to Intermountain and A/E and prior to the resolution of the error, inconsistency or omission, the Contractor shall assume appropriate responsibility for such performance and shall bear an appropriate amount of the attributable costs for correction.

4.1.2 FIELD CONDITIONS. The Contractor shall take field measurements and verify field conditions and shall carefully compare such field measurements and conditions and other information known to the Contractor, or information which a Contractor of ordinary skill and expertise for the type of Work involved would have known, before commencing activities. Errors, inconsistencies or omissions discovered shall be reported to Intermountain and A/E at once. If the Contractor performs any construction activity without such notice to Intermountain and A/E and prior to the resolution of the error, inconsistency or omission, the Contractor shall assume appropriate responsibility for such performance and shall bear an appropriate amount of the attributable costs for correction.

4.1.3 PERFORM IN ACCORDANCE WITH CONTRACT DOCUMENTS AND SUBMITTALS. The Contractor shall perform the Work in accordance with the Contract Documents and submittals approved in accordance with the Contract Documents

4.1.4 PERFORMANCE TO PRODUCE THE COMPLETE SYSTEM AND INTENDED RESULTS. Performance by the Contractor shall be required to the extent consistent with the Contract Documents and reasonably inferable from the Contract Documents as being necessary to allow the system to function within its intended use.

4.1.5 INTENT AND HIERARCHY. The Contract Documents should be read as a whole and wherever possible, the provisions should be construed in order that all provisions are operable. 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 complimentary, and what is required by one Document or provisions thereof shall be as binding as if required by all the Documents or provisions thereof. In case of an irreconcilable conflict between provisions within a Contract Document or between Contract Documents, the following priorities shall govern as listed below:

(1) A particular Modification shall govern over all Contract Document provisions or Modifications issued prior to said particular Modification.

(2) Attachments to the Contractor's Agreement resulting from the Selection process including any management plan or documented interview information shall govern over addenda, the General Conditions, plans and specifications.

(3) A particular Addendum shall govern over all other Contract Document provisions issued prior to said particular Addendum. Subsequent Addenda shall govern over all prior Addenda.

(4) The Supplementary General Conditions shall govern over the General Conditions.

(5) These General Conditions shall govern over all other Contract Documents except for the Supplementary General Conditions, Addenda, Modifications and Attachments resulting from the selection process.

(6) The drawings and specifications shall not govern over any of the documents listed above.

(7) In case of a conflict or ambiguity within the same level of hierarchy of described documents, Intermountain reserves the right to select the most stringent requirement unless the preponderance of the contract indicates the less stringent requirement.

4.1.6 DIVIDING WORK AND CONTRACTOR REPRESENTATION. 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. Contractor represents that the Subcontractors, Sub-subcontractors, manufacturers and suppliers engaged or to be engaged by it are and will be familiar with the requirements for performance by them of their obligations.

4.1.7 PLANNING AND PRIORITY. The Contractor shall plan and schedule its work to facilitate the Project and shall maintain a work schedule to place proper priority to sequence work to complete the project timely.

4.2 SUPERVISION AND CONSTRUCTION PROCEDURES

4.2.1 SUPERVISION AND CONTROL. 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 the construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, except to the extent that the Contract Documents expressly and specifically state otherwise.

4.2.2 RESPONSIBILITY. The Contractor shall be responsible to Intermountain for acts and omissions of the Contractor's employees, Subcontractors, and their agents and employees, and other persons performing portions of the Work under a contract with the Contractor or on behalf of the Contractor.

4.2.3 NOT RELIEVED OF OBLIGATIONS. The Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents either by activities or duties of Intermountain or its agents in Intermountain's administration of the Contract, or by tests, inspections or approvals required or performed by persons other than the Contractor or for those that the Contractor is liable.

4.2.4 INSPECTIONS AND APPROVALS

(1) The Contractor is responsible for requesting inspections for various stages and portions of the Work required under the Contract Documents in a timely manner.

(2) If any of the Work is required to be inspected or approved by the terms of the Contract Documents by any public authority, the Contractor shall timely request such inspection or approval to be performed in accordance with Article 9. Except as provided in Article 9, work shall not proceed without any required inspection and the associated authorization to proceed. Contractor shall promptly notify Intermountain if the inspector fails to appear at the site.

4.3 LABOR AND MATERIALS

4.3.1 PAYMENT BY CONTRACTOR. Except to the extent it is otherwise stated 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, supplies, consumables and services necessary for the proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

4.3.2 DISCIPLINE AND COMPETENCE. The Contractor shall enforce strict discipline and good order among the Contractor's employees, its Subcontractors, agents, representatives and other persons performing under the Contract Documents. The Contractor shall not permit employment of unfit persons or persons not skilled in tasks assigned to them.

4.4 TAXES AND OTHER PAYMENTS TO GOVERNMENT. The Contractor shall pay sales, consumer, use, employment-related and similar taxes related to the Work or portions

thereof provided by the Contractor which are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect, and shall comply with the laws and regulations regarding the payment of Sales and/or Use Tax and any exemptions; provided that, Intermountain is a sales-tax exempt entity for materials supplied to the Project and will provide a Utah State Tax Commission Exemption Certificate to the Contractor.

4.5 PERMITS, FEES, NOTICES, LABOR AND MATERIALS

4.5.1 PERMITS AND FEES. Unless required in the Supplementary General Conditions or an Addendum, it will not be necessary for the Contractor to obtain or pay for local building permits, plan check fees, electrical permits, plumbing permits, connection fees, or impact fees, nor will it be necessary to pay fees for inspections pertaining thereto.

4.5.2 COMPLIANCE WITH PUBLIC AUTHORITIES, NOTICES. The Contractor shall comply with and give notices required by laws, ordinances, resolutions, rules, regulations and lawful orders of public authorities bearing on the performance of the Work.

4.5.3 CORRELATION OF CONTRACT DOCUMENTS AND ENACTMENTS. It is not the Contractor's responsibility to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, resolutions, building codes, and rules and regulations. Notwithstanding this, if the Contractor observes, or if such is readily observable to a Contractor of ordinary skill and expertise for the type of Work involved, that a portion of the Contract Documents is at variance therewith, the Contractor shall promptly notify the A/E and Intermountain in writing, and necessary changes shall be accomplished by appropriate Modification.

4.5.4 FAILURE TO GIVE NOTICE. If the Contractor, or any Subcontractor thereof performs Work without complying with the requirements of this Article 4.5 hereinabove, the Contractor shall assume appropriate responsibility for such Work and shall bear the appropriate amount of the attributable costs.

4.6 SUPERINTENDENT. The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site at all times during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor. Important communications shall be confirmed in writing. Other communications shall be similarly confirmed on written request in each case.

4.7 TIME AND CONTRACTOR'S CONSTRUCTION SCHEDULES

4.7.1 PROGRESS AND COMPLETION

(1) **TIME IS OF THE ESSENCE; COMPLETE WITHIN CONTRACT TIME.** Time is of the essence. By executing the Contractor's Agreement, the Contractor confirms that the Contract Time is adequate to perform the Work. The Contractor shall proceed expeditiously with adequate forces to achieve Substantial Completion within the Contract Time.

(2) **NOTICE TO PROCEED AND INSURANCE.** The Contractor shall not prematurely commence operations on the site or elsewhere prior to the issuance of a Notice to

Proceed by Intermountain or prior to the effective date of insurance required by Article 10 to be furnished by the Contractor, whichever is the latter.

4.7.2 SCHEDULE PREPARATION. The Contractor, promptly after being awarded the Contract, shall prepare and submit for Intermountain's and A/E's review, a reasonably detailed CPM schedule for the Work. The schedule shall indicate the order, sequence, and interdependence of all items known to be necessary to complete the Work including construction, procurement, fabrication, and delivery of materials and equipment, submittals and approvals of samples, shop drawings, procedures, or other documents. Work items of Intermountain, other Contractors, utilities and other third parties that may affect or be affected by the Contractor shall be included. If Intermountain is required, by the Contract Documents, to furnish any materials, equipment, or the like, to be incorporated into the Work by the Contractor, Contractor shall submit, with the first schedule submittal, a letter clearly indicating the dates that such items are required at the Project Site. The critical path should be identified, including the critical paths for interim completion dates and milestones. The CPM schedule shall be developed using Primavera, MS Project, or Suretrack unless otherwise authorized by Intermountain Representative. The Contractor's schedule shall be updated at least once per month and submitted with each pay request. The Contractor shall maintain an original baseline schedule and shall provide Intermountain monthly written reports indicating Contractor's compliance or noncompliance with the original schedule.

4.7.3 INITIAL CONTRACT TIME. Unless otherwise specified in the bidding documents, the initial Contract Time is the time identified in the Contractor's Agreement.

4.7.4 INTERIM COMPLETION DATES AND MILESTONES. The schedule must include contractually specified interim completion dates and milestones. The milestone completion dates indicated are considered essential to the satisfactory performance of this Contract and to the coordination of all Work on the Project. The milestone dates listed are not intended to be a complete listing of all Work under this Contract or of interfaces with other Project Contractors.

4.7.5 SCHEDULE CONTENT REQUIREMENTS. The schedule shall indicate an early completion date for the Project that is no later than the Project's required completion date. The schedule, including all activity duration's shall be given in calendar days. The Schedule shall also indicate all of the following:

- (1) Interfaces with the work of outside contractors (e.g., utilities, power and with any separate Contractor);
- (2) Description of activity including activity number/numbers;
- (3) Estimated duration time for each activity;
- (4) Early start, late start, early finish, late finish date, and predecessor/successors including stop-start relationships with lead and lag time for each activity;
- (5) Float available to each path of activities;
- (6) Actual start date for each activity begun;
- (7) Actual finish date for each activity completed;

(8) The percentage complete of each activity in progress or completed;

(9) Identification of all critical path activities;

(10) The critical path for the Project, with said path of activities being clearly and easily recognizable on the time-scaled network diagram. The path(s) with the least amount of float must be identified. Unless otherwise authorized by Intermountain Representative, no more than 40% of all activities may be identified as critical path items. The relationship between non-critical activities and activities on the critical path shall be clearly shown on the network diagram;

(11) Unless otherwise authorized by Intermountain Representative, all activities on the schedule representing construction on the site may not have duration longer than 14 days. Construction items that require more than 14 days to complete must be broken into identifiable activities on the schedule with durations less than 14 days. The sum of these activities represents the total length required to complete that construction item; and

(12) Additional requirements as specified in the Supplemental General Conditions.

4.7.6 INTERMOUNTAIN'S RIGHT TO TAKE EXCEPTIONS. Intermountain reserves the right to take reasonable exception to activity duration, activity placement, construction logic or time frame for any element of the Work to be scheduled.

4.7.7 FLOAT TIME. Float or slack time is defined as the amount of time between the earliest start date and the latest start date or between the earliest finish date and the latest finish date of a chain of activities on the Schedule. By a proposal request or modification delivered to the Contractor, Intermountain has the right to use the float time for non-critical path activities until the Contractor has reallocated such time on a newly submitted schedule.

4.7.8 INITIAL SCHEDULE SUBMISSION. No progress payments will be approved until the Contractor has submitted a Project detailed CPM schedule for the entire project.

4.7.9 UPDATES. Prior to any approval of a pay request, Intermountain, A/E and Contractor shall review the Contractor's schedule compared to the Work completed. Intermountain approves the amount of Work completed as supported by the schedule of values and as verified by the determination of Work completed. If necessary, the Contractor shall then update and submit to Intermountain the schedule with the pay request; all of which in accordance with Intermountain's approval. All updates shall be provided in electronic and hard copy formats. At each scheduled meeting with Intermountain Representative, the Contractor shall provide a "three week look ahead" with long lead items identified.

4.7.10 SCHEDULE OF SUBMITTALS. The Contractor shall prepare and keep current, for the A/E's and Intermountain's review, a schedule of submittals required under the Contract Documents which is coordinated with the Contractor's construction schedule and allows the A/E a reasonable time to review the submittals. This submittal schedule is to be included as part of the construction schedule. Submittals requiring expedited review must be clearly identified as such in the schedule of submittals.

4.7.11 SCHEDULE RECOVERY. If the Work represented by the critical path falls behind by more than 7 days, the project schedule shall be redone within 14 days showing how

the Contractor shall recover the time. A narrative that addresses the changes in the schedule from the previously submitted schedule shall be submitted along with the schedule in both hard copy (appropriate report formats to be determined by Intermountain Representative) and electronic copy. The Contractor shall comply with the most recent schedules.

4.7.12 SCHEDULE CHANGES AND MODIFICATIONS.

(1) **CONTRACT TIME CHANGE REQUIRES MODIFICATION.** The Contract Time may only be shortened or extended by a written modification fully executed by Intermountain.

(2) **CONTRACTOR CHANGING ACTIVITY DURATIONS.** Should the Contractor, after approval of the complete detailed construction schedule, desire to change his plan of construction, he shall submit his requested revisions to Intermountain and the A/E along with a written statement of the revisions including a description of the sequence and duration changes for rescheduling the work, methods of maintaining adherence to intermediate milestones and the contract completion date and the reasons for the revisions. If the requested changes are acceptable to Intermountain, which acceptance shall not be unreasonably withheld, they will be incorporated into the Schedule in the next reporting period. If after submitting a request for change in the Contract Schedule, Intermountain does not agree with the request, Intermountain will schedule a meeting with the Contractor to discuss the differences.

(3) **CHANGES IN CONTRACT TIME.** The critical path schedule as the term is used in the provisions herein shall be based on the current version of the Contractor's schedule for the Project and accepted by Intermountain just prior to the commencement of the modification, asserted delay, suspension or interruption. If the Contractor believes it is entitled to an extension of Contract Time under the Contract Documents, the Contractor shall submit a PCO in accordance with Article 7.2 to the A/E and Intermountain Representative accompanied by an analysis of the requested time adjustment.

4.7.13 EXCUSABLE DELAY

(1) **IN GENERAL.** If the Contractor is delayed at any time in the progress of the Work on the critical path schedule by an act or neglect of Intermountain or other causes beyond the Contractor's control or by other causes which Intermountain determines may justify delay, then the Contract Time shall be extended by Change Order. The Contractor shall immediately take all steps reasonably possible to lessen the adverse impact of such delay. Notwithstanding the above, to the extent any of the causes for delay were caused by the Contractor, reasonably foreseeable by the Contractor or avoidable by the Contractor, then to such extent the delay shall not be cause for extension of the Contract Time. For purposes of this paragraph, Contractors shall include all subcontractors and others under the responsibility of the Contractor.

The determination of the total number of days' extension will be based upon the current construction schedule in effect at the inception of the change and/or delay and upon all data relevant to the extension as it exists in the project record. Once approved, such data shall be incorporated in the next monthly update of the schedule.

Contractor acknowledges and agrees that delays in work items which, according to the schedule analysis, do not affect any milestone dates or the Contract completion dates shown on the CPM at the time of the delay, will not be the basis for a contract extension.

(2) **WEATHER-RELATED EXCUSABLE DELAYS.** Completion time will not be extended for normal bad weather or any weather that is reasonably foreseeable at the time of entering into the contract. The time for completion as stated in the contract documents includes due allowance for calendar days on which Work cannot be performed out of doors. The Contractor acknowledges that it may lose days due to weather conditions. Contract time may be extended at no cost to Intermountain if all of the following are met which must be established by the Contractor:

- (a) That the weather prevented Work from occurring that is on the critical path for the project based upon a critical path schedule previously submitted to Intermountain and to the extent accepted by Intermountain;
- (b) There are no concurrent delays attributed to the Contractor;
- (c) The Contractor took all reasonable steps to alleviate the impact of the weather and took reasonable attempts to prevent the delay and despite such reasonable actions of Contractor, the weather impacted the critical path as described above; and
- (d) One of the following occurred:
 - 1. The weather was catastrophic, such as a tornado, hurricane, severe wind storm, severe hail storm; or
 - 2. Based on the full history of information published from the closest station as indicated from the Western Regional Climate Center (Desert Research Institute 2215 Raggio Parkway Reno, Nevada 89512, and as may be described on the website at <http://www.wrcc.dri.edu/summary/>), one or more of the following occurred:
 - a. For any day between November 1 and March 31, the minimum temperature fell below the average minimum temperature plus the extreme low temperature recorded for the month divided by 2.
 - b. For any day between November 1 and March 31, the maximum temperature fell below the monthly average for the minimum temperature.
 - c. The daily precipitation exceeded 75% of the historical one day maximum for the month.
 - d. The snowfall for the month exceeded 175% of the historical average snow fall for the month.

4.7.14 COMPENSABLE DELAY, SUSPENSION OR INTERRUPTION

(1) **BASIC CONDITIONS.** In addition to the other requirements of the Contract Documents, a compensable delay, suspension or interruption of the work occurs only when the following are met:

(a) Is wholly unanticipated by the parties at the time of execution of the Contractor's Agreement or is caused by the breach of a fundamental obligation of the Contract Documents attributable to Intermountain; and

(b) The Contractor delivers a written notice to A/E and Intermountain within seven (7) days that the Contractor knows or should have known of the condition giving rise to the purported compensable delay, disruption, suspension or interruption, and said continuation affects the Contract Time as indicated by the last submitted and reasonable critical path schedule.

(2) **COMPENSABLE DELAY FORMULA.** To the extent of the compensable delay, the Contractor's total entitlement for all compensable delay damages is the computed result of the following formula: Contract Sum divided by Contract Time (in calendar days); the result of which is then multiplied by 0.05; and the result of which is multiplied by the number of calendar days of compensable days allowed under these General Conditions that are beyond the Contract Time. Notwithstanding any other provision of these General Conditions or the Contract Documents, to the extent the Contractor is entitled to receive the 10% or 15% markup under Article 7.4, this provision shall be inapplicable and the markup shall be deemed to include all the compensable delay damages provided by this paragraph.

(3) **PERIOD OF COMPENSABLE DELAY, SUSPENSION OR INTERRUPTION.** The length and extent of compensable delay, shall be determined, with the use of the Project's critical path schedule, by ascertaining the number of additional days to the Contract Time that are needed in order to perform the Work in accordance with the Contract Documents as a result of the continuation of the aforesaid delay, disruption, suspension or interruption after receipt of the written notice received by the A/E and Intermountain under Section 4.7.14(1)(b) above.

(4) **CONCURRENT DELAY.** Notwithstanding any other provision of these General Conditions, to the extent a non-compensable delay occurs at the same time as a compensable delay, Intermountain shall not be responsible for any compensation for the period of the non-compensable delay.

4.7.15 TIME EXTENSION REQUEST. Any time extension shall be requested within 21 days after the Contractor knew or should have known about the delay and shall be supported by the critical path schedule analysis.

4.7.16 LIQUIDATED DAMAGES

(1) **IN GENERAL.** Should the Contractor fail to complete the Work within the Contract Time, there shall be deducted from any amount due or that may become due the Contractor, the sum, if any, stated in the Contractor's Agreement. Such sum is fixed and agreed upon by Intermountain and Contractor as liquidated damages due Intermountain by reason of the inconvenience and added costs of administration, engineering, supervision and other costs resulting from the Contractor's default, and not as a penalty. Actual damages related to delay cannot be ascertained at the time of execution of the Contract. To the extent that the liquidated

damages exceed any amounts that would otherwise be due the Contractor, the Contractor shall be liable for such excess to Intermountain. Intermountain may seek enforcement of such obligation by legal action, and if such is necessary, shall recover the related costs and attorney fees. Notwithstanding any other provision of these General Conditions, the availability of liquidated damages to Intermountain shall not limit Intermountain's right to seek damages or other remedies available under law or equity to the extent such damages or remedies are not based upon delay.

(2) **NO WAIVER OF INTERMOUNTAIN'S RIGHTS.** Permitting the Contractor to continue any part of the Work after the time fixed for completion or beyond any authorized extension thereof, shall in no way operate as a waiver or estoppel on the part of Intermountain of any of its rights under the Contract Documents, including the right to liquidated damages or any other remedies or compensation.

4.8 DOCUMENTS AND SAMPLES AT THE SITE, CERTIFYING "AS-BUILTS". The Contractor shall maintain at the site for Intermountain, one record copy of the Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked weekly to record changes and selections made during construction, as well as approved Shop Drawings, Product Data, Samples and similar submittals. These aforesaid items shall be available to the A/E and shall be delivered to the A/E for submittal to Intermountain upon completion of the Work, signed by the Contractor, certifying that they show complete and exact "as-built" conditions, stating sizes, kind of materials, vital piping, conduit locations and similar matters. All notes of encountered or changed conditions shall be included.

4.9 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

4.9.1 NOT CONTRACT DOCUMENTS. Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents. The submittal shall demonstrate, for those portions of the Work for which the submittal is required, the way the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents.

4.9.2 PROMPTNESS. The Contractor shall review, approve and submit to the A/E, Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents with reasonable promptness and in such sequence as to cause no delay in the Work, or the activities of Intermountain or separate contractors.

4.9.3 NOT PERFORM UNTIL A/E APPROVES. The Contractor shall perform no portion of the Work requiring submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been approved in writing by the A/E. Such Work shall be in accordance with the approved submittals.

4.9.4 REPRESENTATIONS BY CONTRACTOR. By approving and submitting Shop Drawings, Product Data, Samples and similar submittals, the Contractor represents that the Contractor has determined and verified materials, field measurements and field construction criteria related thereto, and has checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

4.9.5 CONTRACTOR'S LIABILITY. The Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the A/E's approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor

has specifically informed the A/E in writing of such deviation at the time of the submittal and the A/E has given written approval to the specific deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the A/E's review and comment.

4.9.6 DIRECT SPECIFIC ATTENTION TO REVISIONS. The Contractor shall direct specific attention in writing to all revisions on resubmitted Shop Drawings, Product Data, Samples or similar submittals, except those requested by the A/E and indicated on previous submittals.

4.9.7 INFORMATIONAL SUBMITTALS. Informational submittals upon which the A/E is not expected to take responsive action may be so identified in the Contract Documents.

4.9.8 RELIANCE ON PROFESSIONAL CERTIFICATION. When professional certification of performance criteria of materials, systems or equipment is required by the Contract Documents, Intermountain and A/E shall be entitled to rely upon the accuracy and completeness of such calculations and certifications. If a professional stamp is required, the professional shall be licensed in the State of Utah unless otherwise approved by Intermountain in writing. Likewise, the Contractor is entitled to rely upon the accuracy and completeness of the calculations made by the A/E in developing the Contract Documents, unless a Contractor of ordinary skill and expertise for the type of Work involved would know that such is inaccurate or incomplete and therefore must immediately notify Intermountain in writing.

4.10 USE OF SITE

4.10.1 IN GENERAL. The Contractor shall confine operations at the site to areas permitted by the Contract Documents, law, ordinances, resolutions, rules and regulations, and permits and shall not unreasonably encumber the site with materials or equipment. Contractor shall take all reasonable means to secure the site, protect the site and protect the Work from any damage. The site shall be left free and clear of refuse, equipment, materials, etc. and the site shall not be subject to spilled liquids and chemicals, toxic or otherwise. Should such an incident occur while the Contractor has control of the site, the Contractor shall be responsible to clean the site and pay all associated costs, fines and penalties. Notwithstanding this, Contractor is not responsible for any damage to the site or the Work to the extent caused by Intermountain or Intermountain's agents.

4.10.2 ACCESS TO NEIGHBORING PROPERTIES. The Contractor shall not, except as provided in the Contract Documents or with Intermountain's advance written consent when necessary to perform the Work, interfere with access to properties neighboring the Project site by the owners of such properties and their respective tenants, agents, invitees and guests.

4.11 ACCESS TO WORK. The Contractor shall provide Intermountain and A/E access to the Work in preparation and progress, wherever located.

4.12 ROYALTIES AND PATENTS. The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of patent rights and shall hold Intermountain and A/E harmless from loss on account thereof, but shall not be responsible for such defense or loss when a particular design, process or product of a particular manufacturer or manufacturers is required by the Contract Documents. However, if the Contractor has reason to believe that the required design, process or product is an infringement of a patent, the Contractor

shall be responsible for such loss unless such information is promptly furnished to Intermountain in writing.

4.13 INDEMNIFICATION

4.13.1 IN GENERAL

(1) To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless Intermountain and its affiliates, subsidiaries, officers, employees, agents, authorized volunteers (hereinafter the above listing of entities and persons is referred to as “**indemnitees**”) from and against every kind and character of claims, damages, losses and expenses, including but not limited to attorneys’ fees, and including those events covered under the blanket Contractual Liability Coverage required under the Contract Documents, arising out of or resulting from any act or omission in the performance of the Work including the work of all the Subcontractors and their employees, provided that any such claim, damage, loss or expense is caused in whole or in part by the negligent or wrongful act or omission of the Contractor, any Subcontractor, and their employees, provided that any such claim, damage loss or expense is caused in whole or in part by the negligent or intentional act or omission of the Contractor, any Subcontractor, or anyone directly or indirectly employed or the agent of any of them or anyone for whose acts any of them may be liable, regardless of whether or not it is caused in part by a party indemnified hereunder. The Contractor shall defend all actions brought upon such matters to be indemnified hereunder and pay all costs and expenses incidental thereto, but Intermountain shall have the right, at its option, to participate in the defense of any such action without relieving the Contractor of any obligation hereunder. Notwithstanding any of the above, to the extent the Contractor is complying with a written directive from Intermountain that is not based on the Contractor’s recommendation, the Contractor shall not be held liable under the indemnification provision of this Agreement if the Contractor has promptly disagreed with the written directive by delivering such objection to Intermountain in writing.

(2) Such obligation shall not be construed to negate, abridge, or otherwise reduce any other right or obligation of indemnity which would otherwise exist as to any party or person under Contract Documents.

(3) In claims against any person or entity indemnified under this Article 4.13 by an employee of the Contractor, Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under this Article 34.13 shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or Subcontractor under workers’ or workmen’s compensation acts, disability benefits acts or other employee benefit acts.

(4) Intermountain and Contractor waive all rights against each other for damages to the Work during construction to the extent covered by the applicable Builder’s Risk Policy, except such rights as they may have to the proceeds of such insurance as set forth in these General Conditions. Contractor shall require similar waivers from its Subcontractors, Subconsultants, and agents at any tier.

ARTICLE 5 SUBCONTRACTORS

5.1 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK

5.1.1 APPROVAL REQUIRED

(1) Listing of Subcontractors shall be as stated in the Contract Documents, including but not limited to the “Intermountain Subcontractors List Form”.

(2) The Contractor shall not contract with a proposed person or entity to whom Intermountain has made a reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

5.1.2 BUSINESS AND LICENSING REQUIREMENTS. All Subcontractors used by the Contractor shall comply with all applicable business and licensing requirements.

5.1.3 SUBSEQUENT CHANGES. After the bid opening, the Contractor may change its listed Subcontractors only in accordance with the Contract Documents and with written approval of the Director.

(1) Intermountain will pay the additional costs for an Intermountain requested change in subcontractor if all of the following are met:

- (a) If Intermountain in writing requests the change of a subcontractor;
- (b) The original subcontractor is a responsible subcontractor that meets the requirements of the Contract Documents; and
- (c) The original subcontractor did not withdraw as a subcontractor on the project.

(2) In all other circumstances, the Contractor shall pay the additional cost for a change in a subcontractor.

5.1.4 BONDING OF SUBCONTRACTORS. Subcontractors as identified by Intermountain in the procurement documents, may be required to submit performance and payment bonds to cover the full extent of their portion of the Work. This provision does not in any way limit the right of the Contractor to have subcontractors at any tier be required to have a performance and/or payment bond.

5.2 SUBCONTRACTUAL RELATIONS

5.2.1 COMPLY WITH CONTRACT DOCUMENTS. By appropriate enforceable agreement, and to the extent it can be practically applied, the Contractor shall require each Subcontractor to be bound to the Contractor by the terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities which the Contractor, by these Documents, assumes towards Intermountain and A/E.

5.2.2 RIGHTS. Each Subcontractor agreement shall preserve and protect the rights of Intermountain and A/E 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 Subcontractor agreement, the

benefit of all rights and remedies against the Contractor that the Contractor, by the Contract Documents, has against Intermountain.

5.2.3 SUB-SUBCONTRACTORS. The Contractor shall require each Subcontractor to enter into similar agreements with its Subcontractors which complies with the requirements of Paragraphs 5.2.1 and 5.2.2 hereinabove.

5.2.4 DOCUMENT COPIES. The Contractor shall make available to each proposed Subcontractor, prior to execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound. Subcontractors shall similarly make copies of applicable portions of the Contract Documents available to their respective proposed Subcontractors.

5.3 CONTINGENT ASSIGNMENT OF SUBCONTRACTS

5.3.1 CONDITIONS FOR ASSIGNMENT TO INTERMOUNTAIN. Each subcontract agreement for a subcontractor at any tier for a portion of the Work is assigned by the Contractor to Intermountain provided that the assignment is effective only after termination of the Contract by Intermountain for cause pursuant to Article 12.2 or stoppage of the Work by Intermountain pursuant to Article 12.5, and only for those subcontract agreements which Intermountain accepts by notifying the Subcontractor in writing. The subcontract shall be equitably adjusted to meet the new conditions of the work.

ARTICLE 6 PROTECTION OF PERSONS AND PROPERTY

6.1 SAFETY OF PERSONS AND PROPERTY

6.1.1 CONTRACTOR RESPONSIBILITY. The Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Contract. The Contractor shall take all reasonable precautions for the 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 or a 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.

6.1.2 SAFETY PROGRAM, PRECAUTIONS. The Contractor shall institute a safety program at the start of construction to minimize accidents. Said program shall continue to the final completion of the Project and conform to applicable laws and regulations including the Utah Occupational Safety and Health Rules and Regulations as published by the Utah Industrial Commission - UOSH Division. The Contractor shall post signs, erect barriers, and provide those items necessary to implement the safety program. As soon as the Contractor proceeds with the Work, the Contractor shall have all workers and all visitors on the site wear safety hard hats, as

well as all other appropriate safety apparel such as safety glasses and shoes, and obey all safety rules and regulations and statutes. The Contractor shall post a sign in a conspicuous location indicating the necessity of wearing hard hats and the Contractor shall loan such hats to visitors.

6.1.3 COMPLIANCE WITH LAWS. The Contractor shall give notices and comply with applicable laws, ordinances, rules, regulations and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury or loss. In particular, the Contractor shall comply with all applicable provisions of Federal, State and municipal safety laws, rules and regulations as well as building codes to prevent accidents or injury to persons on, about, or adjacent to the premises where the Work is being performed.

6.1.4 ERECT AND MAINTAIN SAFEGUARDS. The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including effective fences, posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent sites and utilities.

6.1.5 UTMOST CARE. 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.

6.1.6 PROMPT REMEDY. 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 Paragraph 6.1.1 of these General Conditions caused in whole or in part by the Contractor, a 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 said Paragraph 6.1.1, except to the extent such damage or loss is directly due to errors in the Contract Documents or caused by agents or employees of the A/E or Intermountain. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under the Contract Documents.

6.1.7 SAFETY DESIGNEE. The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents, damage, injury or loss. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to Intermountain and A/E.

6.1.8 LOAD SAFETY. The Contractor shall not load or permit any part of the construction or site to be loaded so as to endanger its safety.

6.1.9 OFF-SITE RESPONSIBILITY. In addition to its other obligations under this Article 6, the Contractor shall, at its sole cost and expense, promptly repair any damage or disturbance to walls, utilities, streets, ways, sidewalks, curbs and the property of Intermountain and third parties (including municipalities and other governmental agencies) resulting from the performance of the Work, whether by it or by its Subcontractors at any tier. The Contractor shall not cause materials, including soil and debris, to be placed or left on streets or ways.

6.1.10 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. Contractor shall promptly notify Intermountain Representative of the action taken.

6.2 HAZARDOUS MATERIALS. In the event the Contractor encounters on the site material reasonably believed to be asbestos or polychlorinated biphenyl (PCB) or any other hazardous waste or substance which may endanger the health of those persons performing the Work or being on the site, the Contractor shall immediately stop Work in the area affected and immediately report the condition to Intermountain Representative and A/E by phone with a follow-up document in writing. The Work in the affected area shall be resumed when written direction is provided by Intermountain Representative. Except to the extent provided otherwise in the Contract Documents or if the presence of hazardous materials is due to the fault of the Contractor, the Contractor shall not be required to perform without the Contractor's consent, any Work relating to asbestos, polychlorinated biphenyl (PCB) or any other hazardous waste or substance. Intermountain shall procure a licensed abatement contractor qualified to remove the hazardous material. The abatement contractor shall submit notification of demolition to the Utah Division of Air Quality. Abatement contractor shall pay the notification fee. A copy of the hazardous material survey report shall be available to all persons who have access to the construction site.

6.3 HISTORICAL AND ARCHEOLOGICAL CONSIDERATIONS. In the event the Contractor knows or should have known of any cultural, historical or archeological material that is either recognized as an item to be protected under Federal, State, or local law or regulation, or is an item of obvious value to Intermountain, the Contractor shall cease any work that would interfere with such discovery and immediately report the condition to the Intermountain Representative and A/E by phone with a follow-up document in writing. Work shall resume based upon the direction of Intermountain Representative. Contractor cooperation with any Intermountain recognized archaeologist or other cultural/historical expert is required.

6.4 CONTRACTOR LIABILITY. If the Contractor fails in any of its obligations in Articles 6.1 through 6.3 above, the Contractor shall be liable to any damages to Intermountain or any third party resulting from such noncompliance. The Contractor shall also be liable for any mitigation or restoration effort resulting from such noncompliance. To the extent all the following is met, the Contractor may treat the discovery of such material similarly to an unforeseen condition:

6.4.1 The discovery of such material is reasonably unforeseeable given the site conditions that the Contractor should have been aware;

6.4.2 The presence of such material was not identified in any part of the Contract Documents;

6.4.3 The Contractor has undertaken all proper action to mitigate any impact of such discovery on the critical path or monies related to the Project;

6.4.4 The discovery affects the critical path or contract price from that which was contemplated by the Contract Documents; and

6.4.5 The requirements of 7.1.5 and the Contract documents are met.

**ARTICLE 7
MODIFICATIONS, REQUEST FOR INFORMATION,
PROPOSED CHANGE ORDER, AND CLAIMS PROCESS**

7.1 MODIFICATIONS: IN GENERAL

7.1.1 TYPES OF MODIFICATIONS AND LIMITATIONS. Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or ASI, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents. The Contractor must have a written Modification executed by Intermountain under this Article 7 prior to proceeding with any Work sought to be an extra.

7.1.2 BY WHOM ISSUED. A Change Order or Construction Change Directive shall be issued by Intermountain Representative. An ASI is issued by the A/E. The A/E shall prepare Change Orders and Construction Change Directives with specific documentation and data for Intermountain's approval and execution in accordance with the Contract Documents, and may issue ASIs not involving an adjustment in the contract sum or an extension of the Contract Time which are not inconsistent with the intent of the Contract Documents.

7.1.3 CONTRACTOR TO PROCEED UNLESS OTHERWISE STATED. Changes in the Work shall be performed under applicable provisions of the Contract Documents, and the Contractor shall proceed promptly, unless otherwise provided in the Change Order, Construction Change Directive or ASI.

7.1.4 ADJUSTING UNIT PRICES. If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are so changed in a proposed Change Order or Construction Change Directive that application of such unit prices to quantities of Work proposed will cause a substantial inequity to Intermountain or Contractor, the applicable unit prices may be equitably adjusted.

7.1.5 SPECIAL NOTICES REQUIRED IN ORDER TO BE ELIGIBLE FOR ANY CONTRACT MODIFICATION. In order to be eligible for any Modification under this Article 7, the Contractor must have met the following special notice requirements:

(1) **CONCEALED OR UNKNOWN CONDITIONS.** The Contractor must file a written notice with Intermountain Representative within seven (7) calendar days of that the Contractor knew or should have known of a site condition described below or the Contractor shall be deemed to waive any right to file any PCO or Claim for additional monies or time related to such condition:

(a) If the Contractor encounters unknown and reasonably unforeseeable subsurface or otherwise concealed physical conditions, including hazardous or historical/cultural materials under Article 6, which differ materially from those indicated by the Contract Documents or a site inspection; or

(b) If the Contractor encounters unknown physical conditions of an unusual nature which 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.

(2) **INCREASE IN CONTRACT TIME.** If the Contractor encounters a situation in which the Contractor knows or should have known that such situation would cause a delay, disruption, interruption, suspension or the like to the Project, the Contractor must file a

notice with the Intermountain Representative within seven (7) working days of when the Contractor knew or should have known of such circumstance or the Contractor shall be deemed to waive any right to file any PCO or Claim for additional monies or time related to such circumstance. To the extent Intermountain is damaged by the failure of the Contractor to provide such notice after the Contractor knows or should have known of such circumstance, the Contractor shall be liable for damages attributable thereto in addition to any liquidated damages (if applicable).

7.2 CONTRACTOR INITIATED REQUESTS

7.2.1 THE REQUEST FOR INFORMATION, RFI, PROCESS AND TIME TO FILE. The Contractor may file an RFI with the A/E regarding any concern which will assist the Contractor in the proper completion of the Work including, but not limited to issues related to the Contract Documents, plans and specifications. The RFI shall be filed with the A/E in a timely manner so as not to prejudice Intermountain as to the quality, time or money related to the Work.

7.2.2 PROPOSED CHANGE ORDER (“PCO”). Within twenty-one (21) days after the Contractor knows or should have known of a situation or concern where the Contractor is going to request additional monies or time, the Contractor must file a Proposed Change Order (“PCO”) with Intermountain Representative, or the Contractor shall be deemed to waive any right to claim additional monies or time related to such situation or concern. The PCO shall include all available documentation supporting the PCO available to the Contractor at the time of filing and the Contractor shall thereafter diligently pursue the supplementation(s) of such documentation and promptly deliver such supplementation(s) to Intermountain Representative.

(1) **INTERMOUNTAIN REPRESENTATIVE RESPONSE.** One of the following may occur after a PCO is filed with Intermountain Representative:

(a) Intermountain Representative, after considering any input by the A/E, may reach an agreement with the Contractor and issue a Change Order.

(b) Intermountain, after considering any input by the A/E, may issue a Construction Change Directive.

(c) If Intermountain Representative, after considering any input by the A/E, disagrees with the Contractor’s PCO, Intermountain representative may seek additional information or verification from the Contractor, the A/E or other sources, may negotiate with the Contractor, may issue a Change Order upon such later agreement, may retract the PR, or may issue a Construction Change Directive. The A/E must continually work with Intermountain in providing data, documentation and efforts to resolve the issues related to the PR.

7.3 PROPOSAL REQUEST INITIATED BY INTERMOUNTAIN. Intermountain may file a Proposal Request with the Contractor seeking information, data and/or pricing relating to a change in the contract time and or monies owing for particular scope changes or other modifications to the Contract Documents. The PR shall provide a time limit for the Contractor to file a response with the A/E and Intermountain Representative. If a proposal is not timely provided by the Contractor, Intermountain may calculate the Change Order under Article 7.4.2 below. Upon such timely receipt of the proposal, one of the following shall occur:

7.3.1 IF AGREEMENT, CHANGE ORDER ISSUED. Intermountain Representative, after considering any input by the A/E, may reach an agreement with the Contractor and issue a Change Order.

7.3.2 IF DISAGREEMENT. If the Intermountain Representative disagrees with the Contractor's proposal, after considering any input from the A/E, Intermountain representative may seek additional information or verification from the Contractor or other sources, may negotiate with the Contractor, may issue a Change Order upon such later agreement, may retract the PR, or may issue a Construction Change Directive. If a Construction Change Directive is issued which identifies Intermountain representative's position in regard to the subject contract sum and/or time adjustment, the Contractor must initiate the Claim resolution process provided for herein within twenty-one (21) days of the Contractor's receipt of the Construction Change Directive, or the Contractor shall be deemed to waive any such request for additional time or money as a result of the issuance of the Construction Change Directive. Such waiver shall entitle Intermountain to convert the Construction Change Directive into a Change Order, whether or not executed by the Contractor. If the Construction Change Directive leaves open the determination of additional time or money related to the directed change, then the time period for initiating the Claim resolution process shall not accrue until such time as Intermountain has conveyed to the Contractor a position as to the time and money owing as a result of the directed change.

7.4 EVALUATION OF PROPOSAL FOR ISSUING CHANGE ORDERS

7.4.1 ADJUSTING SUM BASED UPON AGREEMENT. If the Change Order provides for an adjustment to the Contract Sum, the adjustment shall be based on the mutual agreement of the Contractor and Intermountain, including any terms mandated by unit price agreements or other terms of the Contract Documents.

7.4.2 INTERMOUNTAIN RESOLUTION OF SUM AND STANDARDS IN THE ABSENCE OF AN AGREEMENT UNDER PARAGRAPH 7.4.1. In the absence of an agreement under Paragraph 7.4.1 above, the adjustment shall be based on an itemized accounting of costs and savings supported by appropriate data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Paragraph shall be limited to the following:

(1) All direct and indirect costs of labor; including workers compensation insurance, social security and other federal and state payroll based taxes, and payroll based fringe benefits paid by Contractor so long as they are reasonable and no higher than that charged to other clients;

(2) Costs of materials, on-site temporary facilities, supplies and equipment (except hand tools) required for or incorporated into the work;

(3) Rental costs of machinery, equipment, tools (except hand tools), and on-site temporary facilities, whether rented from the Contractor or others;

(4) Costs of permits and other fees, sales, use or similar taxes related to the Work;

(5) Additional costs of field supervision and field office personnel directly attributable to the change; and

(6) Overhead and profit by the following liquidated formula which is not a penalty but a reasonable calculation agreed upon at the time of execution of the Contractor's Agreement, and provided by formula herein due to the fact that the actual amount due for said overhead and profit cannot easily be ascertained at the time of such execution. The markups in 7.4.2(6)(a) and (b) below are to cover the Contractor's additional payment and performance bond premiums, insurance premiums not specified under Paragraph 7.4.2(1), home office and on-site overhead and profit. Overhead and profit includes, but is not limited to the Contractor's Project Manager and Cost Estimator. Each request for pricing shall stand on its own and not be combined with other requests for pricing in determining the allowed markup described below. A particular request for pricing shall include all items reasonably related together and determinable at the time of the request. If several unrelated requests for pricing are grouped together in a single Change Order, each request for pricing will be considered separately for purposes of calculating the markup under the following formula:

(a) A markup of 15% shall be applied to the cost of each individual charge up to \$20,000 in cost, but in no case shall the markup be less than \$150;

(b) A markup of 10% shall be applied to the portion of the cost of each individual charge in excess of \$20,000;

(c) Subcontractors at any tier shall be entitled to markup their costs related to a Change Order with the same percentages as specified in Paragraphs 7.4.2(6)(a) and (b) above, except that the minimum markup shall be \$50 for any individual change.

7.4.3 CREDITS. The amount of credit to be allowed by the Contractor to Intermountain for a deletion or change which results in a net decrease in the Contract Sum shall be actual net cost as confirmed to Intermountain based upon corroboration by an appropriate source.

7.5 CONSTRUCTION CHANGE DIRECTIVES

7.5.1 WHEN USED AND CONTRACTOR'S RIGHT TO CHALLENGE. A Construction Change Directive may be issued by Intermountain Representative in the case of a need for the Work to commence. If the Construction Change Directive leaves open the determination of additional time or money related to the directed change, then the Construction Change Directive shall indicate the timeframe(s) in which further information is to be provided to resolve the matter. At any time that Intermountain and the Contractor agree upon the time and money related to a Construction Change Directive, a Change Order shall be executed by the parties. Additionally, the Construction Change Directive may be converted to a Change Order under Paragraph 7.2.2 or Article 7.3 above.

7.5.2 PROCEED WITH WORK AND NOTIFY INTERMOUNTAIN ABOUT ADJUSTMENT METHOD. Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved.

7.5.3 INTERIM PAYMENTS BY INTERMOUNTAIN. Pending the final determination of the total cost of the Construction Change Directive, Intermountain shall pay any undisputed amount to the Contractor.

7.6 A/E'S SUPPLEMENTAL INSTRUCTION (Commonly referred to as an "ASI"). The A/E may at any time that is consistent with maintaining the quality, safety, time, budget and function of the Work, issue to the Contractor a supplemental instruction ("ASI") after approval from Intermountain Representative is obtained. The Contractor must file with Intermountain Representative a PCO under Paragraph 7.2.2 above, within 21 calendar days of the Contractor's receipt of the ASI, or the Contractor shall be deemed to have waived any right to additional time or monies as a result of such ASI.

7.8. RESOLUTION OF CLAIMS.

7.8.1 ESCALATION PROCESS. Each Claim must be submitted to the escalation process and then, if necessary, to judicial action, as described in the following:

(1) The parties involved in the Claim will arrange in-person meetings or telephone conferences at mutually convenient times and places, according to the levels and time schedules set forth below. The parties will use reasonable and good faith efforts in this escalation process to respond promptly and to resolve the Claim.

Levels and Representatives	Allotted Time Period from Notice or from Previous Level
<u>Level 1</u> Contractor: Managing Principal Intermountain: the Director	7 days
<u>Level 2</u> Associate Vice President or higher level executive	10 days

7.8.2 JUDICIAL ACTION. If any Claim cannot be resolved through the escalation process described above, the matter will be resolved through judicial action brought exclusively in the state courts of the State of Utah or in the federal courts of the United States which are located in Salt Lake County, Utah. The parties hereto hereby agree to submit to the jurisdiction and venue of such courts for the purposes hereof.

7.8.3 CONTRACTOR REQUIRED TO CONTINUE PERFORMANCE. Pending the final determination of the Claim, including any judicial review or appeal process, and unless otherwise agreed upon in writing by the Director, the Contractor shall proceed diligently with performance of the Contract and Intermountain shall continue to make payments in accordance with the Contract Documents.

7.9 PAYMENT OF CLAIM

7.9.1 When a standalone component of a Claim has received a final determination, and is no longer subject to review or appeal, that amount shall be paid in accordance with the payment provisions of the Contract Documents or judicial order.

7.9.2 When the entire Claim has received a final determination, and is no longer subject to review or appeal, the full amount shall be paid within fourteen (14) days of the date of the final determination unless the work or services has not been completed, in which case the amount shall be paid in accordance with the payment provisions of the Contract Documents to the point that the work or services is completed.

7.9.3 The final determination date is the earlier of the date upon which the claimant accepted the settlement in writing with an executed customary release document and waived its rights of appeal, or the expiration of the appeal period, with no appeal filed, or the determination made resulting from the final appeal.

7.9.4 Any final determination where the Intermountain is to pay additional monies to the Contractor shall not be delayed by any appeal or request for judicial review by another party brought into the process by Intermountain as being liable to Intermountain.

7.9.5 Notwithstanding any other provision of the Contract Documents, payment of all or part of a Claim is subject to any set-off, claims or counterclaims of Intermountain.

7.9.6 Payment to the Contractor for a Subcontractor issue (Claim) deemed filed by the Contractor, shall be paid by the Contractor to the Subcontractor in accordance with the contract between the Contractor and the Subcontractor.

7.9.7 The execution of a customary release document related to any payment may be required as a condition of making the payment.

7.10 ALLOCATION OF COSTS OF CLAIM RESOLUTION PROCESS

7.10.1 Except for attorneys' fees, and unless otherwise agreed to by the parties to the Claim, the costs of resolving the Claim shall be allocated among the parties on the same proportionate basis as the determination of financial responsibility for the Claim. The costs of resolving the Claim that are subject to allocation include the claimant's filing fee, the costs of any person(s) evaluating the Claim, the costs of making any required record of the process, and any additional testing or inspection procured to investigate and/or evaluate the Claim.

7.10.2 The prevailing Party in any Claim, judicial action or other proceeding is entitled to recover its reasonable attorneys' fees, other fees, and costs incurred in the proceeding, in addition to any other relief to which that Party may be entitled.

7.11 ALTERNATIVE PROCEDURES. To the extent otherwise permitted by law, if all parties to a Claim agree in writing, a protocol for resolving a Claim may be used that differs from the process described in this Article 7.

ARTICLE 8 PAYMENTS AND COMPLETION

8.1 SCHEDULE OF VALUES. With the first Application for Payment, the Contractor shall submit to the A/E and Intermountain Representative a schedule of values allocated to all the various portions of the Work. The Schedule of Values shall be submitted on the form approved and provided by Intermountain. The A/E shall make recommendations to the Intermountain Representative regarding the Schedule of Values including any suggested modifications. When approved, including any approved modifications, by Intermountain Representative, it shall be the basis for future Contractor Applications for Payments. The Contractor shall not be entitled to payment until receipt and acceptance of the Schedule of Values.

8.2 APPLICATIONS FOR PAYMENT

8.2.1 IN GENERAL. The following general requirements shall be met:

(1) The Contractor shall submit to the A/E an itemized Application for Payment for Work completed in accordance with the schedule of values and that reflects retainage as provided for in the Contractor's Agreement. The Application for Payment shall be on a special form approved and provided by Intermountain.

(2) Such application shall be supported by such data substantiating the Contractor's right to payment as Intermountain or A/E may require. Said data may include, but is not limited to, copies of requisitions from Subcontractors.

(3) Such applications may include requests for payment pursuant to approved Change Orders or Construction Change Directives.

(4) Such applications may not include requests for payment for portions of the Work performed by a subcontractor when the Contractor does not intend to pay to a Subcontractor because of a dispute or other reason.

(5) In executing the Application for Payment, the Contractor shall attest that subcontractors involved with prior applications for payment have been paid, unless the Contractor provides a detailed explanation why such payment may not have occurred. Intermountain reserves the right to require the Contractor to submit a payment waiver from one or more subcontractors.

8.2.2 PAYMENT FOR MATERIAL AND EQUIPMENT. 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 Intermountain and A/E, 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 Intermountain to establish Intermountain's title to such materials and equipment or otherwise protect Intermountain's interest, and shall include applicable insurance, storage and transportation to the site for such materials and equipment stored off the site. Intermountain may require copies of invoices or other suitable documentation.

8.2.3 WARRANTY OF TITLE. The Contractor warrants that title to all Work covered by an Application for Payment will pass to Intermountain no later than the time for 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 Intermountain 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, or other persons or entities making a claim by reason of having provided labor, materials and/or equipment relating to the Work.

8.2.4 HOLDBACK BY INTERMOUNTAIN. Notwithstanding anything to the contrary contained in the Contract Documents, Intermountain may, as a result of the Claim resolution process, withhold any payment to the Contractor hereunder if and for so long as the Contractor fails to perform any of its obligations hereunder or otherwise is in default under any of the Contract Documents.

8.3 CERTIFICATES FOR PAYMENT

8.3.1 ISSUED BY A/E. The A/E shall within ten (10) days after receipt of the Contractor's Application for Payment, either issue to Intermountain a Certificate for Payment, with a copy to the Contractor, for such amount as the A/E determines due, or notify the Contractor and Intermountain in writing of the A/E's reasons for withholding certification in whole or in part as provided in Paragraph 8.4.1. If the A/E fails to act within said ten (10) day period, the Contractor may file the Application for Payment directly with Intermountain Representative and Intermountain will thereafter have twenty (20) days from the date of Intermountain's receipt to resolve the amount to be paid and to pay the undisputed amount. The accuracy of the Contractor's Applications for Payment shall be Contractor's responsibility, not A/E's.

8.3.2 A/E'S REPRESENTATIONS. The A/E's issuance of a Certificate for Payment shall constitute a representation to Intermountain that to the best of the A/E's knowledge, information and belief, based upon the A/E's observations at the site, the data comprising the Application for Payment, and what is reasonably inferable from the observations and data, that the Work has progressed to the point indicated in the Application and that the quality of the work is in accordance with the Contract Documents. The foregoing representations are subject to minor deviations from the Contract Documents correctable prior to completion and to specific qualifications expressed by the A/E. The issuance of a Certificate for Payment will further constitute a representation that the Contractor is entitled to payment in the amount certified. However, the issuance of a Certificate for Payment shall not be a representation that the A/E has (a) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work, (b) reviewed construction means, methods, techniques, sequences or procedures, (c) reviewed copies of requisitions received from Subcontractors and material suppliers and other data requested by Intermountain to substantiate the Contractor's right to payment, (d) ascertained how or for what purpose the Contractor used money previously paid on account of Contract Sum, or (e) any duty to make such inquiries.

8.4 DECISIONS TO WITHHOLD CERTIFICATION

8.4.1 WHEN WITHHELD. The A/E may decide not to certify payment and may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect Intermountain, if in the A/E's judgment the representations to Intermountain required in Paragraph 8.3.2 above cannot be made. If the A/E is unable to certify payment in the amount of the Application, the A/E shall notify the Contractor and Intermountain as provided in Paragraph

above. If the Contractor and A/E cannot agree on a revised amount, the A/E shall promptly issue a Certificate for Payment for the amount to which the A/E makes such representations to Intermountain. The A/E may also decide not to certify payment or, because of subsequently discovered evidence or observations, may nullify the whole or part of a Certificate for Payment previously issued, to such extent as may be necessary in the A/E's opinion to protect Intermountain from loss because of:

- (1) Defective Work not remedied;
- (2) Third party claims filed or reasonable evidence indicating probable filing of such claims;
- (3) Failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment;
- (4) Reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- (5) Damage to Intermountain or another contractor;
- (6) Reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- (7) Failure to carry out the Work in accordance with the Contract Documents.

8.4.2 CERTIFICATION ISSUED WHEN REASONS FOR WITHHOLDING REMOVED. When the reasons stated in Paragraph 8.4.1 for withholding certification are removed, certification will be made for such related amounts.

8.4.3 CONTINUE WORK EVEN IF CONTRACTOR DISPUTES A/E'S DETERMINATION. If the Contractor disputes any determination by the A/E or the result of the Claim resolution process with regard to any Certification of Payment, the Contractor nevertheless shall expeditiously continue to prosecute the Work.

8.4.4 INTERMOUNTAIN NOT IN BREACH. Intermountain shall not be deemed to be in breach of this Contract by reason of the withholding of any payment pursuant to any provision of the Contract Documents provided Intermountain's action or such withholding is consistent with the results of the dispute resolution process.

8.5 PROGRESS PAYMENTS

8.5.1 IN GENERAL, INTEREST ON LATE PAYMENTS

(1) Except as provided in Paragraph 8.3.1, Intermountain shall pay any undisputed amount within sixty (60) days of the date that the application for payment was submitted to the A/E. In no event shall Intermountain be required to pay any disputed amount.

(2) Except as otherwise provided by law, if any payment is made more than sixty (60) days after receipt by Intermountain of the applicable invoice (with any required supporting documentation), the late payment shall bear interest from the due date until payment is made at the rate of five percent (5%) per annum.

8.5.2 CONTRACTOR AND SUBCONTRACTOR RESPONSIBILITY. The Contractor shall promptly pay each Subcontractor, upon receipt of payment from Intermountain, out of the amount paid to the Contractor on account of such Subcontractor's portion of the Work, the amount to which said Subcontractor is entitled. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payment to its Subcontractors in a similar manner.

8.5.3 INFORMATION FURNISHED BY A/E OR INTERMOUNTAIN TO SUBCONTRACTOR. The A/E or Intermountain shall, on request, furnish to the Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the A/E and Intermountain on account of portions of the Work done by such Subcontractor.

8.5.4 INTERMOUNTAIN AND A/E NOT LIABLE. Neither Intermountain nor A/E shall have an obligation to pay, monitor or enforce the payment of money to a Subcontractor, except to the extent as may otherwise be required by law.

8.5.5 CERTIFICATE, PAYMENT OR USE NOT ACCEPTANCE OF IMPROPER WORK. A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by Intermountain shall not constitute acceptance of Work that is not in accordance with the Contract Documents.

8.6 PAYMENT UPON SUBSTANTIAL COMPLETION. Upon Substantial Completion of the Work or designated portion thereof and upon application by the Contractor and certification by the A/E, Intermountain shall make payment, reflecting adjustment in retainage, if any, for such Work or portion thereof as provided in the Contract Documents. To the extent allowed by law, Intermountain may retain up to 200% of the fair market value of the work that has not been completed in accordance with the Contract Documents.

8.7 PARTIAL OCCUPANCY OR USE

8.7.1 IN GENERAL. Intermountain 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, and authorized by public authorities having jurisdiction over the Work. Such partial occupancy or use may commence whether or not the portion is Substantially Complete, provided Intermountain 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 the warranties required by the Contract Documents. When the Contractor considers a portion to be substantially complete, the Contractor shall prepare and submit a list to the A/E as previously provided for herein. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. Contractor shall have continuing responsibility to protect the unoccupied portions of the site and the Work during such partial occupancy and shall be responsible for damage except to the extent caused solely by Intermountain during such partial occupancy or use.

The stage of progress of the Work shall be determined by written agreement between Intermountain and Contractor.

8.7.2 INSPECTION. Immediately prior to such partial occupancy or use, Intermountain, Contractor and A/E 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.

8.7.3 NOT CONSTITUTE ACCEPTANCE. Except to the extent it is agreed upon in writing by Intermountain, partial occupancy or use of a portion or portion of the Work shall not constitute acceptance of Work not complying with the requirement of the Contract Documents.

8.8 FINAL PAYMENT

8.8.1 CERTIFICATE FOR PAYMENT. The A/E's final Certificate for Payment shall constitute a further representation that the conditions listed in Paragraph 8.8.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

8.8.2 CONDITIONS FOR FINAL PAYMENT. Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the A/E the following to the extent required by Intermountain Representative:

(1) An affidavit that payrolls, bills for material and equipment, and other indebtedness connected with the Work for which Intermountain's property might be responsible or encumbered (less amounts withheld by Intermountain) have been paid or otherwise satisfied;

(2) A current or additional certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days prior written notice, by certified mail, return receipt requested, has been given to Intermountain;

(3) A written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents;

(4) If requested by surety in a timely manner or by Intermountain, consent of surety, to final payment;

(5) Receipt of Record Drawings, Specifications, Addenda, Change Orders and other Modifications maintained at the site; the warranties, instructions, operation and maintenance manuals, and training videos required to be furnished by the Contract Documents;

(6) Other data establishing payment or satisfaction of obligations, such as receipts, 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 Intermountain. If a Subcontractor refuses to furnish a release or waiver required by Intermountain, Intermountain may require consent of Surety to the final payment. If such liens, claims, security interests or encumbrances remain unsatisfied after payments are made, the Contractor shall refund to Intermountain all money that Intermountain may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees; and

(7) A written statement demonstrating how the Contractor will distribute interest earned on retention to Subcontractors as required by Section 13.8.5, U.C.A.

8.8.3 WAIVER OF CLAIMS: FINAL PAYMENT. The making of final payment shall constitute a waiver of Claims by Intermountain 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 warranties required by the Contract Documents; or
- (4) The one-year guaranty period and any corrected Work.

8.8.4 DELAYS NOT CONTRACTOR'S FAULT. 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, Intermountain shall, upon application by the Contractor and certification by the A/E, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of claims. Unless otherwise stated by Intermountain in writing, the making of final payment shall constitute a waiver of claims by Intermountain as provided in Paragraph 8.8.3 for that portion of that Work fully completed and accepted by Intermountain.

8.8.5 WAIVER BY ACCEPTING FINAL PAYMENT. Acceptance of final payment by the Contractor or a Subcontractor shall constitute a waiver of Claims by that payee except those Claims previously made in writing and identified by that payee as unsettled at the time of final Application for Payment. Such waivers shall be in addition to the waiver described in Paragraph 8.8.3.

ARTICLE 9 TESTS AND INSPECTIONS, SUBSTANTIAL AND FINAL COMPLETION, UNCOVERING, CORRECTION OF WORK, AND GUARANTY PERIOD

9.1 TESTS AND INSPECTIONS

9.1.1 IN GENERAL. Tests, inspections and approvals of portions of the Work required by the Contract Documents or by laws, ordinances, rules, regulations, resolutions or orders of public authorities having jurisdiction shall be made at an appropriate time. Unless otherwise specifically set forth in the Contract Documents or agreed to by Intermountain in writing, Intermountain shall contract for such tests, inspections and approvals with an independent entity, or with the appropriate public authority, and Intermountain shall bear all related costs of tests, inspections and approvals except as provided below. If any of the Work is required to be inspected or approved by the terms of the Contract Documents or by any public authority, the Contractor shall, at least two working days prior to the time of the desired inspection, and following the procedures established by Intermountain, request such inspection or approval to be performed. The Contractor shall give the A/E timely notice of when and where tests and inspections are to be made so that the A/E may observe such procedures.

9.1.2 FAILURE OF AN INSPECTOR TO APPEAR. Work shall not proceed without any required inspection and the associated authorization by Intermountain to proceed unless the following procedures and requirements have been met:

(1) The inspection or approval was requested in a timely manner as provided in Paragraph 9.1.1;

(2) The Contractor received written confirmation from the inspection entity that the inspection was scheduled;

(3) The Contractor has contacted or attempted to contact the inspector to confirm that the inspector is unable to perform the inspection as scheduled;

(4) If the inspector has confirmed that it is unable to perform the inspection as scheduled or if the Contractor is unable to contact the inspector, the contractor shall attempt to contact the Intermountain Representative for instruction; and the Contractor has documented the condition of the work prior to being covered through photos or other means.

9.1.3 NONCONFORMING WORK. If such procedures for testing, inspection or approval under Paragraph 9.1.1 reveal failure of portions of the Work to comply with the requirements established by the Contract Documents, the Contractor shall bear all costs made necessary by such failure including those of repeated procedures and compensation for Intermountain's expenses, including the cost of retesting for verification of compliance if necessary, until Intermountain accepts the Work in question as complying with the requirements of the Contract Documents.

9.1.4 CERTIFICATES. 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 A/E.

9.1.5 A/E OBSERVING. If the A/E is to observe tests, inspections or approvals required by the Contract Documents, the A/E shall do so with reasonable promptness and, where practicable, at the normal place of testing.

9.1.6 PROMPTNESS. Tests, inspections and arrangements for approvals conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

9.2 INSPECTIONS: SUBSTANTIAL AND FINAL

9.2.1 SUBSTANTIAL COMPLETION INSPECTION. Prior to requesting a substantial completion inspection, the Contractor shall prepare a comprehensive initial punchlist, including unresolved items from prior inspections, for review by Intermountain and A/E to determine if the Project is ready for a substantial completion inspection. If Intermountain determines that the initial punchlist indicates that the Project is not substantially complete, the initial punchlist will be returned to the Contractor with written comments. If Intermountain determines that the initial punchlist indicates that the Project may be substantially complete, the A/E shall promptly organize and perform a Substantial Completion inspection in the presence of Intermountain and all appropriate authorities.

(1) If the A/E reasonably determines that the initial punchlist prepared by the Contractor substantially understates the amount of the Work remaining to be completed and the Project is not substantially complete, the A/E shall report this promptly to Intermountain, and upon concurrence of Intermountain, the Contractor will be assessed the costs of the inspection and punchlist preparation incurred by the A/E and Intermountain.

(2) When the Work or designated portion thereof is Substantially Complete, the A/E shall prepare a Certificate of Substantial Completion which shall establish the date of Substantial Completion; shall establish responsibilities of Intermountain and Contractor for security, maintenance, heat, utilities, damage to the work and insurance; and shall fix the time within which the Contractor shall finish all items on the punchlist accompanying the Certificate. The Certificate of Substantial Completion shall require approval by Intermountain Representative. If there is a punchlist, the Contractor shall proceed promptly to complete and correct items on the list. Failure to include an item on the punchlist does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

(3) Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof except to the extent as provided otherwise in the Contract Documents or if such warranty is related to an item where the work is not complete. Such warranty documents shall state the length of the warranty, which must comply with the Contract Documents.

(4) The Certificate of Substantial Completion shall be submitted by the A/E to Intermountain and Contractor for their written acceptance of responsibilities assigned to them in such Certificate.

(5) Except to the extent Intermountain Representative otherwise approves in advance and in writing, the Contractor shall submit the following documents in order to achieve Substantial Completion: written warranties, guarantees, operation and maintenance manuals, and all complete as-built drawings. The Contractor must also provide or obtain any required approvals for occupancy. The Contractor is responsible for the guaranty of all Work, whether performed by it or by its Subcontractors at any tier.

9.2.2 FINAL COMPLETION INSPECTION. Prior to requesting a final inspection, the Contractor shall verify all punchlist items are corrected/completed. Once all punchlist items are corrected/completed the Contractor shall notify Intermountain and request a final inspection. Intermountain shall notify the A/E and perform a final inspection. Two final inspections may be allowed due to required weather changes required to complete some items. When all punchlist items are completed a final pay request will be provided by the Contractor, authorized by the A/E and processed by Intermountain.

9.3 UNCOVERING OF WORK

9.3.1 UNCOVER UNINSPECTED WORK. Except as provided in Paragraph 9.3.3, if a portion of the Work is covered prior to an Inspector's approval to proceed, it must, be uncovered for the Inspector's inspection and be replaced at the Contractor's expense without change in the Contract Time.

9.3.2 OBSERVATION PRIOR TO COVERING. Except as provided in Paragraph 9.3.3, if Intermountain or the A/E has requested in writing to observe conditions prior to any Work being covered or if such observation is specified in the Contract Documents, and the Work is covered without such observation, the Contractor shall be required to uncover and appropriately replace the Work at the Contractor's expense without change in the Contract Time. If the Contractor requests an inspection and Intermountain or A/E, including any inspector of

each, does not appear, the Contractor shall immediately notify Intermountain of such lack of appearance, but shall not cover the Work without such inspection.

9.3.3 WHEN AN INSPECTOR FAILS TO APPEAR OR A/E OR INTERMOUNTAIN DID NOT MAKE PRIOR REQUEST. If Work is performed by the Contractor without an inspection as provided in Paragraph 9.1.2 or if a portion of the Work has been covered which the A/E or Intermountain has not specifically requested to observe prior to its being covered or such observation is not specified by the Contract Documents, the A/E or Intermountain may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement, shall, by appropriate Change Order, be charged to Intermountain. If such Work is not in accordance with the Contract Documents, the Contractor shall pay such costs unless the condition was caused by Intermountain or a separate contractor in which event Intermountain shall be responsible for payment of such costs.

9.4 CORRECTION OF WORK AND GUARANTY PERIOD

9.4.1 CONTRACTOR CORRECT THE WORK. The Contractor shall correct Work rejected by the A/E, Inspector or Intermountain, or failing to conform to the requirements of the Contract Documents, whether observed before or after Substantial Completion and whether or not fabricated, installed or completed. The Contractor shall bear the costs of correcting such rejected Work, including additional testing and inspections and compensation for the A/E's and Inspector's services and expenses made necessary thereby.

9.4.2 GUARANTY AND CORRECTION AFTER SUBSTANTIAL COMPLETION. 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 Paragraph 9.2.1 or by terms of an applicable special warranty or guaranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, including failure to perform for its intended purpose, the Contractor shall correct it promptly after receipt of written notice from Intermountain to do so unless Intermountain has previously given the Contractor a written acceptance of such condition. The period of one year shall be extended with respect to portions of the Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual performance of the Work. This obligation of the Contractor under this Paragraph 9.4.2 shall be operative notwithstanding the acceptance of the Work under the Contract, the final certificate of payment, partial or total occupancy and/or termination of the Contract. Intermountain shall give notice of observed defects with reasonable promptness, however, failure to give such notice shall not relieve the Contractor of its obligation to correct the Work at the cost that the Contractor would have incurred if Intermountain did so report with reasonable promptness. All corrected Work shall be subject to a one-year guaranty period the same in all respects as the original Work, except that such guaranty period shall commence from the time of Substantial Completion of the corrected Work. This guaranty period does not affect Intermountain's right to pursue any available remedies against Contractor.

9.4.3 REMOVAL OF WORK

(1) The Contractor shall promptly remove from the premises all Work that Intermountain and/or the A/E determines as being in nonconformance with the Contract Documents, whether incorporated or not.

(2) The Contractor shall promptly replace and re-execute the Work in accordance with the Contract Documents and without expense to Intermountain.

(3) The Contractor shall bear the expense of correcting destroyed or damaged construction, whether completed or partially completed, of Intermountain or of other contractors destroyed or damaged by such removal or replacement.

(4) If the Contractor does not remove such rejected Work within a reasonable time, fixed by written notice, Intermountain may have the materials removed and stored at the expense of the Contractor.

(5) If the Contractor does not correct the nonconforming Work within a reasonable time, fixed by written notice, Intermountain may correct it in accordance with Paragraph 12.2.2 of these General Conditions.

9.4.4 NOT LIMIT OTHER OBLIGATIONS. Nothing contained in this Article 9.4 shall be construed to establish a period of limitation with respect to other obligations which the Contractor may have under the Contract Documents. Establishment of the time period of one year as described in Paragraph 9.4.2 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.

9.5 ADDITIONAL WARRANTIES

9.5.1 IN GENERAL. In addition to any other provisions of this Article 9, the following warranties shall apply:

(1) The Contractor warrants to Intermountain that materials and equipment furnished under the Contract will be of good quality and new, except to the extent otherwise required or expressly permitted by the Contract Documents.

(2) The Contractor also warrants to Intermountain that the Work will be free from defects not inherent in the quality required or permitted and that the Work will conform to the requirements of the Contract Documents. Work not conforming to said requirements, including substitutions not properly approved and authorized, may be considered defective at Intermountain's option.

9.5.2 EXCLUSION. Unless due to the negligent or intentional act or omission of the Contractor or those under the Contractor's control, or as otherwise stated in the Contract Documents, the Contractor's guaranty excludes remedy for damage or defect caused by abuse, modifications not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear under normal usage.

9.5.3 FURNISH EVIDENCE ON REQUEST. If requested by the A/E or Intermountain, the Contractor shall furnish satisfactory evidence as to the type and quality of materials and equipment.

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

ARTICLE 10 INSURANCE AND BONDS

10.1 LIABILITY INSURANCE. To protect against liability, loss and/or expense arising in connection with the performance of services described under the Contract Documents, the Contractor shall obtain and maintain in force during the entire period of Contract Documents without interruption, as part of the Construction Costs for the Project, the following stated insurance from insurance companies authorized to do business in the State of Utah, in a form and content satisfactory to Intermountain. The Contractor shall require all Subcontractors to have and maintain similarly required policies. All of the following listed insurance coverages shall be provided by the Contractor.

10.1.1 CONTRACTOR'S COMMERCIAL GENERAL LIABILITY INSURANCE. The Contractor shall maintain coverage on an occurrence made basis, annual aggregate policy limit based on the following chart, unless modified by mutual agreement of the parties, including coverage for Premises-Operations, Independent Contractors' Protective, Products-Completed Operations, Contractual Liability, Personal Injury, and Broad-Formed Property Damage (including coverage for Explosion, Collapse, and Underground hazards).

Small Project (\$2,000,000 or less)
Minimum Commercial General Liability Coverage
\$1,000,000 each occurrence,
\$3,000,000 general aggregate
Medium Project (\$2,000,001 to \$10,000,000)
Minimum Commercial General Liability Coverage
\$5,000,000 each occurrence,
\$10,000,000 general aggregate
Large Project (Greater than \$10,000,000)
Minimum Commercial General Liability Coverage
\$10,000,000 each occurrence,
\$20,000,000 general aggregate

For insurance purposes, the size of the Project will be specified in the Contractor's Agreement or CM/GC Agreement, as applicable.

Intermountain reserves the right to require additional coverage from that stated in the chart herein above, at Intermountain's expense for the additional coverage portion only. Intermountain also reserves the right to require project specific insurance, and if such right has been exercised it

shall be indicated in the Contract Documents. Unless project specific insurance is required by Intermountain, the coverage shall be written under a policy with limits applicable to this project only. Products and Completed Operations insurance must be maintained in force for the discovery of claims for the full statute of limitations period under applicable law. The Contractor's policy must also include contractual liability coverage applicable to the indemnity provision of this Agreement for those portions of the indemnity provisions that are insured under the Contractor's policy and in accordance with this Agreement, including the attachments hereto.

The Contractor shall collect and keep on-file evidence that Contractor and each Subcontractor has current certificates of this Commercial General Liability Insurance requirement, and produce them upon request by Owner.

10.1.2 WORKERS' COMPENSATION INSURANCE AND EMPLOYERS' LIABILITY INSURANCE. Worker's Compensation Insurance shall cover full liability under the Worker's Compensation Laws of the jurisdiction in which the Project is located at the statutory limits required by said jurisdiction's laws. The Contractor shall collect and keep on-file evidence that Contractor and each Subcontractor has current Workers Compensation Insurance, as required by State statute, and produce them upon request by Owner.

10.1.3 AUTOMOBILE. Automobile liability insurance for claims arising from the ownership, maintenance, or use of a motor vehicle. The insurance shall cover all owned, non-owned, and hired automobiles used in connection with the work, with the following minimum limits of liability: \$1,000,000 – Combined Single Limit Bodily Injury and Property Damage per Occurrence.

10.1.4 VALUABLE PAPERS AND RECORDS COVERAGE AND ELECTRONIC DATA PROCESSING (DATA AND MEDIA) COVERAGE. The Contractor and all Subcontractors of the Contractor shall provide coverage for the physical loss of or destruction to their work product including drawings, specifications, and electronic data and media.

10.1.5 AIRCRAFT USE. Contractor using its own aircraft, or employing aircraft in connection with the work performed under the Contract Documents shall maintain Aircraft Liability Insurance with a combined single limit of not less than \$1,000,000 per occurrence. Said certificate shall state that the policy required by this paragraph has been endorsed to name Intermountain as an Additional Insured.

10.1.6 POLICY AGGREGATE(S). The Contractor's policy(ies) shall be endorsed to have General Aggregate apply to this Project only.

10.1.7 CERTIFICATES. Before the Contract Documents are executed, the Contractor shall submit certificates in form and substance satisfactory to Intermountain as evidence of the insurance requirements of this Article. Such certificates shall contain provisions that no cancellation, or non-renewal shall become effective except upon thirty (30) days prior written notice by US Mail to Intermountain as evidenced by return receipt, certified mail sent to Intermountain. The Contractor shall notify Intermountain within thirty (30) days of any claim(s) against the Contractor which singly or in the aggregate exceed 20% of the applicable required insured limits and the Contractor shall, if requested by Intermountain, use its best efforts to reinstate the policy within the original limits and at a reasonable cost. Intermountain shall be named as an additional insured party, as primary coverage and not contributing, on all the

insurance policies required by this Article except the professional liability and workers' compensation policies. Intermountain reserves the right to request the Contractor to provide a loss report from its insurance carrier.

10.1.8 MAINTAIN THROUGHOUT CONTRACT DOCUMENTS TERM. The Contractor agrees to maintain all insurance required under the Contract Documents during the required term. If the Contractor fails to furnish and maintain said required insurance, Intermountain may purchase such insurance on behalf of the Contractor, and the Contractor shall pay the cost thereof to Intermountain upon demand and shall furnish to Intermountain any information needed to obtain such insurance.

10.1.9 WAIVERS OF SUBROGATION. All policies required, except Workers Compensation Insurance, shall be endorsed to include waivers of subrogation in favor of Intermountain.

10.1.10 EXCESS COVERAGES. Any type of insurance or any increase of limits of liability not described in the Contract Documents which the Contractor requires for its own protection or on account of any statute, rule or regulation, shall be its own responsibility and at its own expense.

10.1.11 NOT RELIEVE CONTRACTOR OF LIABILITY. The carrying of any insurance required by the Contract Documents shall in no way be interpreted as relieving the Contractor of any other responsibility or liability under the Contract Documents or any applicable law, statute, rule, regulation, or order.

10.1.12 CONTRACTOR COMPLIANCE WITH POLICIES. Contractor shall not violate or knowingly permit to be violated any of the provisions of the policies on insurance required under this Agreement.

10.1.13 DEDUCTIBLE LIABILITY. Any and all deductibles in the above described policies shall be assumed by, for the account of, and at sole risk of Contractor. The allowable deductible for any of the policies required by these General Conditions shall be no more than \$1,000 or 0.1 percent of the Contract Amount, whichever is greater.

10.1.14 ADDITIONAL REQUIREMENTS

(1) Any type of insurance or any increase of limits of liability not described in this Agreement which the Contractor requires for its own protection or on account of any statute, rule or regulation, shall be its own responsibility and at its own expense.

(2) The carrying of any insurance required by this Agreement shall in no way be interpreted as relieving the Contractor or Subcontractors of any other responsibility or liability under this Agreement or any applicable law, statute, rule, regulation or order.

(3) Contractor shall not violate or knowingly permit to be violated any of the provisions of the policies on insurance required under these General Conditions.

10.2 "BUILDER'S RISK" PROPERTY INSURANCE

10.2.1 IN GENERAL. At Intermountain's option, Intermountain may provide, or may require Contractor to provide, "Builder's Risk" property insurance to protect Intermountain, as well as all Contractors and Subcontractors, and include them as insureds, with respect to Work

performed hereunder at Intermountain's own cost and expense, according to the policies and forms currently in force with insurance carriers selected by Intermountain.

10.2.2 DEDUCTIBLE. The above described "Builders Risk" policies shall be subject to a total deductible of \$5,000 per loss occurrence, which shall be assumed by all Contractors or Subcontractors, in proportion to their share of the total amount of an insured loss occurrence.

10.2.3 WAIVER. Contractor, including all Subcontractors, and Intermountain hereby waive all rights against each other for damages caused by perils insured against under the "Builder's Risk" insurance provided by Intermountain and the Contractor each shall require similar waivers from their contractors, subcontractors, sub-consultants and agents, at any tier.

10.2.4 SPECIAL HAZARDS. Intermountain shall bear the risk of loss, delay and/or damage due to earthquake and/or flood and may either insure or self-insure that risk. If the Contractor requests in writing that insurance for other special hazards be included in the "Builder's Risk" policy, Intermountain shall, if possible, include such insurance in the policy and the cost thereof shall be charged to the Contractor by Change Order.

10.3 PERFORMANCE BOND AND PAYMENT BOND. If required by the Contract Documents, the Contractor shall submit and maintain in full force and effect as required by law and the Contract Documents, as part of the Construction Costs for the Project, on forms provided by Intermountain, and include as part of the quoted total all costs involved in securing and furnishing, the bonds listed below, based on the completed cost of the Contract and effective upon execution of the Contract. Said bonds shall be from surety companies which are authorized to do business in the State of Utah, listed in the U. S. Department of Treasury Circular 570, Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies, and acting within the limitation listed therein.

10.3.1 A full 100 percent performance bond covering the faithful execution of the Contract in accordance with the Contract Documents; and

10.3.2 A full 100 percent payment bond covering payment of all obligations arising under the Contract Documents, for the protection of each person supplying labor, service, equipment, or material for the performance of the Work.

10.3.3 Any required insurance required under the U.S. Terrorism Risk Insurance Act of 2002, any similar applicable law, or as such Act may be amended.

10.4 INTERMOUNTAIN SELF-INSURANCE. Intermountain may, at its option, satisfy any insurance requirements applicable to Intermountain through its self-insurance and risk management program.

ARTICLE 11 MISCELLANEOUS PROVISIONS

11.1 A/E'S RESPONSIBILITIES. These General Conditions are not intended to provide an exhaustive or complete list of the A/E's responsibilities. A separate agreement between Intermountain and A/E incorporates these General Conditions by reference and includes additional Design responsibilities.

11.2 SUCCESSORS AND ASSIGNS. Intermountain and Contractor respectively bind themselves, to the other party in respect to covenants, agreements and obligations contained in the Contract Documents. The Contractor shall not assign the Contract without the prior written consent of Intermountain, nor shall the Contractor assign any amount due or to become due as well as any rights under the Contract, without prior written consent of Intermountain.

11.3 WRITTEN NOTICE. Written notice shall be deemed to have been duly served if (a) delivered in person to the individual or a member of the firm or entity or to an officer of the corporation for which it was intended, or (b) delivered at or sent by registered or certified mail, return receipt requested, or (c) deposited for delivery with a nationally recognized overnight courier service, to the last business address known to the party giving notice.

11.4 RIGHTS AND REMEDIES

11.4.1 NOT LIMIT. 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.

11.4.2 NOT WAIVER. Except as expressly provided elsewhere in the Contract Documents, no action or failure to act by Intermountain, A/E or Contractor shall constitute a waiver of a right or duty afforded them under the Contract Documents, nor shall such action or failure to act constitute approval or acquiescence in a breach thereunder, except as any of the above may be specifically agreed to in writing. In no case shall the Contractor or any Subcontractors be entitled to rely upon any waiver of any of these General Conditions unless agreed to in writing by Intermountain.

11.5 COMMENCEMENT OF STATUTORY LIMITATION PERIOD

11.5.1 BEFORE SUBSTANTIAL COMPLETION. Except as provided in 11.5.4 below, as to acts or failures to act occurring prior to the relevant date of Substantial Completion, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than such date of Substantial Completion.

11.5.2 BETWEEN SUBSTANTIAL COMPLETION AND FINAL CERTIFICATION FOR PAYMENT. Except as provided in Paragraph 11.5.4 below, as to acts or failures to act occurring subsequent to the relevant date of Substantial Completion and prior to issuance of the final Certification for Payment, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than the date of issuance of the final Certification for Payment.

11.5.3 AFTER FINAL CERTIFICATION FOR PAYMENT. Except as provided in Paragraph 11.5.4 below, as to acts or failures to act occurring after the relevant date of issuance of the final Certificate for Payment, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than the date of any act or failure to act by the Contractor pursuant to any guaranty provided under Article 9 the date of any correction of the Work or failure to correct the Work by the Contractor under Paragraph 9.4.2, or the date of actual commission of any other act or failure to perform any duty or obligation by the Contractor or Intermountain, whichever occurs last.

11.5.4 EXCEPTION. Notwithstanding any other provision of this Article 11.5 to the contrary, no applicable statute of limitations shall be deemed to have commenced with respect to any portion of the Work which is not in accordance with the requirements of the Contract Documents, which would not be visible or apparent upon conducting a reasonable investigation, and which is not discovered by Intermountain until after the date which, but for this Paragraph 11.5.4, would be the date of commencement of the applicable statute of limitations; the applicable statute of limitations instead shall be deemed to have commenced on the date of such discovery by Intermountain.

11.6 APPLICABLE LAWS. The applicable laws and regulations of the State of Utah, as well as any applicable local laws and regulations not superseded or exempted by State law, shall govern the execution of the Work embodied in the Contract Documents as well as the interpretation of the Contract Documents.

11.7 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 modification or an article is absent from the statement and appears in another is not intended to affect the interpretation of either statement.

11.8 VENUE. In case of any dispute, which may arise under the Contract Documents, the place of venue shall be in the County of Salt Lake, Utah, unless otherwise agreed to by all the parties in writing.

11.9 SEVERABILITY. The invalidity of any part, paragraph, subparagraph, phase, provision or aspect of the Contract documents shall not impair or affect in any manner the validity, enforceability or effect of the remainder of the Contract Documents.

11.10 CONSTRUCTION OF WORDS. Unless otherwise stated in the Contract Documents, words, which have well-known technical or construction industry meanings, shall be construed as having such recognized meanings. Unless the context requires otherwise, all other technical words shall be construed in accordance with the meaning normally established by the particular, applicable profession or industry. All other words, unless the context requires otherwise, shall be construed with an ordinary, plain meaning.

11.11 NO THIRD PARTY RIGHTS. These General Conditions create rights and duties only as between Intermountain and Contractor, and Intermountain and A/E. Nothing contained herein shall be deemed as creating third party beneficiary contract rights or other actionable rights or duties as between Contractor and A/E, or as between Intermountain, Contractor, or A/E on the one hand, and any other person or entity.

ARTICLE 12 TERMINATION OR SUSPENSION OF THE CONTRACT

12.1 TERMINATION BY CONTRACTOR

12.1.1 IN GENERAL. If the Work is stopped for a period of ninety (90) days through no act or fault of the Contractor or a Subcontractor, or their agents or employees or any other persons performing portions of the Work under contract with any of the above, the Contractor, may terminate the Contract in accordance with 12.1.2 herein below for any of the following reasons:

(1) Because Intermountain has persistently failed to fulfill fundamental Intermountain's obligations under the Contract Documents with respect to matters important to the progress of the Work;

(2) Issuance of an order of a court or other public authority having jurisdiction which necessitates such termination, except that where the Contractor has standing, the Contractor must cooperate in efforts to stay and/or appeal such order;

(3) An act of government, such as a declaration of national emergency, making material unavailable; or

(4) Unavoidable casualties or other similar causes as listed in Paragraph 12.2.2(2) herein below.

12.1.2 NOTICE. If one of the reasons for termination in Paragraph 12.1.1 hereinabove exist, the Contractor may, upon ten (10) additional days' written notice to Intermountain and A/E, and such condition giving cause for termination still not cured, terminate the Contract and recover from Intermountain payment for Work executed and for proven loss with respect to materials, equipment, tools, and construction equipment and machinery, including reasonable overhead, profit and damages associated only with work completed prior to the notice of termination.

12.2 TERMINATION BY INTERMOUNTAIN FOR CAUSE

12.2.1 IN GENERAL. Intermountain may terminate the Contract if the Contractor fails to cure any of the following within a period of ten (10) days (or longer if Intermountain so approves in writing) after receipt of notice from Intermountain specifying the cause for termination:

(1) The Contractor persistently or repeatedly refuses or fails to supply enough properly skilled workers or proper materials;

(2) The Contractor fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;

(3) The Contractor persistently disregards laws, ordinances, or rules, regulations, resolutions or orders of a public authority having jurisdiction; or

(4) The Contractor fails to perform the Work within the time specified in the Contract Documents or any authorized extension thereof or the Contractor fails to make progress with the Work as to endanger such compliance;

(5) The Contractor fails to perform the Work or is otherwise in breach of a material provision of the Contract Documents;

(6) The Contractor fails to respond promptly to the financial responsibility inquiry under the Contractor's Agreement;

(7) As permissible by law for a reason to terminate, the Contractor is adjudged bankrupt;

(8) As permissible by law for a reason to terminate, the Contractor should make a general assignment for the benefit to creditors;

(9) As permissible by law for a reason to terminate, the Contractor should have a receiver appointed on account of the Contractor's insolvency; or

(10) The Contractor fails to follow the material safety requirements and precautions either as expressly provided in the Contract Documents or as consistent with the customary practices in the industry.

12.2.2 INTERMOUNTAIN'S RIGHT TO CARRY OUT THE WORK

(1) If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten (10) day period (or longer if approved by Intermountain in writing) after receipt of written notice from Intermountain to cure such default or neglect, Intermountain may without prejudice to other remedies Intermountain may have, correct such deficiencies, including taking over the Work and prosecuting the same to completion, by contract or otherwise, and may take possession of, and utilize in completing the Work, such materials, appliances, and facilities as may be on the site of the Work as well as the site as necessary for its proper completion. In such case, Intermountain shall offset from payments then or thereafter due the Contractor the cost of correcting such deficiencies, including compensation for the A/E, Intermountain's staff and legal counsel's additional services and expenses made necessary by such default, neglect or failure. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to Intermountain. The Contractor shall continue performance of the Contract to the extent not terminated.

(2) Except with respect to defaults of Subcontractors, the Contractor shall not be liable for any excess costs if the failure to perform the Contract arises out of causes beyond the control and without the fault or negligence of the Contractor or anyone for whom the Contractor may be liable. Such causes may include, but are not limited to, acts of God or of the public enemy, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and unusually severe weather; but in every case the failure to perform must be beyond the control and without the fault or negligence of the Contractor or anyone for whom the Contractor may be liable. If the failure to perform is caused by the default of a Subcontractor, and if such default arises out of causes beyond the control of both the Contractor and the Subcontractor, and without the fault or negligence of either of them or anyone for whom either may be liable, the Contractor shall not be liable for any excess costs for failure to perform unless the supplies or services to be furnished by the Subcontractor were obtainable from other sources in sufficient time to permit the Contractor to meet the required delivery or completion schedule.

12.2.3 ITEMS REQUIRED TO BE TRANSFERRED OR DELIVERED.

Intermountain may require the Contractor to transfer title and deliver to Intermountain, in the manner and to the extent directed by Intermountain:

(1) Any completed portion of the Work; and

(2) Any partially completed portion of the Work and any parts, tools, dies, jigs, fixtures, drawings, information, and contract rights (hereinafter called "construction materials") as the Contractor has specifically produced or specifically acquired for the

performance of such part of this Contract as has been terminated; and the Contractor shall, upon direction of Intermountain, protect and preserve property in the possession of the Contractor in which Intermountain has an interest.

12.2.4 PAYMENT. When Intermountain terminates the Contract for one or more of the reasons stated in Paragraph 12.2.1, Intermountain may withhold payment and/or pursue all available remedies.

12.2.5 INTERMOUNTAIN PROTECTION IF LIENABLE. When the subject property is lienable, Intermountain may withhold from amounts otherwise due the Contractor for such completed Work or construction materials such sum as Intermountain determines to be necessary to protect Intermountain against loss because of outstanding liens or claims for former lien holders.

12.2.6 CREDITS AND DEFICITS. If the unpaid balance of the Contract Sum exceeds the full cost of finishing the Work, including compensation for the A/E's services and expenses made necessary thereby, such excess shall be paid to the Contractor. If such cost exceeds the unpaid balance, the Contractor shall pay the difference to Intermountain this obligation for payment shall survive the termination of the Contract.

12.2.7 IF CONTRACTOR FOUND NOT IN DEFAULT OR EXCUSABLE. If, after notice of termination of the Contract under the provisions of this Article, it is determined for any reason that the Contractor was not in default under the provisions of this Article, or that the default was excusable under the provisions of this Article, the rights and obligations of the parties shall be the same as if the notice of termination had been issued pursuant to the termination for convenience provisions.

12.2.8 RIGHTS AND REMEDIES NOT EXCLUSIVE. The rights and remedies of Intermountain provided in this Article 12.2 shall not be exclusive and are in addition to any other rights and remedies provided by law or under this Contract.

12.3 SUSPENSION, DELAY OR INTERRUPTION OF WORK BY INTERMOUNTAIN FOR CONVENIENCE

12.3.1 BY INTERMOUNTAIN IN WRITING. Intermountain may in writing and without cause, order the Contractor to suspend, delay or interrupt the Work in whole or in part for such period of time as Intermountain may determine to be appropriate for the convenience of Intermountain.

12.3.2 ADJUSTMENTS. Any adjustment in Contract Sum and Time shall be in accordance with Articles 3, 4, and 7.

12.4 TERMINATION FOR CONVENIENCE OF INTERMOUNTAIN

12.4.1 IN GENERAL. The performance of Work under this Contract may be terminated by Intermountain in accordance with this Article 12.4 in whole, or from time to time, in part, whenever Intermountain shall determine that such termination is in the best interest of Intermountain or any person for whom Intermountain is acting under this Contract. Any such termination shall be effected by delivery to the Contractor of a notice of termination specifying the extent to which performance of Work under the Contract is terminated, and the date upon which such termination becomes effective.

12.4.2 CONTRACTOR OBLIGATIONS. After receipt of a notice of termination, and except as otherwise directed by Intermountain in writing, the Contractor shall:

(1) Stop work under the Contract on the date and to the extent specified in the notice of termination;

(2) Place no further orders or subcontracts for materials, services or facilities, except as may be necessary for completion of such portion of the Work under the Contract as is not terminated;

(3) Terminate all orders and subcontracts to the extent that they relate to performance of Work terminated by the notice of termination;

(4) Assign to Intermountain in the manner, at the times, and to the extent directed by Intermountain, all of the right, title and interest of the Contractor under the orders and subcontracts so terminated, in which case Intermountain shall have the right, in its discretion, to settle or pay any or all claims arising out of the termination of such orders and subcontracts;

(5) Settle all outstanding liabilities and all claims arising out of such termination of orders and subcontracts, with the approval or ratification of Intermountain, which approval or ratification shall be final for all the purposes of this Article 12.4;

(6) Transfer title and deliver to Intermountain in the manner, at the times, and to the extent, if any, directed by Intermountain:

(a) The fabricated or unfabricated parts, work in process, completed work, supplies, and other material produced as a part of, or acquired in connection with the performance of the Work terminated by the notice of termination; and

(b) The completed or partially completed drawings, information, and other property which, if the Contract had been completed, would have been required to be furnished to Intermountain;

(7) Use best efforts to sell, in the manner, at the times, to the extent, and at the price or prices directed or authorized by Intermountain, any property of the types referred to in Paragraph 12.4.2(6) above; provided, however, that the Contractor:

(a) Shall not be required to extend credit to any purchaser; and

(b) May acquire any such property under the conditions prescribed by and at a price or prices approved by Intermountain; and provided further that the proceeds of any such transfer of or disposition shall be applied in reduction of any payments to be made by Intermountain to the Contractor under this Contract or shall otherwise be credited to the price or cost of the Work covered by this Contract or paid in such other manner as Intermountain may direct;

(8) Complete performance of such part of the Work as shall not have been terminated by the notice of termination; and

(9) Take such action as may be necessary, or as Intermountain may direct, for the protection and preservation of the property related to this Contract which is in the possession of the Contractor in which Intermountain has or may acquire an interest.

12.4.3 AGREED UPON PAYMENT. Subject to the provisions of Paragraph 12.4.3 above, the Contractor and Intermountain may agree upon the amount to be paid to the Contractor by reason of the total or partial termination of Work pursuant to this Article 12.4.

12.4.4 PAYMENT NOT AGREED UPON. In the event of the failure of Contractor and Intermountain to agree, as provided in Paragraph 12.4.4, upon the whole amount to be paid to the Contractor by reason of the termination of Work pursuant to this Article 12.4, Intermountain shall pay to the Contractor the amounts determined by Intermountain as follows, but without duplication of any amounts agreed upon in accordance with Paragraph 12.4.3:

(1) With respect to all Contract Work performed prior to effective date of the notice of termination, the total (without duplication of any items) of:

(a) The cost of such Work including undisputed Claim amounts;

(b) The cost of terminating, settling and paying claims arising out of the termination of Work under subcontracts or orders as provided in Paragraph 12.4.2(5) above, exclusive of the amounts paid or payable on account of supplies or materials delivered or services furnished by Subcontractors prior to the effective date of the notice of termination under this Contract, which amounts shall be included in the cost on account of which payment is made under Paragraph 12.4.4(1)(a) above;

(c) A sum, as overhead and profit on Paragraph 12.4.4(1) (a) above, determined by Intermountain to be fair and reasonable;

(d) The reasonable cost of the preservation and protection of property incurred pursuant to Paragraph 12.4.2(9); and any other reasonable cost incidental to termination of Work under this Contract, including expenses incidental to the determination of the amount due to the Contractor as the result of the termination of Work under this Contract.

(2) The total sum to be paid to the Contractor under Paragraph 12.4.4(1) above shall not exceed the total Contract Sum as reduced by the amount of payments otherwise made and as further reduced by the Contract price of work not terminated. Except for normal spoilage, and except to the extent that Intermountain shall have otherwise expressly assumed the risk of loss in writing, there shall be excluded from the amounts payable to the Contractor under Paragraph 12.4.4(1) above, the fair value of property which is destroyed, lost, stolen, or damaged so as to become undeliverable to Intermountain, or to a buyer pursuant to Paragraph 12.4.2(7).

12.4.5 DEDUCTIONS. In arriving at the amount due the Contractor under this Article 12.4, there shall be deducted:

(1) All unliquidated advance or other payments on account theretofore made to the Contractor, applicable to the terminated portion of this Contract;

(2) Any Claim which Intermountain may have against the Contractor in connection with this Contract; and

(3) The agreed price for, or the proceeds of sale of, any materials, supplies, or other things acquired by the Contractor or sold, pursuant to the provisions of this Article 13.4, and not otherwise recovered by or credited to Intermountain.

12.4.6 PARTIAL PAYMENTS. Intermountain may, from time to time, under such terms and conditions as it may prescribe, make partial payments and payments on account against cost incurred by the Contractor in connection with the terminated portion of this Contract whenever, in the opinion of Intermountain the aggregate of such payments shall be within the amount to which the Contractor will be entitled hereunder. If the total of such payments is in excess of the amount finally agreed or determined to be due under this Article 12.4, such excess shall be payable by the Contractor to Intermountain upon demand, together with interest at a rate of five percent (5%) per annum for the period until the date such excess is repaid to Intermountain; provided, however, that no interest shall be charged with respect to any such excess payment attributable to a reduction in the Contractor's claim by reason of retention or other disposition of termination inventory until ten (10) days after the date of such retention or disposition, or such later date as determined by Intermountain by reason of the circumstances.

12.4.9 PRESERVE AND MAKE AVAILABLE RECORDS. Unless otherwise provided for in this Contract, or by applicable law, the Contractor shall, from the effective date of termination until the expiration of three years after final settlement under this Contract, preserve and make available to Intermountain at all reasonable times at the office of the Contractor, but without direct charge to Intermountain, all books, records, documents and other evidence bearing on the costs and expenses of the Contractor under this Contract and relating to the Work terminated hereunder, or, to the extent approved by Intermountain Representative, photographs, micrographs, or other authentic reproductions thereof.

12.4.10 INTERMOUNTAIN'S RIGHT TO STOP THE WORK. If the Contractor fails to correct Work or fails to carry out Work, as required by the Contract Documents or fails to comply with all required and customary safety precautions; Intermountain, by written order signed personally or by an agent specifically so empowered by Intermountain in writing, may order the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Intermountain to stop the Work shall not give rise to a duty on the part of the Intermountain to exercise this right for the benefit of the Contractor or any other person or entity

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SECTION 00 1000

**INVITATION TO BID
(REFER TO OWNER'S INVITATION TO BID DOCUMENTS INCLUDED IN RFP)**

- PROJECT:** Intermountain Healthcare
USP 797 – Pharmacy Remodel
Cassia Regional Hospital
Burley, Idaho 83318
- LOCATION:** The project is located at:
1501 Hiland Ave.
Burley, Idaho 83318
- OWNER:** **IHC Health Services, Inc.**
- TIME AND PLACE:** The Owner will receive bids on **T.B.D.**: See owner's Invitation to Bid.
IHC Health Services, Inc. (Intermountain Healthcare)
Facility Design and Construction (FD&C)
36 South State Street, 21st Floor
Salt Lake City, Utah 84111-1486
Attention: Shannon Brown (Shannon.M.Brown@imail.org)
- TYPE OF BID:** Bids shall be on a **Stipulated Sum** basis.
- TIME OF COMPLETION:** Bidders shall provide a Date of Substantial Completion on their Bid Form. Consideration will be given to bidders offering earlier times of completion.
- BIDDING DOCUMENTS:** Bidding documents will be available on **T.B.D.**, thru the office of **NJRA Architects, 5272 S. College Drive, Murray, Utah 84123** in accordance with the Instructions to Bidders. Electronic copies of the Contract Documents (PDF's) will be provided to invited Contractors only. Bidding Documents **are not allowed to be posted** in any plan rooms. Any Contractor who violates this, will be disqualified.
- BID SECURITY/BONDS:** Bid Security or Performance and Payment Bonds will not be required for this project.
- LIQUIDATED DAMAGES:** Liquidated Damages will not be assessed for this project.
- RIGHT TO REJECT BIDS:** The **Owner** reserves the right to reject any or all bids, and to waive any irregularities in any bid or in the bidding

END OF SECTION

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SECTION 00 2213**SUPPLEMENTARY INSTRUCTIONS TO BIDDERS**

- A. The Supplementary Instructions to Bidders herein describe, contain changes and additions to Section 00 0100 - AIA A701 Instructions to Bidders (included by reference - copies may be obtained from the Architect's office for the cost of reproduction). Where any part of the Instructions to Bidders is modified by these Supplementary instructions, the unaltered provisions shall remain in effect.

3.1.5 COPIES

Add the following:

The title or cover sheet to the drawings and the index to the Project Manual contains a list of all documents which comprise a full set of bid documents for this project. Any Contractor, Subcontractor, vendor or any other person participating in or bidding on this project shall be responsible for the information contained in any and all sheets of drawings and all sections of the specifications. If any person, party or entity elects to submit bids for any portion, or all, of this project, that person, party or entity shall be responsible for any and all information contained in these drawings and specifications, including, but not limited to, any subsequent addendums or clarifications that may be issued.

3.3 SUBSTITUTIONS

Amend 3.3.2 to read:

No substitution will be considered prior to receipt of Bids unless written request for approval has been received by the Architect at least 7 days prior to the date for receipt of Bids. Such requests...

3.4 ADDENDA

Amend 3.4.3 to read:

No addenda will be issued later than 24 hours prior to the date for receipt of Bids except an addendum may be issued no later than 12 hours prior to the date for receipt of bids for the purpose of cancellation or postponement of receipt of bids. It is the responsibility of the Bidder to disseminate telephone addendum information to sub-bidders.

4.2 BID SECURITY

Delete this article in its entirety. Bid bonds will not be required for this project.

4.3 SUBMISSION OF BIDS

Amend 4.3.4 to read:

Bids shall be hand delivered in sealed envelope or emailed to the Owner at the address noted in the Invitation to Bid. Bids submitted orally, or by telephone or facsimile will not be considered.

5.3 ACCEPTANCE OF BID (AWARD)

Amend 5.3.2 to read:

The Owner shall ... to determine the low bidder on the basis of the sum of the Base Bid or on the basis of the sum of the Base Bid and any combined accepted Alternates. Cost of insurance will not be used as the basis of award.

ARTICLE 7 - PERFORMANCE AND PAYMENT BOND

Delete this Article in its entirety. Bonds will not be required for this Project.

END OF SECTION

SECTION 00 4000

BID FORM

TO: **IHC Health Services, Inc.** (Intermountain Healthcare)
Facility Design and Construction (FD&C)
36 South State Street, 21st Floor
Salt Lake City, Utah 84111-1486

Attention: Shannon Brown
Email: Shannon.M.Brown@imail.org

PROJECT: **Intermountain Healthcare**
USP797 Pharmacy Remodel – Cassia Hospital
1501 Hiland Avenue
Burley, Idaho 83318

NAME OF BIDDER: _____

BIDDER ADDRESS: _____

DATE: _____

The undersigned, in compliance with your Invitation To Bid, having examined the Drawings and Specifications (Contract Documents) and related documents and the site of the proposed work and being familiar with all of the conditions surrounding the construction of the proposed project, including the availability of labor, hereby propose to furnish all labor, materials, services, equipment and appliances required in connection with or incidental to the construction of the above named project in strict conformance with the following specification and drawings:

Instructions to Bidders, General Conditions, Supplemental General Conditions, Specification Divisions as shown and all applicable addenda and Drawings as listed on the drawing cover sheets as prepared by NJRA Architects..

I/We certify, by signing this BID FORM, that I/We have a working relationship with the proposed subcontractors and that Bids we're not solicited from; and/or the received Contract Documents were not listed in any Plan Rooms for distribution to subcontractors broadly.

BASE BID – for the USP797 Pharmacy Remodel – Cassia Hospital for Intermountain Healthcare:

For Work of the Base Bid contract listed above and shown on the Drawings and described in the Project Manual, I/We agree to perform for the sum of:

_____ Dollars (\$_____)
(In the case of discrepancy, written amount shall govern)

ALTERNATES:

Alternate No. 1: Remove all existing Pharmacy workroom millwork as shown in plan, and make necessary repairs to the existing wall where millwork is being removed.

ADD/DELETE _____ Dollars (\$ _____)
(In the case of discrepancy, written amount shall govern)
Required additional calendar days: _____

Alternate No. 2: Provide Scholox EPA 2-part epoxy based moisture mitigation system under new vinyl Pharmacy flooring.

ADD/DELETE _____ Dollars (\$ _____)
(In the case of discrepancy, written amount shall govern)
Required additional calendar days: _____

CONTRACTOR’S PROPOSED CONSTRUCTION TIME PERIOD:

This Bid requires a construction time in **calendar days** from the date of authorization of _____ calendar days. The anticipated date of Substantial Completion is thus _____, 20__.

The above Bid includes _____ winter weather delay days.

ALLOWANCES:

- 1. N/A

ADDENDA:

I/We acknowledge receipt of the following addenda for the above noted project: ___/___/___/___/___

SCHEDULE OF VALUES:

I/We have attached with this Bid Form our Schedule of Values (Section 00 4373) which reflects the above Base Bid. We submit this for Owner review of subcontractors that are being proposed for this Project.

TYPE OF ORGANIZATION:

(Corporation, Partnership, Individual, etc.) _____

SEAL (If a Corporation)

Respectfully Submitted,

Name of Bidder

Authorized Signature

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SECTION 00 4373

SCHEDULE OF VALUES

NAME OF BIDDER: _____

DATE: _____

DIV	TITLE	AMOUNT	\$/SQ. FT	COMMENTS
01	General Conditions	\$ _____	\$ _____	
02	Demolition	\$ _____	\$ _____	
02	Saw cut slab	\$ _____	\$ _____	
03	Concrete	\$ _____	\$ _____	
04	Masonry	\$ _____	\$ _____	
05	Steel	\$ _____	\$ _____	
06	Woods and Plastics	\$ _____	\$ _____	
07	Thermal and Moisture Protection	\$ _____	\$ _____	
08	Openings	\$ _____	\$ _____	
09	Finishes	\$ _____	\$ _____	
10	Specialties	\$ _____	\$ _____	
12	Furnishings	\$ _____	\$ _____	
21	Fire Suppression	\$ _____	\$ _____	
22	Plumbing	\$ _____	\$ _____	
23	HVAC	\$ _____	\$ _____	
26	Electrical	\$ _____	\$ _____	
31	Earthwork	\$ _____	\$ _____	
32	Landscape	\$ _____	\$ _____	
33	Utilities	\$ _____	\$ _____	
	SUBTOTAL	\$ _____	\$ _____	
	OVERHEAD AND PROFIT	\$ _____	\$ _____	

Intermountain Healthcare

Cassia Regional Hospital
Pharmacy Remodel (for USP 797)

TOTAL COST	\$ _____	\$ _____	
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END OF SECTION

SECTION 00 5200

OWNER/CONTRACTOR AGREEMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Intermountain Healthcare's '**CONTRACTOR AGREEMENT**' (**Stipulated Sum**) for Construction between the Owner and General Contractor' where the basis of payment is a STIPULATED SUM, will *presumably* be used on this project. An electronic copy may be obtained from Intermountain Healthcare's Project Manager.

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SECTION 00 6000**BONDS, CERTIFICATES AND OWNER DOCUMENTS****PART 1 - GENERAL****1.1 SUMMARY**

- A. The following documents are incorporated by reference; copies may be obtained from Intermountain Healthcare or the Architect for the cost of reproduction, if necessary. Electronic copies of the Intermountain Healthcare Documents can be obtained by contacting the Intermountain Healthcare Project Manager.
1. Intermountain Healthcare Document – **'Application and Certificate for Payment'**
 2. Intermountain Healthcare Document – **'Application and Certificate for Payment – Continuation Sheet'**
 3. Intermountain Healthcare Document – **'Change Order' (CO)**
 4. Intermountain Healthcare Document – **'Proposed Change Order' (PCO)**
 5. Intermountain Healthcare Document – **'A/E Supplement Instructions' (ASI)**
 6. Intermountain Healthcare Document – **'Proposal Request' (PR)**
 7. Intermountain Healthcare Document – **'Construction Change Directive' (CCD)**
 8. Intermountain Healthcare Document – **'Request For Information' (RFI)**
 9. AIA Document G704 – **'Certificate of Substantial Completion'**
 10. AIA Document G707 – **'Consent of Surety to Final Payment'** (if required)
 11. AIA Document G707A – **'Consent of Surety to Reduction in or Partial Release of Retainage'** (if required)
 12. AIA Document A312 – **'Payment Bond'** (if required)
 13. AIA Document A312 – **'Performance Bond'** (if required)

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SECTION 00 6276.13
EXEMPTION CERTIFICATE

PART 1 - GENERAL

1.1 SUMMARY

- A. Construction materials purchased by or on behalf of **Intermountain Healthcare** *may be* exempt from Utah sales and use taxes. Tax Exempt **Form TC-721** must be used by vendors when purchasing construction materials for **Intermountain Healthcare** projects. A copy of Form TC-721, with the Owner's pertinent tax information, follows this cover page.



Utah State Tax Commission • 210 N 1950 W • Salt Lake City, UT 84137

Exemption Certificate
(Sales, Use, Tourism and Motor Vehicle Rental Tax)

TC-721
Rev. 11/18

Name of business or institution claiming exemption (purchaser) IHC Health Services, Inc.		Telephone number 801.442.2000	
Street address 36 South State Street, Suite 2200	City Salt Lake City	State UT	ZIP Code 84111
Authorized signature 	Name (please print) Brian Deppe	Title Corporate Tax Director	
Name of Seller or Supplier:		Date	
Sales Tax License Number: 11990296-013-STC		Required for all exemptions marked with an asterisk (*)	

The signer of this certificate MUST check the box showing the basis for which the exemption is being claimed.

DO NOT SEND THIS CERTIFICATE TO THE TAX COMMISSION
Keep it with your records in case of an audit.

For purchases by government, Native American tribes and public schools, use form TC-721G.

Resale or Re-lease

I certify I am a dealer in tangible personal property or services that are for resale or re-lease. If I use or consume any tangible personal property or services I purchase tax free for resale, or if my sales are of food, beverages, dairy products and similar confections dispensed from vending machines (see Rule R865-19S-74), I will report and pay sales tax directly to the Tax Commission on my next sales and use tax return.

Religious or Charitable Institution

I certify the tangible personal property or services purchased will be used or consumed for essential religious or charitable purposes. **This exemption can only be used on purchases totaling \$1,000 or more, unless the sale is pursuant to a contract between the seller and purchaser.**

Construction Materials Purchased for Religious and Charitable Organizations

I certify the construction materials are purchased on behalf of a religious or charitable organization and that they will be installed or converted into real property owned by the religious or charitable organization.
Name of religious or charitable organization: _____

Name of project: _____

Fuels, Gas, Electricity

I certify all natural gas, electricity, coal, coke, and other fuel purchased will be used for industrial use only and not for residential or commercial purposes.

Machinery and Equipment and Normal Operating Repair or Replacement Parts Used in a Manufacturing Facility, Mining Activity, Web Search Portal or Medical Laboratory

I certify the machinery and equipment, normal operating repair or replacement parts, or materials (except office equipment or office supplies) are for use in a Utah manufacturing facility described in SIC Codes 2000-3999 or a NAICS code within NAICS Sector 31-33; in a qualifying scrap recycling operation; in a co-generation facility placed in service on or after May 1, 2006; in the operation of a Web search portal by a new or expanding business described in NAICS Code 518112; in a medical laboratory described in NAICS Code 621511; or in a business described in NAICS 212, Mining (except Oil and Gas), or NAICS 213113, Support Activities for Coal Mining, NAICS 213114, Support Activities for Metal Mining, or NAICS 213115, Support Activities for Nonmetallic Minerals (except Fuels) Mining. For a definition of exempt mining equipment, see Utah Code §59-12-104(14).

Machinery and Equipment and Normal Operating Repair or Replacement Parts Used in an Electronic Payment Service

I certify the machinery and equipment and normal operating repair or replacement parts have an economic life of three years or more and are for use in the operation of an electronic payment service described in NAICS Code 522320.

Machinery or Equipment Used by Payers of Admissions or User Fees

I certify that: (1) the machinery or equipment has an economic life of three or more years and will be used by payers of admissions or user fees (Utah Code §59-12-103(1)(f)); (2) the buyer is in the amusement, gambling or recreation industry (NAICS Subsector 713); and (3) at least 51 percent of the buyer's sales revenue for the previous calendar quarter came from admissions or user fees.

Refinery Machinery, Equipment and Normal Repair or Replacement Parts

I certify the machinery, equipment, normal operating repair parts, catalysts, chemicals, reagents, solutions or supplies are for the use of a refiner who owns, leases, controls or supervises a refinery (see Utah Code §63M-4-701) located in Utah.

Pollution Control Facility

I certify our company has been granted a "Certification of Pollution Control Facilities" as provided for by Utah Code §§19-12-101 - 19-12-305 by either the Air Quality Board or the Water Quality Board. I further certify each item of tangible personal property purchased under this exemption is qualifying.

Municipal Energy

I certify the natural gas or electricity purchased: is for resale; is prohibited from taxation by federal law, the U.S. Constitution, or the Utah Constitution; is for use in compounding or producing taxable energy; is subject to tax under the Motor and Special Fuel Tax Act; is used for a purpose other than as a fuel; is used by an entity exempted by municipal ordinance; or is for use outside a municipality imposing a municipal energy sales and use tax. The normal sales tax exemptions under Utah Code §59-12-104 do not apply to the Municipal Energy Sales and Use Tax.

Short-term Lodging Consumables

I certify the tangible personal property is consumable items purchased by a lodging provider as described in Utah Code §59-12-103(1)(i).

Direct Mail

I certify I will report and pay the sales tax for direct mail purchases on my next Utah *Sales and Use Tax Return*.

Commercial Airlines

I certify the food and beverages purchased are by a commercial airline for in-flight consumption; or, any parts or equipment purchased are for use in aircraft operated by common carriers in interstate or foreign commerce.

Commercials, Films, Audio and Video Tapes

I certify that purchases of commercials, films, prerecorded video tapes, prerecorded audio program tapes or records are for sale or distribution to motion picture exhibitors, or commercial television or radio broadcasters. If I subsequently resell items to any other customer, or use or consume any of these items, I will report any tax liability directly to the Tax Commission.

Alternative Energy

I certify the tangible personal property meets the requirements of Utah Code §59-12-104 and is leased or purchased by or for an alternative energy electricity production facility, a waste energy production facility, or a facility that produces fuel from alternative energy.

Locomotive Fuel

I certify this fuel will be used by a railroad in a locomotive engine.

Research and Development of Alternative Energy Technology

I certify the tangible personal property purchased will be used in research and development of alternative energy technology.

Life Science Research and Development Facility

I certify that: (1) the machinery, equipment and normal operating repair or replacement parts purchased have an economic life of three or more years for use in performing qualified research in Utah; or (2) construction materials purchased are for use in the construction of a new or expanding life science research and development facility in Utah.

Mailing Lists

I certify the printed mailing lists or electronic databases are used to send printed material that is delivered by U.S. mail or other delivery service to a mass audience where the cost of the printed material is not billed directly to the recipients.

Semiconductor Fabricating, Processing or Research and Development Material

I certify the fabricating, processing, or research and development materials purchased are for use in research or development, manufacturing, or fabricating of semiconductors.

Telecommunications Equipment, Machinery or Software

I certify these purchases or leases of equipment, machinery, or software, by or on behalf of a telephone service provider, have a useful economic life of one or more years and will be used to enable or facilitate telecommunications; to provide 911 service; to maintain or repair telecommunications equipment; to switch or route telecommunications service; or for sending, receiving, or transporting telecommunications service.

Ski Resort

I certify the snow-making equipment, ski slope grooming equipment or passenger rope-ways purchased are to be paid directly with funds from the ski resort noted on the front of this form.

Aircraft Maintenance, Repair and Overhaul Provider

I certify these sales are to or by an aircraft maintenance, repair and overhaul provider for the use in the maintenance, repair, overhaul or refurbishment in Utah of a fixed-wing, turbine-powered aircraft that is registered or licensed in a state or country outside Utah.

Leasebacks

I certify the tangible personal property leased satisfies the following conditions: (1) the property is part of a sale-leaseback transaction; (2) sales or use tax was paid on the initial purchase of the property; and, (3) the leased property will be capitalized and the lease payments will be accounted for as payments made under a financing arrangement.

Film, Television, Radio

I certify that purchases, leases or rentals of machinery or equipment will be used by a motion picture or video production company for the production of media for commercial distribution.

Prosthetic Devices

I certify the prosthetic device(s) is prescribed by a licensed physician for human use to replace a missing body part, to prevent or correct a physical deformity, or support a weak body part. This is also exempt if purchased by a hospital or medical facility. (Sales of corrective eyeglasses and contact lenses are taxable.)

Out-of-State Construction Materials

I certify this tangible personal property, of which I am taking possession in Utah, will be taken out-of-state and will become part of real property located in a state that does not have sales tax, is taxed at a lower rate, or does not allow credit for tax paid to Utah. I will report the tax on my next Utah return at the lower of the Utah rate where the tangible personal property was purchased or the rate of the location where the tangible personal property is converted to real property in the other state if the other state allows a credit for tax paid to Utah.

Agricultural Producer

I certify the items purchased will be used primarily and directly in a commercial farming operation and qualify for the Utah sales and use tax exemption. **This exemption does not apply to vehicles required to be registered.**

Tourism/Motor Vehicle Rental

I certify the motor vehicle being leased or rented will be temporarily used to replace a motor vehicle that is being repaired pursuant to a repair or an insurance agreement; the lease will exceed 30 days; the motor vehicle being leased or rented is registered for a gross laden weight of 12,001 pounds or more; or, the motor vehicle is being rented or leased as a personal household goods moving van. This exemption applies only to the tourism tax (up to 7 percent) and the short-term motor vehicle rental tax (Transportation Corridor Funding – 2.5 percent) – not to the state, local, transit, zoo, hospital, highways, county option or resort sales tax.

Textbooks for Higher Education

I certify that textbooks purchased are required for a higher education course, for which I am enrolled at an institution of higher education, and qualify for this exemption. An institution of higher education means: the University of Utah, Utah State University, Utah State University Eastern, Weber State University, Southern Utah University, Snow College, Dixie State University, Utah Valley University, Salt Lake Community College, or the Utah System of Technical Colleges.

* Purchaser must provide sales tax license number in the header on page 1.

NOTE TO PURCHASER: You must notify the seller of cancellation, modification, or limitation of the exemption you have claimed.

Questions? Email taxmaster@utah.gov, or call 801-297-2200 or 1-800-662-4335.

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SECTION 00 7000

GENERAL CONDITIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. **INTERMOUNTAIN HEALTHCARE GENERAL CONDITIONS of the Contract for Construction** to be furnished, as requested. Where any part of the General Conditions is modified, the unaltered provisions shall remain in effect. An electronic copy may be obtained from Intermountain Healthcare's Project Manager.

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SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Work covered by the Contract Documents.
 - 2. Use of premises.
 - 3. Code compliance
 - 4. Dust control
 - 5. Protection of existing improvements
 - 6. Traffic Control
 - 7. Temporary Controls

1.3 WORK COVERED BY CONTRACT DOCUMENTS

- A. Project Identification: Project consists of remodel of existing inpatient pharmacy to meet USP 797 requirements in the Cassia Regional Hospital.
- B. Total square feet: 1,618 s.f.

Project Location: Cassia Regional Hospital, 1501 Hiland Ave, Burley, ID 83318.
- C.
 - 1. Owner: Intermountain Healthcare, 36 South State Street, 21st Floor Salt Lake City, Utah 84111
 - 2. Owner's Representative: Brenda Roberts, Intermountain Healthcare – Central Office, Salt Lake City, Utah
- D. Architect: NJRA Architects, 5272 College Drive, Suite 104, Murray, Utah 84123.
- E. The Work consists of the following:
 - 1. The Work includes: architectural, mechanical, plumbing and electrical work as defined on the contract documents.

1.4 USE OF PREMISES

- A. Contractor's use of premises is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

- B. Assume full responsibility for the protection and safekeeping of products under this Contract, stored on the site.

1.5 CODE COMPLIANCE

- A. All work shall comply with current edition of codes including but not limited to the following:
 - 1. International Building Code
 - 2. International Existing Building Code
 - 3. International Mechanical Code
 - 4. International Plumbing Code
 - 5. NFPA
 - 6. National Electric Code
 - 7. OSHA Regulation
 - 8. Health and Safety Regulations
 - 9. Utility Company Regulations
 - 10. Police, Fire Department Rules
 - 11. Environmental Protection Regulations
 - 12. Americans with Disabilities Act
- B. Arrange for authorities having jurisdiction to inspect and test according to their requirements and for each temporary utility before use. Obtain required certifications and permits.
- C. Requirements of codes and regulations shall be considered as the minimum. Where the contract documents exceed (without violating) code and regulation requirements, contract requirements shall take precedence. Where codes conflict, the more stringent shall apply.

1.6 DUST CONTROL

Temporary partitions should be constructed as called out on the Contract Documents and as mentioned in specification Section 024119 – Selective Demolition.

1.7 PROTECTION OF EXISTING IMPROVEMENTS

- A. Take precautions necessary to protect all existing utilities, monitor wells, and other Site improvements to remain from damage due to the work of this Project.
- B. Provide restoration of damaged property if damage is a result of construction activities.

1.8 TRAFFIC CONTROL

- A. Maintain control of vehicular and pedestrian traffic caused by, or resulting from, the work of this Project.
- B. Means of control shall be in accordance with the applicable regulations of the jurisdiction responsible for traffic safety.

1.9 TEMPORARY CONTROLS

- A. Conform to all applicable state and local ordinances and regulations. Obtain and pay for necessary permits and licenses as required by local jurisdictions.

END OF SECTION

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SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
 - 2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

- A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.
- C. Execute accepted alternates under the same conditions as other work of the Contract.
- D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

- A. ALTERNATE #1: Remove all existing Pharmacy workroom millwork as shown in plan, and make necessary repairs to the existing wall where millwork is being removed.
- B. ALTERNATE #2: Provide Scholox EPA 2-part epoxy based moisture mitigation system under new vinyl Pharmacy flooring.

END OF SECTION

SECTION 012900 – PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes measurement and payment provisions for, but not limited to, the following:
 - 1. Materials Delivered but Not Yet Installed.
 - 2. Schedule of Values.
 - 3. Applications for Payment.
 - 4. Preliminary Progress Schedule.
 - 5. Construction Progress Schedule.
 - 6. Change Orders.

1.2 MATERIALS DELIVERED BUT NOT INSTALLED

- A. Exclude from Applications for Payment materials or equipment delivered and stored, but not yet incorporated into the Work, unless circumstances dictate acceptance (i.e. pre-purchase of equipment for early delivery to prevent delay of construction or subsequent facility opening date) and pre-payment is agreed to, in writing, by the Owner.
- B. If Owner has agreed to make early payment on account of materials or equipment not incorporated in the Work, but delivered and stored in conformance with the requirements of the Contract Documents, at the site, or at some other location agreed upon in writing, such pre-payment shall be conditioned upon approval by Contractor's Insurance Carrier, and Architect, in writing, prior to submission by Contractor of the applicable payment request.
- C. Pre-payment request shall contain substantiating documentation, including:
 - 1. Bill(s) of Sale.
 - 2. Evidence of insurance for the materials or equipment, covering the item(s) until completion of installation.
 - 3. Provision for transportation to the Project Site.
 - 4. Protection of Owner's interest under any circumstance (i.e. Owner's right to retrieve equipment or materials from storage area of a bankrupt company's property).
 - 5. Provision for inspection/testing at the stored location.
 - 6. Provision for security until completion of installation.

1.3 SCHEDULE OF VALUES

- A. Type schedule on AIA Document G703. Owner's Standard Invoice/Schedule of Values or Contractor's standard forms and automated printout equivalent to the AIA Document will be considered for approval by Owner upon Contractor's request. Identify schedule with:

1. Title of Project and location.
 2. Architect and Project number.
 3. Name and Address of Contractor.
 4. Contract designation.
 5. Date of submission.
- B. Schedule shall list the installed dollar value of the component parts of the Work in sufficient detail to serve as a basis for computing values for progress payments during construction.
- C. List each subcontract first using the Table of Contents of the Project Manual as the format.
1. Next list any allowances included in the contract amount.
 2. List each major section or portion of work to be performed by the Contractor.
 3. List Contractor's fee separately.
 4. List any contingencies.
 5. Identify each line item with the number and title of the respective major section of the specifications.
 6. Subdivide items to correspond with cost correlation requirements for construction progress schedule.
- D. For each major line item list sub-values of major products by building area or floor level or other operations under the item.
- E. For the various portions of the Work:
1. Each item shall include a directly proportional amount of the Contractor's 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.
- F. The sum of all values listed in the schedule shall equal the total Contract Sum.
- G. Refer to General Conditions, Article 12, for changes.

1.4 APPLICATIONS FOR PAYMENT

- A. Format and Data Required:
1. Submit applications typed on AIA Document G702/703, Application for Payment. Contractor's standard forms and automated print-out equivalent to the AIA Document will be considered for approval by Architect upon request by the Contractor.
 2. Submit 2 copies with "wet" signatures.
 3. Add provision for Inspector of Record's signature.
- B. Provide itemized data on continuation sheet:

1. Format, schedules, line items and values: Those of the Schedule of Values accepted by Architect.
 2. Include Payment Application number.
- C. Preparation of Application for Each Progress Payment:
1. Application Form:
 - a. Fill in required information, including that for Change Orders executed prior to date of submittal of application along with the number assigned to each Change Order.
 - b. Fill in summary of dollar values to agree with respective totals indicated on continuation sheets.
 - c. Certification that the Project Record Documents are current with the progress status of the Project.
 - d. Execute certification with signature of a responsible officer of Contract firm.
 2. Continuation Sheets:
 - a. Fill in total list of all scheduled component items of Work, with item number and scheduled dollar value for each item.
 - b. Fill in dollar value in each column for each scheduled line item when work has been performed or products stored.
 - 1) Round off values to nearest dollar, or as specified for Schedule of Values, and percent of item completion.
 - c. List each Change Order executed prior to date of submission, at the end of the continuation sheets.
 - 1) List by Change Order number, and description, as for an original component item of work.
- B. Substantiating Data for Progress Payments:
1. When Owner or Architect requires substantiating data, submit information, with a cover letter identifying:
 - a. Project.
 - b. Application number and date.
 - c. Detailed list of enclosures.
 - d. For stored products.
 - 1) Item number and identification as shown on application.
 - 2) Description of specific Material.
 2. Submit 1 copy of data and cover letter for each copy of application.
 3. Revised updated CPM schedule.
 4. Current period's General Contractor Conditional Waiver and the prior period's Unconditional Waiver.
 5. Waivers from Subcontractors.
 6. Copies of invoices for National Purchase Agreement (NPA) items.
 7. Corrections and updates to "as-built" documents.
- C. Preparation of Application for Final Payment:
1. Fill in application form as specified for progress payments.
 2. Use continuation sheet for presenting the final statement of accounting as specified in Section 01700 - CONTRACT CLOSEOUT.
- D. Submittal Procedure:

1. Submit Applications for Payment to Owner at the times stipulated in the Agreement.
2. Number: 3 copies of each Application.
3. When Owner, Inspector of Record, and Contractor agree on percentages to be requested, and when agreed and signed by them and Architect, Architect will transmit the Certificate for Payment to Owner.
4. Approval and signing of the Application for Payment by Owner and Architect is contingent upon approval of the current status of the As-Built Drawings/Record Documents and submittal of updated CPM schedule.

1.5 CHANGE ORDERS

- A. Change Orders shall be processed by the Architect in accordance with the Conditions of the Contract, Supplementary Conditions of the Contract, and as herein specified.
- B. Coordination with Contractor's Submittals:
 1. Revise Schedule of Values and Application for Payment forms monthly to record each change as a separate item of Work, and to record the adjusted Contract Sum.
 2. Upon completion of work under a Change Order, enter pertinent changes in record documents.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION

SECTION 013100 – PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section describes the requirements for Project coordination.

1.2 DESCRIPTION OF REQUIREMENTS

- A. Minimum administrative and supervisory requirements necessary for coordination of Work shall be fulfilled collectively by the Contractor in coordination with subcontractors including, but not necessarily limited to, the following:

- 1. Coordination drawings.
- 2. Coordination meetings.
- 3. Administrative coordinating personnel.
- 4. Contractor's coordination of work.

1.3 COORDINATION MEETINGS

- A. Schedule and conduct meetings and conferences at project site, unless otherwise indicated.

1.4 ADMINISTRATIVE COORDINATION PERSONNEL

- A. Provide a General Superintendent and other administrative and supervisory personnel required for performance of the Work.
- B. Provide specific coordinating personnel for each subcontractor as reasonably required for interfacing Work with other work of total Project.
- C. Submittal of Staff Names, Duties: Within 7 days of Notice to Proceed submit to the Owner a listing of principal staff assignments and consultants, including names, addresses and telephone numbers.

1.5 CONTRACTOR'S COORDINATION OF WORK

- A. Provide and coordinate the following:
 - 1. General and special services and operations to furnish and install Work.
 - 2. Primary, major and accessory materials, and items necessary to complete the installation.
 - 3. Labor operations and material items reasonably incidental for finishing.
 - 4. Performance of work and delivery of materials in accordance with established construction schedules.
- B. Coordinate all aspects of construction operations, generally, and specifically as

required to provide Owner with a complete, operable facility.

1. Resolve any dispute over coordination, or failure to coordinate, such that resolution is consistent with Contract Documents. When such resolution is not possible, refer to the General Conditions.
 2. Where proper execution of this Work depends on the work of any other contractor, inspect and promptly report to Architect any defects in such work that render it unsuitable for such proper execution and results.
 3. Cooperate with other contractors on the Project site and with Architect so that completion of all work can proceed with prudent speed.
 - a. Furnish other contractors, whose work is fitted to this work, detail and erection drawings giving full information regarding the fabrication and assembly of this Work.
 - b. So far as possible, drawings shall indicate checked field measurements.
 - c. Cooperate in timing this Work to join with the work of other contractors or the Owner.
 4. Check the drawings of other contracts for interferences with this Work and promptly report to Architect, in writing, any such interferences.
 5. Submit complete information, including Drawings, descriptions, sketches, marked prints, etc., as required for Architect's review and coordination of drawings by others which are a part of this Work.
- C. Mechanical, Electrical, and Related Systems Coordination: Prior to proceeding with the work, and before installation, coordinate and work out all "tight" conditions involving work of various Sections.
1. Before work proceeds in these areas, prepare supplemental drawings for review by the Architect.
 2. Provide all work necessary to coordinate tight conditions, including supplemental drawings in sufficient detail for showing that all work is coordinated in "tight" areas, and additional labor and materials necessary to overcome "tight" conditions at no increase in cost to the Owner.
 3. Coordination of "tight" conditions shall include:
 - a. Providing sufficient clear space around all equipment necessary for maintenance access and as required by Code.
 - b. Adjustments in depth, position, and elevation of underground and overhead utilities at points of conflict. Utility space conflicts shall be resolved by giving precedence to those utilities which are called out to be sloped. The term "utility" as used in this paragraph includes: all piping, conduit, and ductwork.

1.6 COORDINATION DRAWINGS

- A. Submit plans and cross-sections in sufficient detail to show coordinated layout of all ducts, pipes, electrical work, access doors, above ceiling clearances, canopy rigging, acoustical curtains, and other related items. Plans and cross-sections shall be provided that include all underground ducts, electrical ductbanks, piping, and other underground utilities.
- B. Engage professional drafter to prepare these drawings to one-quarter scale on Auto-CAD with title blocks to match the Contract Drawings.

1. These plans shall reflect existing dimensions as field-verified by the Contractor.
2. Plans shall be uniform and identical and shall serve as backgrounds for preparation of shop or layout drawings required under Divisions 15 and 16 and ultimately for recording of as-built information required under these divisions.
3. Where additional sheets of elevations, sections, details, and/or diagrams are required, such sheets shall match the Contract Drawings with respect to size and title block.
4. Prior to beginning excavation for structural footings and utilities, submit a coordination plan showing all underground utilities including: all underground piping, underground ductwork, electrical and communication ductbanks.
 - a. The plan shall be a composite overlay of sheets each dedicated to a single underground utility using a common background and scale.
 - b. Dimensions shall be sufficient to clearly indicate the position and depth of each utility relative to structural footings, above grade structures, and finished grade.
 - c. At points where the plan indicates that utilities will cross each other, cross a structural footing, or run within six (6) feet parallel to either each other or a structural footing, provide a cross section drawing.
 - d. Cross section drawings shall clearly show the relative positions and depths of each utility and structural footing.
 - e. The composite plan and cross section drawing(s) shall be updated to "as-builts" and submitted with the Project Record (As-Built) Drawings.

C. Do not commence work until the Architect has reviewed these Drawings.

1.7 MISCELLANEOUS PROVISIONS

- A. Prior to starting a particular type or kind of work:
 1. Examine for relevant information, all Contract Documents and subsequent data issued;
 2. Check accepted submittals and verify dimensions at job site;
 3. Consult manufacturers for instructions applicable to conditions under which Work is to be installed;
 4. Inspect areas, surfaces or construction receiving the Work.
 - a. Start of work shall signify compliance with the above requirements and acceptance of previously placed construction or substrates as being in satisfactory condition to achieve proper installations and first quality workmanship as intended under these specifications.
 - b. Failure to so inspect and report shall constitute an acceptance of the other contractor's work.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION

SECTION 013110 – FIELD ENGINEERING

PART 1 - GENERAL

1.1 FIELD MEASUREMENTS AND EXISTING CONDITIONS

- A. Contractor Responsibility: Exact field measurements are responsibility of the Contractor. Any required off-sets, additional fittings, re-routing of existing or new work to provide serviceable system within the location shown, and to maintain head room and clearances to match existing construction, are responsibility of the Contractor.
- B. Layout of the Work: The Contractor shall employ, at the Contractor's own expense, Registered Civil Engineer or Licensed Land Surveyor. Contractor's engineer or surveyor will provide layout of the work of the Project and establish all reference points and elevations required for construction.

1.2 GRADES, LINES AND LEVELS

- A. Identification: Owner will identify existing benchmarks, control points, and property corners.
- B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
- C. Benchmarks: Establish and maintain a minimum of six permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
 - 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
 - 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
 - 3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.
- D. Preservation: All stakes, boundary lines, bench marks or survey marks, etc., which have been or may be established in any part of the Project site or adjacent thereto shall be carefully preserved and respected by the Contractor and shall be restored at the Contractor's expense if lost or destroyed as result of the Contractor's operations.
 - 1. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

- E. Conflict: The Contractor will be held responsible for correctness of layout, for establishing location of existing concealed utility lines, and for notifying the Architect in writing in event of conflict with the Drawings. In such case, the Contractor shall not proceed until instructed by the Architect.
- F. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, plumbness and elevations of construction and sitework.
- G. Final Property Survey: Prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
 - 1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.

END OF SECTION

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

1.3 SUBMITTAL PROCEDURES

- A. General: Electronic copies of CAD Drawings of the Contract Drawings will not be provided by Architect for Contractor's use in preparing submittals.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
- C. Submittals Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities. Submittals should be submitted by contractor to architect **within 30 days from notice to proceed**.
- D. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
 - 1. Initial Review: Allow 10 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 - 2. Resubmittal Review: Allow 10 days for review of each resubmittal.
- E. Identification: Place a permanent label or title block on each submittal for identification.
 - 1. Indicate name of firm or entity that prepared each submittal on label or title block.
 - 2. Include the following information on label for processing and recording action taken:
 - a. Project name.
 - b. Date.

- c. Name and address of Architect.
 - d. Name and address of Contractor.
 - e. Name and address of subcontractor.
 - f. Name and address of supplier.
 - g. Name of manufacturer.
 - h. Submittal number or other unique identifier, including revision identifier.
 - i. Number and title of appropriate Specification Section.
 - j. Drawing number and detail references, as appropriate.
 - k. Location(s) where product is to be installed, as appropriate.
- F. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form.
- G. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities.
1. Use for Construction: Use only final submittals with mark indicating "Approval notation from Architect's action stamp".

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

- A. General: Prepare and submit Action Submittals required by individual Specification Sections.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. Mark each copy of each submittal to show which products and options are applicable.
 2. Include the following information, as applicable:
 - a. Manufacturer's written recommendations.
 - b. Manufacturer's product specifications.
 - c. Manufacturer's installation instructions.
 - d. Standard color charts.
 - e. Manufacturer's catalog cuts.
 - f. Standard product operation and maintenance manuals.
 - g. Compliance with specified referenced standards.
 3. Submit Product Data concurrent with Samples.
 4. Number of Copies: Submit four copies of Product Data, unless otherwise indicated.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

- a. Dimensions.
 - b. Identification of products.
 - c. Fabrication and installation drawings.
 - d. Roughing-in and setting diagrams.
 - e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
 - f. Shopwork manufacturing instructions.
 - g. Schedules.
 - h. Design calculations.
 - i. Compliance with specified standards.
 - j. Relationship to adjoining construction clearly indicated.
2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 30 by 40 inches (750 by 1000 mm).
 3. Number of Copies: Submit four opaque copies of each submittal, Architect will retain two copies; remainder will be returned.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
1. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit one full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

3.2 ARCHITECT'S ACTION

- A. General: Architect will not review submittals that do not bear Contractor's approval.
- B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:

END OF SECTION

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SECTION 014000 – QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section describes the requirements for Owner furnished testing and inspection services which include the following:
1. Observation by Inspector of Record.
 2. Laboratory responsibilities.
 3. Laboratory reports.
 4. Limits on testing laboratory authority.
 5. Contractor responsibilities.
 6. Schedule of inspections and tests.
- B. These services are identified to indicate the requirement for cooperation and assistance needed by Owner's testing and inspection agency.

1.2 QUALITY ASSURANCE

- A. Testing and Inspection Agency Qualifications: A testing and inspection agency must have a minimum 5 years continuing experience preceding date of these Contract Documents, and be qualified in accordance with the following American Society for Testing and Materials (ASTM) publications:
1. ASTM E 548-84 Standard Practice for Generic Criteria for use in the Evaluation of Testing and Inspection Agencies.
 2. ASTM E 699-79 (1984) Standard Criteria for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating Building Components in Accordance with Test Methods Promulgated by ASTM Committee E-6.
- B. Testing Equipment: Calibrated at intervals with devices of accuracy traceable to either National Bureau of Standards or accepted values of natural physical constants.

1.3 INSPECTION AND TESTING PERSONNEL AND FACILITIES

- A. Inspector of Record:
1. The Owner will employ one or more qualified Inspectors of Record, acceptable to the Local Building Department issuing Permits who will be employed continuously at the construction site, working under the Owner Representative's general direction. The IOR(s) will observe progress of the work and to report to the Owner any non-conformance with Contract Documents.
 2. In compliance with the State Building Code, Part 1, Title 24 of the California Code of Regulations, Article 7-145, the Inspector of Record shall have personal knowledge, obtained by continuous inspection of all

- parts of the work of construction in all stages of its progress, to ensure that the work is in accordance with the approved contract documents.
3. Specific duties and limits of responsibilities include the following:
 - a. Observing and spot checking materials upon arrival at site, and work in progress, to determine conformance with Contract Documents. Reporting any defects immediately to the Owner.
 - b. Maintaining liaison with the Contractor and his Subcontractors only through Contractor's superintendent.
 - c. Evaluating Contractor's suggestions and reporting them with recommendations to the Owner for final decision.
 - d. Remaining alert to the Construction Schedule and immediately reporting any potential delays and problems to the Owner.
 - e. Maintaining a Daily Log of activities on site, pertinent to a continuous project report record.
 - f. Preparing a Verified Report every 3 months (or sooner if required for a specific project schedule).
 - g. Receiving Samples of construction materials at the jobsite.
 - h. Scheduling and accompanying regulatory inspectors through the project and reporting to the Owner the results of such inspection visits.
 - i. Being alert to conditions which could affect Hospital's existing operation.
 - j. Reviewing and verifying degree of work completion with that cited in Contractor's monthly payment request.
 - k. Maintaining Contract information and Shop Drawing files.
 - l. Preparing a Field Inspection Report of incomplete or unsatisfactory work at intervals throughout the work progress. Checking off such items when made complete and satisfactory by Contractor.
 - m. Attending project meetings in accordance with specifications Section 013100.
 - n. Enforcing Infection Control requirements.
 - o. Provide all coordination for independent Testing Laboratories.
 - p. Participate in formation of Final Punch List.
 - B. Local Permit Issuing Agency will approve the Inspector of Record for the project who shall be allowed access to the project site at any time.
 - C. Testing and Inspection Agency:
 1. The Owner will employ and pay for the services of an independent testing and inspection agency to perform the tests and inspections required herein except where noted otherwise.
 - a. Employment of the testing and inspection agency shall in no way relieve the Contractor's obligation to perform the work defined in the Contract Documents.
 2. Limitations of authority of the Testing and Inspection Agency:
 - a. Testing Agency is not authorized to:
 - 1) Release, revoke, alter, or enlarge on the requirements of the Contract Documents;
 - 2) Approve or accept any portion of the Work, or;
 - 3) Perform any duties of the Contractor.
 3. All work shall conform to the requirements of state and local applicable

- Codes.
4. Testing and inspection agency shall perform tests and inspections as required by applicable regulation as indicated in the specification Sections, and as directed by the Owner and required by the Code.
 5. Testing and inspection agency shall prepare, cure, store, and transport job samples to the Laboratory.
 6. At the completion of the Project, verified reports shall be submitted as required by CCR, Title 22 and as directed.

1.4 LABORATORY REPORTS

- A. After each inspection and test, promptly submit copies of laboratory report which includes:
 1. Date issued,
 2. Project title and number,
 3. Name of Inspector from inspection agency,
 4. Date and time of sampling or inspection,
 5. Identification of product and specifications section,
 6. Location in the Project,
 7. Type of inspection or test,
 8. Date of test,
 9. Results of tests,
 10. Conformance with Contract Documents,
 11. Whether original test or re-test,
 12. State/local permit number,
- B. Reports shall be distributed to the following:
 1. Architect of Record
 2. Inspector of Record (I.O.R.)
 3. General Contractor
 4. Owner
 5. Applicable Consultant
 6. Local Jurisdiction where applicable

1.5 LABORATORY RESPONSIBILITIES

- A. Provide qualified personnel at site. Cooperate with Architect/Inspector of Record and Contractor in performance of services.
- B. Perform specified inspecting, sampling, and testing of Products in accordance with specified standards.
- C. Ascertain compliance of materials and mixes with requirements of Contract Documents.
- D. Promptly notify Architect, IOR and Contractor of observed irregularities or non-conformance of Work or Products.
- E. Perform additional inspection and test required by Architect.
- F. Attend preconstruction meetings and progress meetings when requested.

1.6 CONTRACTOR'S RESPONSIBILITIES

- A. Cooperate with Inspector of Record and Testing and Inspection Agency and provide access to Work, including off-site manufacturer's or fabricator's operations.
 - 1. Provide required quantities of material samples to be tested.
 - 2. Samples will be selected and taken by representative of Testing and Inspection Agency.
- B. Furnish copies of product data and test reports as required.
- C. Furnish incidental labor and facilities:
 - 1. To provide access to work to be tested;
 - 2. To obtain and handle samples at the Project site, or at the source of the Product to be tested or inspected;
 - 3. To facilitate inspections and tests, and;
 - 4. For storage and curing of test samples at the Project site.
- D. Provide, on a weekly basis, a Short Interval Project Schedule with a minimum three-week duration which identifies upcoming testing requirements.
- E. Schedule the tests and inspections required by the Contract Documents and applicable codes and regulations with the Inspector of Record and the Testing and Inspection Agency, a minimum of 48 hours in advance.
 - 1. When tests or inspections cannot be performed after such notice, or if re-tests and re-inspections are required due to the fault of the Contractor, all costs for such re-work shall be deducted from the Contract Amount. If the remaining unpaid balance in the Contract is insufficient to cover the Change Order for this work, Contractor shall pay the difference directly to the Owner.
 - 2. Do not cover corrected Work until said Work has been re-tested and or re-inspected satisfactorily.
- F. Arrange with Owner's Testing and Inspection Agency and pay for additional samples and tests required for the Contractor's convenience when approved by Owner.
- G. Contractor shall pay costs for the following specified items:
 - 1. Design mixes for:
 - a. Cast-in-Place concrete
 - 2. Redesign of mixes due to change in source of ingredients.
 - 3. Certified mill test reports.
- H. Notification of Architect:
 - 1. In addition to tests and inspections called for in this Section, notify applicable parties of inspections and testing called for in the individual Sections of the Specifications or on the Drawings.
 - 2. Notify 48 hours in advance, to assure inspections prior to covering up or

closing in of work involved. Any work covered up before such required inspection or testing shall be uncovered or removed at the Contractor's expense.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION

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SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

1.3 USE CHARGES

- A. General: Cost or use charges for temporary facilities shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost.
- B. Water Service: Pay water service use charges for water used by all entities for construction operations.
- C. Electric Power Service: Pay electric power service use charges for electricity used by all entities for construction operations.

1.4 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MATERIALS

2.2 TEMPORARY FACILITIES

- A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Common-Use Field Office: Of sufficient size to accommodate needs of construction personnel. Keep office clean and orderly. Furnish and equip offices as follows:
 - 1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.

2. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
3. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.

2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. Heating Equipment: Unless Owner authorizes use of permanent heating system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.
- C. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
- D. Heating: Provide temporary heating required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- E. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

- F. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
- G. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line(s) for each field office.
- H. Traffic Controls: Comply with requirements of authorities having jurisdiction.
 - 1. Protect existing site improvements to remain including curbs, pavement, and utilities.
 - 2. Maintain access for fire-fighting equipment and access to fire hydrants.
- I. Parking: Provide temporary parking areas for construction personnel.
- J. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
 - 1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties nor endanger permanent Work or temporary facilities.
 - 2. Remove snow and ice as required to minimize accumulations.
- K. Project Identification and Temporary Signs: Provide Project identification sign. Install signs where indicated to inform public and individuals seeking entrance to Project. Unauthorized signs are not permitted.
- L. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with Division 1 Section "Cleaning" for progress cleaning requirements.
- M. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

3.3 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
- B. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.
 - 1. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

- C. Stormwater Control: Comply with authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- D. Site Enclosure Fence: Before construction operations, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
- E. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- F. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.
 - 1. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
 - 2. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

3.4 OPERATION, TERMINATION, AND REMOVAL

- A. Maintenance: Maintain facilities in good operating condition until removal.
 - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- B. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

END OF SECTION

SECTION 016000- PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included: This Section contains definitions, product requirements and requirements for prior approved items.
- B. Delivery and storage of materials and equipment.
- C. Procedures for selecting products and approving substitutions.

1.2 DEFINITIONS

- A. General: Definitions are not intended to negate the meaning of other terms used in Contract Documents, including specialties, systems, structure, finishes, accessories, furnishings, special construction, and similar terms, which are self-explanatory and have recognized meanings in the construction industry.
- B. Products: Purchased items for incorporation into the Work, regardless of whether specifically purchased for Project or taken from Contractor's stock of previously purchased products.
- C. Materials: Products which must be substantially cut, shaped, worked, mixed, finished, refined, or otherwise fabricated, processed, installed, or applied to form units of Work.
- D. Appliances, Equipment, and Fixtures: Products with operational parts, regardless of whether motorized or manually operated and particularly including products with service connections (wiring, piping, etc.).
- E. System: A unit of Work (i.e., structural system, vacuum system, etc.) shown or specified to include particular products, materials, appliances, equipment, or fixtures.
- F. Substitutions: Where products, materials, appliances, equipment, or fixtures are listed by trade name(s), manufacturer name(s), or catalog reference(s) or where these items are shown or specified as part of a system or systems, items or systems proposed for use by Contractor that are not listed or differ from those shown or specified as part of a system will be considered substitutions.
 - 1. Submit substitutions in accordance with requirements of this Section.
 - 2. The requirements for substitutions do not apply to specified Contractor options. Revisions to Contract Documents, where requested by Owner or Architect are changes, not substitutions.
 - 3. Contractor's determinations of and compliance with governing regulations and orders issued by governing authorities do not constitute substitutions, and do not constitute a basis for change orders; except as

provided for under substitution procedures in this Section or elsewhere in Contract Documents.

- G. Prior -to-Bid Approvals: Products, materials, appliances, equipment, fixtures, or systems that have been proposed as substitutions and accepted by Owner prior to bid.

1.3 DESCRIPTION

- A. General: Specific products, materials, appliances, equipment, fixtures, accessories, manufacturers, and proprietary mentioned by name, grade, or brand, in Specifications or on Drawings have been selected for their particular fitness, availability, and desirability for use appropriate to Work of this Project and are intended to establish the standard of quality.
- B. Compliance: The compliance requirements, for individual products are multiple in nature and may include generic, descriptive, proprietary, performance, prescriptive, compliance with standards, compliance with codes, conformance with graphic details, and other similar forms and methods of indicating requirements.

1.4 PRODUCT REQUIREMENTS

- A. General: Provide products which comply with requirements, and which are undamaged and unused at time of installation, and which are complete with accessories, trim, finish, safety guards, and other devices and details needed for a complete installation and for intended use.
 - 1. Materials shall be new unless otherwise specified and unused, except for testing of current production models on date of order, undamaged, and un-deteriorated at time of use.
 - 2. Identify materials in accordance with accepted trade standards and requirements of this Section.
 - 3. Select and use methods or processes, including intermediate processes, which will produce the specified finished material or product.
 - 4. Ascertain that the Work, including materials, products, and equipment delivered and installed, is in full compliance with the Contract Documents and appropriate submittals.
 - 5. Standard Products: Where available, provide standard products of types which have been produced and used previously and successfully on other projects and in similar applications.
 - 6. Continued Availability: Where additional amounts of product, by nature of its application, are likely to be needed by Owner at a later date for maintenance and repair or replacement work, provide a standard, domestically produced product which is likely to be available to Owner at such later date.
- B. Nameplates: Except as otherwise indicated for required approval labels and operating data, do not permanently attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products which will be exposed to view either in occupied spaces or on exterior of the Work.

1. Labels: Locate required labels and stamps on a concealed surface or, where required for observation after installation, on an accessible surface which, in occupied spaces, is not conspicuous.
2. Equipment Nameplates: Provide permanent nameplate on each item of service-connected or power-operated equipment. See sections specifying equipment requirements for specifics.

1.5 QUALITY ASSURANCE

- A. Special Requirement: Due to certain Owner requirements, Owner will not consider substitutions on certain items. Therefore, substitutions will not be considered for items followed by the words: "no substitution(s)."
- B. Architect's Compensation:
 1. Except as limited by provisions of Owner-Architect or Owner-Contractor Agreements, Contractor shall reimburse Owner for compensation paid to Architect for evaluation of substitution proposals made during construction, whether or not substitution is accepted by Owner.
 2. Refer to Request for Substitution form at the end of this Section.
- C. Delays and Costs:
 1. Substitution proposals made during construction shall be in accordance with procedures outlined in this Section and be made in sufficient time to allow for adequate time for Architect's review and evaluation.
 2. Delays and added costs associated with inadequate supportive data, necessary extended evaluations, or redesign work caused by substitutions shall be borne by Contractor.
 3. Cost changes resulting from proposed substitutions shall be clearly stated with the initial substitution proposal. Subsequently discovered costs resulting from the substitution shall be borne by Contractor.

1.6 TRANSPORTATION AND HANDLING

- A. Transport products by methods to avoid product damage; deliver in undamaged condition in manufacturer's unopened containers or packaging, dry.
- B. Provide equipment and personnel to handle products by methods to prevent soiling or damage.
- C. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.
- D. Deliver products in the manufacturer's sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting and installing.

1.7 STORAGE AND PROTECTION

- A. Store Products in accordance with manufacturer's instructions, with seals and labels intact and legible.
- B. Store sensitive products in weathertight enclosures; maintain within temperature and humidity ranges required by manufacturer's instructions.
- C. For exterior storage of fabricated products, place on sloped supports above ground. Cover products subject to deterioration with impervious sheet covering; provide ventilation to avoid condensation.
- D. Store loose granular materials on solid surfaces in a well-drained area; prevent mixing with foreign matter.
- E. Arrange storage to provide access for inspection, periodically inspect to assure products are undamaged and are maintained under required conditions.
- F. After installation, provide covering to protect products from damage from traffic and construction operations, remove when no longer needed.

1.8 PROCEDURES

- A. Procedures for Selecting Products: Contractor's options for selecting products are limited by Contract Document requirements and governing regulations, and are not controlled by industry traditions or procedures experienced by Contractor on previous construction projects.
 - 1. Single Product/Manufacturer Name:
 - a. Provide product indicated. Do not offer to provide an unnamed product unless it has been accepted under substitution provisions listed below.
 - b. Except as otherwise indicated, "Named" is defined to mean manufacturer's name for product as recorded in latest issue of published product literature as of date of Contract Documents.
 - c. Refer to requests to use products of a later (or earlier) model to Architect for acceptance before proceeding.
 - 2. Two or More Product/Manufacturer Names:
 - a. Provide 1 of the named products, at Contractor's option.
 - b. Do not offer to provide an unnamed product unless it has been accepted under substitution provisions listed below.
 - 3. Performance Requirements:
 - a. Provide products which comply with specific performances indicated and which are recommended by manufacturer (in published product literature or by individual certification) for application indicated.
 - b. Overall performance of a product is implied where product is specified for specific performances.
 - 4. Standards, Codes, and Regulations: Where compliance with an imposed standard, code, or regulation is required, selection from among products which comply with requirements of those standards, codes, and regulations is Contractor's option.
 - 5. Prescriptive Requirements: Provide products which have been produced

in accordance with prescriptive requirements, using specified ingredients and components, and complying with specified requirements for mixing, fabricating, curing, finishing, testing, and similar operations in manufacturing process.

6. Visual Matching:
 - a. Where matching of an established sample is required, final judgment of whether a product proposed by Contractor matches sample satisfactorily is Architect's judgment.
 - b. Where no product exists within specified cost category, which matches sample satisfactorily and complies with requirements, comply with provisions concerning, substitutions and change orders for selection of an equivalent product.
7. Visual Selection:
 - a. Where specified product requirements include "color(s), pattern(s), texture(s), etc. selected by Architect" or words of similar effect, selection of manufacturer and basic product (complying with requirements) is Contractor's option, and subsequent selection of color(s), pattern(s), and texture(s), etc. is Architect's selection.
 - b. Where specified product requirements include "color(s), pattern(s), texture(s), etc., to match Architect's sample" or words to that effect, selection of product (complying with requirements, and within established cost category) is Architect's selection, including designation of manufacturer where necessary to obtain desired color, pattern, or texture.

1.9 SUBSTITUTION PROCEDURES

- A. Prior (-to-Bid) Approvals: Substitute products, materials, appliances, equipment, fixtures, or systems will be considered by Architect.
 1. Any bidder, material supplier, or manufacturer desiring to propose substitution(s) shall:
 - a. Submit in a sealed envelope catalog cuts, shop drawings, or other descriptive literature for products, materials, appliances, equipment, fixtures, or systems for proposed substitution.
 - b. Submit not later than 14 calendar days before bid opening
 2. Make request to Architect in triplicate on copies of Request for Substitution form included at end of this Section.
 3. Submittal(s) shall include a complete and adequate analysis showing point-for-point comparison to specified item(s) or system(s) and must prove equality or superiority.
 4. Include related Section and Drawing number(s), and fully document compliance with requirements for substitutions.
 5. Include product data/drawings, description of methods, samples.
 - a. Where applicable, statement of effect on construction time and coordination with other affected Work.
 - b. Cost information for proposal.
 6. Include identification of previous use locally with dates and names of Architect and Owner.
 7. Anything less will not be considered.
 8. Equivalency:
 - a. The Architect will be the initial judge of equivalency of proposed

- substitution(s).
 - b. Architect will make written recommendation of acceptance or rejection to Owner.
9. Satisfaction:
- a. Prior to proposing substitution(s), certify that item or system is equal to that specified.
 - b. That it will fit into space allocated.
 - c. That item affords comparable ease of operation, maintenance, and service.
 - d. That appearance, longevity, and suitability for climate and use are comparable to item specified.
 - e. That substitution is in Owner's interest.
10. Manufacturer's data which is readily available to Architect is not acceptable for establishing proof of quality.
- a. Provide laboratory test data performed by a nationally recognized independent testing laboratory known for its testing expertise.
 - b. Laboratory test shall include types of materials used in substitute item or system, including their thickness and strength, and a direct comparison to item or system specified for capacities, capabilities, coatings, functions, life cycle usage, and operations.
 - c. No change in Architect's design intent will be allowed where item or system will be exposed and where it will be used.
11. Proof: Burden of proof that a proposed substitution is equal or equivalent to a specified item or system shall be upon Contractor, who shall support his request with sufficient test data, samples, brochures, and other means to permit Architect to make a fair and equitable decision on merits of proposal.
12. Based on Architect's written recommendation of acceptance or rejection, Owner will determine acceptability of proposed substitutions.
13. Architect will notify Bidders of Owner's acceptance not later than 5 calendar days prior to bid opening via an addendum to the Contract Documents listing only accepted substitutions.
14. Responsibility: Acceptance of substitutions shall not relieve Contractor from responsibility for complying with all other requirements of the Contract Documents and coordinating substitution(s) with adjacent materials and other affected equipment.
- B. During Construction:
- 1. Substitutions will not be considered when they are indicated or implied on submittals without separate written request prior to submittal, or when acceptance will require substantial revision of Contract Documents.
 - 2. Architect and Owner will consider requests from Contractor during construction for substitutions (following procedures outlined above for prior approvals) only under 1 or more of the following conditions:
 - a. Substitution is required for compliance with subsequent interpretation of code requirements or insurance regulations.
 - b. Shown or specified item or system cannot be provided within Contract Time or becomes unavailable due to no fault of Contractor.
 - c. Subsequent information disclosed inability of item(s) or system(s) to

- perform properly or to fit in designated space, or manufacturer(s) refuse(s) to certify or warrant performance as required.
- d. When, in Architect's judgment, a substitution would be substantially in Owner's best interests in terms of cost (substantial credit), time, or other valuable considerations, after deducting offsetting responsibilities Owner may be required to bear, including additional compensation to Architect for evaluation and redesign services, increased cost of other work by Owner or separate contractors, and similar considerations.

PART 2 – PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

REQUEST FOR SUBSTITUTION

A. Completed reproduction of this form shall accompany all requests for substitutions. Failure to submit form with request shall be cause for rejection. Substituted items or systems may be incorporated into the Work only after receipt of Owner's written approval. Fill in all applicable spaces and cross out all nonapplicable information bracketed ([]) or unbracketed.

[Subcontractor:] [Material Supplier:] [Manufacturer:] Date:
Requested Substitution:
Reference: Specification Section _____ Drawing Reference _____
Reason for Substitution: [Prior Approval] [During Construction]:

B. Resulting Change to Contract Amount: [Add] [Deduct] _____
(Include supporting documentation.)

C. For substitutions made during construction the Architect will, upon receipt of substitution proposal, fill in the following compensation information, add it to or deduct it from the Change to the Contract Amount and submit Net Change to Contract Amount to Owner for approval. Upon receipt of Owner's approval, Architect will proceed with substitution review.

D. Architect's Fee for Substitution Evaluation: _____

E. Architect's Fee for Changes to Contract: _____

F. Documents Due to Substitution:
Net Change to Contract Amount (B + C + D): [Add] [Deduct]
Resulting Change to Contract Time: Add _____ Deduct _____
Summary of Related Work Requiring Coordination (if any):

(Contractor shall assume responsibility for complete coordination with Work of all trades involved if Substitution Request is approved.)

G. Attached Documentation: The following is herewith attached to provide complete documentation of requested substitution:

[] Product Data [] Samples [] Shop Drawings
[] Test Reports [] Other:

H. Contractor's Signature

Subcontractor's/Supplier's/Manufacturer's
Signature

SECTION 017600- GUARANTIES AND WARRANTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements for guaranties and warranties for contract closeout and during specified guaranty/warranty periods.

1.2 DESCRIPTION OF REQUIREMENTS

- A. General Limitations: It is recognized that specific guaranties and warranties are intended to protect Owner against failure of the Work to perform as required, and against deficient, defective, and faulty materials and workmanship, regardless of sources.
- B. Related Damages and Losses: When correcting guaranteed or warranted work which has failed, remove and replace other Work of Project which has been damaged as a result of such failure or which must be removed and replaced to provide access for correction of Work.
- C. Reinstatement of Guaranty or Warranty Period: In addition to requirements in the General Conditions, when Work covered by a special project guaranty or product warranty has failed and has been corrected by replacement or restoration, reinstate guaranty or warranty by written endorsement for 1 year starting on date of acceptance of replaced or restored Work.
- D. Replacement Cost, Obligations: Except as otherwise indicated, cost of replacing or restoring failing guaranties or warranted units or products is Contractor's obligation, without regard for whether Owner has already benefitted from use through a portion of anticipated useful service lives.
- E. Rejection of Warranties: Owner reserves the right, at time of Substantial Completion or thereafter, to reject coincidental product warranties submitted by Contractor, which in opinion of Owner detract from or confuse interpretation of requirements of Contract Documents.
- F. Contractor's Procurement Obligations: Do not purchase, subcontract for, or allow others to purchase or subcontract for materials or units of Work for Project where a special project guaranty, specified product warranty, certification, or similar commitment is required until it has been determined that entities required to sign or countersign such commitments are willing to do so.
- G. Specific Guaranty or Warranty Forms: Where a special project guaranty or specified project warranty is required, prepare a written document to contain terms and appropriate identification; ready for execution by required parties.
 - 1. A sample form is attached as the last article of this Section.
 - 2. Refer to individual sections of Divisions 2 through 33 for specific content and requirements.

3. Submit draft to Owner for approval prior to final executions.

1.3 REQUIREMENTS INCLUDED

- A. Compile specified warranties.
- B. Compile specified service and maintenance contracts.
- C. Co-execute submittals when so specified.
- D. Review submittals to verify compliance with Contract Documents.
- E. Submit to Architect for review and transmittal to Owner.

1.4 SUBMITTAL REQUIREMENTS

- A. Assemble warranties, bonds, and service and maintenance contracts, executed by each of the respective manufacturers, suppliers, and subcontractors.
- B. Number of original signed copies required: 2 each.
- C. Table of Contents: Neatly typed, in orderly sequence. Provide complete index information for each item.
 1. Product or work item with index number to bound item.
 2. Firm, with name of principal, address, and telephone number.
 3. Scope.
 4. Date of beginning of warranty, bond or service and maintenance contract.
 5. Duration of warranty, bond, or service maintenance contract.
 6. Provide information for Owner's personnel:
 - a. Procedure to be followed in case of failure.
 - b. Circumstances which might affect the validity of warranty or bond.
 7. Contractor, name of responsible principal, address and telephone number.

1.5 FORM OF SUBMITTALS

- A. Prepare in duplicate packets.
- B. Format:
 1. Size 8-1/2 x 11 inches on punched sheets for standard 3-ring binder
 - a. Fold larger sheets to fit into binders.
 2. Warranty-Guaranty wording shall be as printed below.
 3. Cover: Identify each packet with typed or printed title "GUARANTIES AND WARRANTIES". List:
 - a. Title of Project.
 - b. Name of Contractor.

- C. Binders: Commercial quality, 3-ring, with durable and cleanable plastic covers.

1.6 TIME OF SUBMITTALS

- A. Make submittals within 10 days after date of Substantial Completion prior to final request for payment.
- B. For items or work, where acceptance is delayed materially beyond Date of Substantial Completion, provide updated submittal within 10 days after acceptance, listing date of acceptance as start of warranty period.

1.7 SUBMITTALS REQUIRED

- A. Submit warranties, bonds, service and maintenance contracts as specified in respective Sections of Specifications and as follows:
 - 1. Provide when noted in individual Sections of the Project Manual Divisions 2 through 33.

1.8 SAMPLE FORM OF WARRANTY-GUARANTY

- A. Print or type Warranty-Guaranty on installing contractor's own letterhead.
- B. Wording and signatures required.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION

GUARANTEE-WARRANTY

When required by the specifications, warranties and/or guarantees other than one year shall be in the form of the following on the Contractor's own letterhead:

GUARANTEE-WARRANTY FOR INTERMOUNTAINHEALTHCARE, OREM COMMUNITY HOSPITAL, PHARMACY REMODEL (FOR USP 797)

We hereby warrant and the General Contractor and/or Material Manufacturer guarantee that the (name of product, equipment or system) that we have installed in the Intermountain Medical Center project, has been done in accordance with the Contract Documents and that the work as installed will fulfill the requirements of the guaranty-warranty included in the specifications. We agree to repair or replace any or all of our work, together with any other adjacent work which may be displaced by so doing, that may prove to be defective in its workmanship or material within a period of _____ years from the date of Substantial Completion, without any expense whatsoever to the Owner, ordinary wear and tear and unusual abuse or neglect excepted.

In the event of our failure to comply with the above mentioned conditions within sixty (60) days after being notified in writing by the Owner, we collectively or separately do hereby authorize the Owner to proceed to have said defects repaired and made good at our expense, and we will honor and pay the costs and charges therefore upon demand.

Signed _____
(Subcontractor)

Countersigned _____
(General Contractor)

Name _____
(Print)

Name _____
(Print)

Company _____

Company _____

Address _____

Address _____

License No. _____

License No. _____

Countersigned _____
(Material Manufacturer)

Name _____
(Print)

Company _____

Address _____

SECTION 017823 – OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

PART 2 - RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

2.2 SUMMARY

- A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory.
 - 2. Emergency manuals.
 - 3. Operation manuals for systems, subsystems, and equipment.
 - 4. Maintenance manuals for the care and maintenance of products, materials, and finishes.
- B. Related Sections include the following:
 - 1. Division 1 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
 - 2. Division 1 Section "Project Record Documents" for preparing Record Drawings for operation and maintenance manuals.
 - 3. Divisions 2 through 33 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

2.3 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

2.4 SUBMITTALS

- A. Final Submittal: Submit one copy one of each manual in final form at least 15 days before final inspection. Architect will return copy with comments within 15 days after final inspection.
 - 1. Correct or modify each manual to comply with Architect's comments. Submit 3 copies of each corrected manual within 15 days of receipt of Architect's comments.

2.5 COORDINATION

- A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

PART 3 - OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

- A. Organization: Include a section in the directory for each of the following:
 - 1. List of documents.
 - 2. List of systems.
 - 3. List of equipment.
 - 4. Table of contents.
- B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
- C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
- D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

3.2 MANUALS, GENERAL

- A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 - 1. Title page.
 - 2. Table of contents.
 - 3. Manual contents.
- B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:
 - 1. Subject matter included in manual.
 - 2. Name and address of Project.
 - 3. Name and address of Owner.
 - 4. Date of submittal.

5. Name, address, and telephone number of Contractor.
 6. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
1. Binders/Maintenance Manuals: Organize operation and maintenance data into suitable sets of manageable size. Binders shall be Red Buckram binders with easy view metal for sheet size 11" X 8 ½" with expandable metal capacity as required for the project, rivet through construction with library corners using #12 BB and lining with same materials as cover, front cover and back-bone foil stamped in white. Binders shall be as manufactured by Hiller Bookbinding or equal. The master index sheet and each tabbed index sheet shall be AICO Gold-Line indexes or equal. Mark appropriate identification on front spine of each binder. Include the following types of information:
 - a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
 - b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
 2. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
 3. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

3.3 EMERGENCY MANUALS

- A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
 2. Emergency instructions.
 3. Emergency procedures.
- B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
1. Fire.
 2. Flood.
 3. Gas leak.
 4. Water leak.
 5. Power failure.
 6. Water outage.
 7. System, subsystem, or equipment failure.
 8. Chemical release or spill.
- C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- D. Emergency Procedures: Include the following, as applicable:
1. Instructions on stopping.
 2. Shutdown instructions for each type of emergency.
 3. Operating instructions for conditions outside normal operating limits.
 4. Required sequences for electric or electronic systems.
 5. Special operating instructions and procedures.

3.4 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions.
 2. Performance and design criteria if Contractor is delegated design responsibility.
 3. Operating standards.
 4. Operating procedures.
 5. Operating logs.
 6. Wiring diagrams.
 7. Control diagrams.
 8. Piped system diagrams.
 9. Precautions against improper use.
 10. License requirements including inspection and renewal dates.
- B. Descriptions: Include the following:
1. Product name and model number.
 2. Manufacturer's name.
 3. Equipment identification with serial number of each component.

4. Equipment function.
 5. Operating characteristics.
 6. Limiting conditions.
 7. Performance curves.
 8. Engineering data and tests.
 9. Complete nomenclature and number of replacement parts.
- C. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
 2. Equipment or system break-in procedures.
 3. Routine and normal operating instructions.
 4. Regulation and control procedures.
 5. Instructions on stopping.
 6. Normal shutdown instructions.
 7. Seasonal and weekend operating instructions.
 8. Required sequences for electric or electronic systems.
 9. Special operating instructions and procedures.
- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- E. Piped Systems: Diagram piping as installed and identify color-coding where required for identification.

3.5 PRODUCT MAINTENANCE MANUAL

- A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Product Information: Include the following, as applicable:
1. Product name and model number.
 2. Manufacturer's name.
 3. Color, pattern, and texture.
 4. Material and chemical composition.
 5. Reordering information for specially manufactured products.
- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
1. Inspection procedures.
 2. Types of cleaning agents to be used and methods of cleaning.
 3. List of cleaning agents and methods of cleaning detrimental to product.

4. Schedule for routine cleaning and maintenance.
 5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

3.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
1. Standard printed maintenance instructions and bulletins.
 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 3. Identification and nomenclature of parts and components.
 4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
1. Test and inspection instructions.
 2. Troubleshooting guide.
 3. Precautions against improper maintenance.
 4. Aligning, adjusting, and checking instructions.
 5. Demonstration and training videotape, if available.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.

2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
 - G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 1. Include procedures to follow and required notifications for warranty claims.

PART 4 - EXECUTION

4.1 MANUAL PREPARATION

- A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
 1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
- E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with

information contained in Record Drawings to ensure correct illustration of completed installation.

1. Do not use original Project Record Documents as part of operation and maintenance manuals.
 2. Comply with requirements of newly prepared Record Drawings in Division 1 Section "Project Record Documents."
- F. All manuals will be delivered in electronic format to the owner upon project completion. No hard copy manuals will be accepted.
- G. Comply with Division 1 Sections for schedule for submitting operation and maintenance documentation.

END OF SECTION

SECTION 017839 – PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product Data.
- B. Related Sections include the following:
 - 1. Division 1 Section for general closeout procedures.
 - 2. Division 1 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
 - 3. Divisions 2 through 33 Sections for specific requirements for Project Record Documents of the Work in those Sections.

1.3 SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit one set(s) of marked-up Record Prints.
 - a. Final Submittal: Submit one set(s) of marked-up Record Prints showing modifications for trades involved in the project.
- B. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit one copy of each Product Data submittal.
 - 1. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in manual instead of submittal as Record Product Data.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.
1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an understandable drawing technique.
 - c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Depths of foundations below first floor.
 - d. Locations and depths of underground utilities.
 - e. Revisions to routing of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Actual equipment locations.
 - h. Duct size and routing.
 - i. Locations of concealed internal utilities.
 - j. Changes made following Architect's written orders.
 - k. Details not on the original Contract Drawings.
 - l. Field records for variable and concealed conditions.
 3. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
 4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

2.2 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.

2.3 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.
- B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

END OF SECTION

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SECTION 017900 – CLEANING

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included: Requirements for periodic, general, and final cleaning of the project.
- B. Provide temporary and periodic clean-up of extra materials, waste and general debris during construction of the work, together with the final clean-up and cleaning, polishing and other "housekeeping" required to bring various surfaces to an acceptable condition prior to final inspection, or before additional work is done during construction.
- C. This Section includes requirements for Cleaning for all phases of the Project. Some requirements of this Section may not be applicable to individual project Phases.

1.2 GENERAL REQUIREMENTS

- A. Maintain premises and public properties free from accumulations of waste, debris, and rubbish in accordance with applicable safety and insurance standards and local ordinances.
- B. The acceptable level of cleanliness of the Project shall be the decision of the Architect.
 - 1. Work necessary to achieve such acceptable state shall be performed when required.
- C. Burning: Burning of waste materials and/or rubbish on Site is not permitted.

1.3 CLEAN-UP DURING CONSTRUCTION

- A. During construction, provide cleaning-up as follows:
 - 1. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
 - 2. Remove debris and rubbish from pipe chases, plenums, down spouts, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
 - 3. Broom and vacuum clean interior areas prior to start of surface finishing and continue cleaning to eliminate dust.
 - 4. Remove waste materials, debris, and rubbish from site weekly, or more often if needed, and dispose off-site in compliance with local regulations.
 - 5. Storage areas: Ensure that materials to be used for construction are stored in designated structures or areas by the appropriate trades. Maintain such areas or structures in a clean condition for the life of the

- Project.
6. Containers: Provide appropriate containers, such as dump containers, and locate on site for collection of waste materials and rubbish.
 7. Supervision: Oversee all cleaning of areas by the trades using them. Ensure that resulting accumulations are deposited in appropriate containers.
 8. Clean-up: Daily, weekly, or as necessary, clean-up floors and Site areas. Remove all loose materials, by sweeping if necessary.

1.4 FINAL CLEANING

- A. Provide final clean-up and polishing just prior to final inspection and/or acceptance of the work of the Project.
- B. Preparation:
 1. Prior to final inspection, remove all loose material of any nature, except spare parts, loose furniture or furnishings, manuals, parts books, and similar items.
 2. Remove all temporary buildings, utility lines or pipes and other work of a temporary nature.
 3. Remove all temporary wrappings. Leave no trace of wrap or adhesive.
- C. Surface Cleaning:
 1. Special cleaning for specific units of Work as specified and as shown on Drawings.
 2. Provide final cleaning of the Work, at time indicated, consisting of cleaning each surface or unit of Work to normal "clean" condition expected for a first-class building cleaning and maintenance program.
 3. Comply with manufacturer's instructions for cleaning operations.
- D. The following are examples, but not by way of limitation, of cleaning levels required:
 1. Remove labels which are not required as permanent labels.
 2. Clean transparent materials, including mirrors and window/door glass, to a polished condition, removing substances which are noticeable as vision-obscuring materials. Replace broken glass and damaged transparent materials.
 3. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of dust, stains, films, and similar noticeable distracting substances.
 - a. Except as otherwise indicated, avoid disturbance of natural weathering of exterior surfaces.
 - b. Restore reflective surfaces to original reflective condition.
 4. Wipe surfaces of mechanical and electrical equipment clean, including elevator equipment and similar equipment; remove excess lubrication and other substances.
 5. Remove debris and surface dust from limited-access spaces including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 6. Clean concrete floors in unoccupied spaces broom clean.

7. Vacuum clean carpeted surfaces and similar soft surfaces.
 8. Clean plumbing fixtures to a sanitary condition, free of stains including those resulting from water exposure.
 9. Clean light fixtures and lamps so as to function with full efficiency.
 10. Clean Project Site (staging areas, Contractor Parking areas), including landscape development areas, of litter and foreign substances.
 11. Sweep paved areas to a broom-clean condition; remove stains, petro-chemical spills, and other foreign deposits.
- E. Pest Control: Engage an experienced exterminator to make a final inspection of Project, and to rid Project of rodents, insects, and other pests.
- F. Removal of Protection: Except as otherwise indicated or requested by Hospital Representative, remove temporary protection devices and facilities which were installed during course of Work to protect previously completed Work during remainder of construction period.
- G. Compliances:
1. Comply with safety standards and governing regulations for cleaning operations.
 2. Do not burn waste materials at site, or bury debris or excess materials on the property, or discharge volatile or other harmful or dangerous materials into drainage systems.
 3. Remove waste materials from site and dispose of in a lawful manner.
- H. Moving Parts: Lubricate moving parts as recommended by the parts manufacturer, or as directed by the Architect. Wipe clean, all surplus lubricants.
- I. Protection: Protect finished floors from damage due to traffic or other causes.

END OF SECTION

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SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Demolition and removal of selected portions of a building or structure.
 - 2. Repair procedures for selective demolition operations.

1.3 DEFINITIONS

- A. Remove: Carefully detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- C. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 MATERIALS OWNERSHIP

- A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, demolished materials shall become Contractor's property and shall be removed from Project site.

1.5 SUBMITTALS

- A. Proposed Dust-Control and Noise-Control Measures: Submit statement or drawing that indicates the measures proposed for use, proposed locations, and proposed time frame for their operation. Identify options if proposed measures are later determined to be inadequate.

1.6 PROJECT CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be

- disrupted. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.
- B. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.
 - 1. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from authorities having jurisdiction.
 - C. Owner assumes no responsibility for condition of areas to be selectively demolished.
 - 1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
 - D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. If materials suspected of containing hazardous materials are encountered in the work, Contractor will be responsible for removal and disposal of all materials. A copy of an Asbestos Report will be provided to the Contractor prior to construction beginning. See Bid Proposal for unit price to remove hazardous materials.
 - E. Storage or sale of removed items or materials on-site will not be permitted.
 - F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- C. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

3.2 UTILITY SERVICES

- A. Existing Utilities: Maintain services indicated to remain and protect them against damage during selective demolition operations.
- B. Do not interrupt existing utilities serving occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and to authorities having jurisdiction.
 - 1. Provide at least 72 hours' notice to Owner if shutdown of service is required during changeover.
- C. Utility Requirements: Locate, identify, disconnect, and seal or cap off indicated utilities serving areas to be selectively demolished.

3.3 PREPARATION

- A. Temporary Enclosures: Provide temporary enclosures for protection of existing building and construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
 - 1. Where heating or cooling is needed and permanent enclosure is not complete, provide insulated temporary enclosures. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
- B. Temporary Partitions: Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.

3.4 SELECTIVE DEMOLITION

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
 - 2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 - 3. Dispose of demolished items and materials promptly.
- B. Existing Facilities: Comply with building manager's requirements for using and protecting building facilities during selective demolition operations.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

END OF SECTION

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Design Mixtures: For each concrete mixture.
- C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement.

1.3 INFORMATIONAL SUBMITTALS

- A. Material certificates.
- B. Material test reports.
- C. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- B. Testing Agency Qualifications: An independent agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1.5 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.

1.6 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 306.1.

1. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- B. Hot-Weather Placement: Comply with ACI 301 (ACI 301M).
- C. Verify underground utilities prior to concrete cutting or chipping and notify architect and owner if utilities exist.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 1. ACI 301 (ACI 301M).
 2. ACI 117 (ACI 117M).

2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice."

2.3 CONCRETE MATERIALS

- A. Cementitious Materials:
 1. Portland Cement: ASTM C 150/C 150M, Type I/II, gray.
 2. Fly Ash: ASTM C 618, Class F.
 3. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.
- B. Normal-Weight Aggregates: ASTM C 33/C 33M, graded.
 1. Maximum Coarse-Aggregate Size: 1 inch (25 mm) nominal.
 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.

4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
- D. Water: ASTM C 94/C 94M.

2.4 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

2.5 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301 (ACI 301M).
- B. Cementitious Materials: Use fly ash, pozzolan, slag cement, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.
- C. Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use water-reducing high-range water-reducing admixture in concrete, as required, for placement and workability.
 2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a w/c ratio below 0.50.

2.6 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Normal-Weight Concrete:
1. Minimum Compressive Strength: 3000 psi (20.7 MPa) at 28 days.
 2. Maximum W/C Ratio: 0.50.

3. Slump Limit: 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25 mm).
4. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

2.7 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.8 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
 1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301 (ACI 301M), to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 (ACI 117M).

3.2 EMBEDDED ITEM INSTALLATION

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.3 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

3.4 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
 - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 - 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

3.5 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.
- B. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

3.6 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
 - 1. Apply float finish to surfaces to receive underlayment.
- C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - 1. Apply a trowel finish to surfaces to be covered with resilient flooring.
 - 2. Finish and measure surface, so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- (3.05-m-) long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch (3.2 mm). Comply with medical equipment vendor

3.7 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 (ACI 301M) for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.

3.8 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

3.9 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

END OF SECTION

SECTION 035300- CONCRETE TOPPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included: Provide and install concrete toppings (cementitious underlayments), complete, as shown on Drawings and as specified, including:
 - 1. Miscellaneous tapers and warps for alignment of top-of-finish flooring at transitions between materials of different heights and thickness, including:
 - a. Section 093000 – Tile.
 - b. Section 096519 – Resilient Tile Flooring.
 - c. Section 096813 – Tile Carpeting.
 - d. Concrete Floors without finish or painted finish.
 - 2. Remedial correction of interior floor slabs to provide specified floor flatness as specified in Section 033000 – Cast-in-Place Concrete; at no additional cost to Owner.
- B. Work Specified Elsewhere:
 - 1. Section 033000 – Cast-in-Place Concrete. Use concrete from this Section when the thickness is at least 2-inches.
 - 2. Section 093000– Tile; Polymer-modified mortars for tile assemblies sloped to drains.

1.2 SUBMITTALS

- A. Comply with requirements of Section 013300 – Submittal Requirements.
- B. Product Data: Manufacturer's literature describing materials and specifications for mixing, placing, curing, and protecting.

1.3 QUALITY ASSURANCE

- A. Applicator: Approved and trained by manufacturer.
- B. Design Criteria:
 - 1. Compressive Strength: Minimum 4,100-PSI at 28 Days per ASTM C109.

1.4 PRODUCT HANDLING

- A. Delivery: Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use.
- B. Storage: Ensure storage facilities are weathertight and dry.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. General: Ardex Inc; Dependable Inc; or equal. Ardex products are specified as Basis-of-Design

2.2 MATERIALS

A. Concrete Topping Types:

1. Self-Leveling Type for Interior Applications: Ardex K-15, or approved equal; 4,100-PSI compressive strength, 16-hour curing time. Installs from feather-edge depth to 1 1/2-inch depth without aggregate; installs up to 5-inch depth with addition of aggregate per manufacturer's written instructions.
2. Trowelable Fast-Setting Patch Type for Interior Applications: Ardex SD-P, or equal; 4,200-PSI compressive strength, 1-hour curing time. Installs from feather-edge depth to 1-inch depth without aggregate; installs up to 3-inch depth with addition of aggregate per manufacturer's written instructions.
3. Fast-Setting, Self-Leveling Type for Interior Applications: Ardex SD-T, or equal; 6,100-PSI compressive strength, 2-hour curing time. Installs from 1/4-inch to 2-inch depth without addition of aggregate, and up to 5-inches depth with addition of aggregate per manufacturer's written instructions.
4. Weather-Resistant, Self-Leveling Type for Interior Applications: Ardex A-300, 3,200-PSI compressive strength. Installs from 1/4-inch depth to 1/2-inch depth without aggregate; installs up to 3/4-inch depth with addition of aggregate per manufacturer's written instructions.
5. Polymer-Reinforced, Weather-Resistant Type for Interior Applications: Ardex Poly-Top, 5,500-PSI compressive strength. Installs from 1/4-inch depth to 1-inch depth without aggregate; installs up to 2-inch depth with addition of aggregate per manufacturer's written instructions.
6. Trowelable Fast-Setting Patch Type for Interior Applications: Ardex CD, 4,000-PSI compressive strength. Installs from 1/16-inch depth to 1/2-inch depth without aggregate.

- B. Primer: Ardex P-51, or equal, and as recommended in writing by the topping manufacturer for the substrata to receive topping.

C. Aggregate:

1. Sand: 1/16-inch or less washed masonry sand, mortar sand, or plaster sand.
2. Gravel: 3/8-inch pea gravel.

- D. Water: Clean and potable, free from impurities detrimental to underlayment.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Examine substrate and verify that surfaces are free from debris and are reasonably clean and dry and that conditions are otherwise

suitable to receive topping. Do not start Work until conditions are satisfactory.

3.2 PREPARATION

- A. Cracks and Voids: Fill with trowelable fast-setting patch type concrete topping.

3.3 MIXES

- A. General: Mix concrete toppings per manufacturer's recommendations.
- B. Aggregates: Add sand or gravel aggregates to topping mix per manufacturer's recommendations for topping thickness.

3.4 INSTALLATION

- A. General: Prime substrates, mix materials, and place toppings per manufacturer's recommendations.
- B. Thickness: Install to thickness as shown or as required, spreading and screeding to smooth surface; abut level to existing surface.
- C. Edge Forms: Provide as required.
- D. Ramps and Slopes to Drains: Including other accommodations for level changes; form with trowelable fast-setting patch type cementitious underlayment.
 - 1. Sloped-to-Drain Setting bed materials for Patient Bathrooms, Showers and Tub Rooms provided in 093000 – Tile.
- E. Finish: As recommended by flooring manufacturer for reception of specified finish materials.
- F. Exterior Work: Provide weather-resistant toppings at concealed locations or at the written direction of the Owner.
- G. Transitions between Floor Finishes of differing thickness:
 - 1. General: Provide concrete topping as required to align top-of-finish floor where flooring materials of different thickness meet.
 - 2. Performance Criteria:
 - a. Provide concrete topping as required so that all offsets between adjacent floor materials are 1/8-inch or less.
 - b. Warp-applied concrete topping with a slope no greater than 1 inch in 48 inches, or a length of slope no less than 18 inches, whichever produces the more gentle transition.
 - 3. Locations: Provide at locations where transitions between the following floor finishes occur that result in a vertical offset of greater than 1/8-inch:
 - a. Section 093000 – Tile.
 - b. Section 096519 – Resilient Flooring.
 - c. Section 096813 – Tile Carpeting.
 - d. Concrete Floors without finish or painted finish.

3.5 CURING

- A. General: Allow concrete topping to harden as recommended by manufacturer.
- B. Traffic: Do not permit traffic on topping during hardening period; minimum 2 hours or longer.
- C. Loading: Do not load floors until reasonable strength has been achieved. Evenly distribute any loading on topping and prohibit concentrated loading.
- D. Conditions: Maintain adequate ventilation and temperature above 50 degrees F. until topping is dry.

3.6 CLEANING AND REPAIR

- A. General: Repair concrete topping damaged after installation as a result of other trades prior to installation of scheduled floor finish, if any, at no additional cost to Owner.

END OF SECTION

SECTION 050500 – METAL FASTENERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included: This Section establishes general standards and requirements for metal fasteners utilized for attachment of items to the primary structure of the building and is incorporated in others Sections of these specifications where referenced, including:
1. Expansion Bolts.
 2. Powder Actuated Devices.
 3. Bolts, screws and other fasteners.
- B. Work Specified Elsewhere:
1. Section 033000 – Cast-in-Place Concrete.
 2. Section 092216 – Non-Structural Metal Framing
 3. DIVISION 23 – Mechanical.
 4. DIVISION 26 – Electrical.

1.2 SUBMITTALS

- A. Comply with provisions of Section 013300 – Submittal Procedures.
- B. Product Data: Manufacturers' information on materials, fabrication, and installation. Include current ICBO Reports and other information to substantiate compliance with Contract Documents.
- C. Substitutions: Include with requests for substitution of fastening device type, minimum embedment, length, load capacity for pull out and shear, and installation torque of fasteners and statement that fastening devices meet or exceed requirements specified in Contract Documents.

1.3 QUALITY ASSURANCE

- A. Field Quality Control:
1. The Owner's Testing Lab will perform and report on tests and inspections as follows:
 2. Expansion Bolts:
 - a. Test 50 percent of drilled-in anchorages to 2.0 times the allowable load specified with special inspection in tension.
 - b. If any anchor fails testing, test all anchors of the same category installed that day until twenty consecutive anchors pass, then resume the initial testing frequency. Cost of this testing shall be borne by Contractor.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Expansion Bolts: Hilti, Inc.'s Kwik Bolt II, Kwik Bolt III or equal; wedge type stud expansion anchor system, comply with FS FF-S-325, Group II, Type 4, Class 1. Provide stainless steel expansion bolts for exterior exposure.
- B. Powder Actuated Devices: Hilti Fastening Systems, Impex Tool Corporation, or equal; pins and tools. Tempered steel pins with special corrosion-resistant finish. Provide guide washers to accurately control penetration. Accomplish fastening by low-velocity piston-driven powder-actuated tool.
 - 1. Type and Size: Hilti X-DNI, dome head nail with smooth shank, 0.145-inch shank diameter, not less than 1-1/4-inch penetration.
- C. Sheet Metal Screws: John Wagner Associates' Grabber or equal: Unless otherwise noted on Drawings, type to suit stud, track, or channel gauge and as follows.
 - 1. Where Overlaid with Gypsum Board or Other Finish Material:
 - a. For Fastening to 20 Gauge and Lighter Material: No. 8 by 9/16-inch Wafer Head Streaker.
 - b. For Fastening to 18 Gauge and Heavier Material: No. 8 by 1/2-inch Wafer Head Self-Drilling.
 - 2. Where Not Overlaid with Finish Material:
 - a. For Fastening to 20 Gauge and Lighter Material: No. 8 by 9/16-inch Hex Head Streaker.
 - b. For Fastening to 18 Gauge and Heavier Material: No. 8 by 1/2-inch Hex Head Self-Drilling.
- D. Nuts and Bolts: ASTM A307 with suitable nuts, in accordance with ASTM A563, and washers 1/4-inch diameter, unless otherwise noted.
- E. U-Bolts: Special sizes and shapes shown; material as specified for nuts and bolts.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Expansion Bolts: Install in predrilled holes for fastening items into concrete.
 - 1. Install expansion bolts according to the manufacturer's instructions as to tools, torque and tightening procedure.
 - 2. Expansion bolt locations and spacings: As shown.
 - 3. Edge Distance: Not less than 10 bolt diameters.
 - 4. Unless otherwise noted, install expansion bolts with manufacturer's recommended minimum embedments. Embedment length is exclusive of thickness of floor coverings, grout pads or other overlays.

5. Do not recess expansion bolts more than one-fourth of the nominal bolt diameter. Abandon overdrilled holes or partially fill with nonshrink grout and redrill when grout has set.
 6. Abandon holes if the axis of a drilled hole deviates more than 5 degrees from normal to the concrete surface.
 7. If a concrete reinforcing bar is encountered during drilling, immediately terminate drilling and notify the Architect. Subject to review and approval the SEOR, the Architect may authorize using one of the following procedures:
 - a. If the location may be shifted, fill abandoned hole with non-shrink grout and install expansion bolt with a minimum of 1/2 inch of sound concrete between the expansion bolt and the abandoned hole, or...
 - b. If the location may not be shifted, use a diamond core drill to cut the rebar and drill the hole beyond the reinforcing such that the whole wedge portion of the expansion bolt can be expanded below the bar, or...
 - c. If the location may not be shifted, core an oversize hole at the direction of the Architect and grout an acceptable anchor in place.
- B. Fasten Work tightly to prevent rattle or vibration except where expansion-contraction tolerances are required.
- C. When expansion bolts are installed through metal deck into concrete slab above, embedment shall not extend closer than 3/4-inch to top of concrete. Locate at center of bottom flute. Minimum embedment shall be 1-1/2-inches above top flute of decking.
- D. Expansion Bolt Test Values:
1. Test Procedure: Apply proof test loads by means of hydraulic ram, calibrating spring loading device, or torque wrench without removing nut if possible. If not possible, remove nut and install a threaded coupler to same tightness as original nut using a torque wrench.
 2. Test Equipment: Calibrated by approved testing laboratory per standard industry procedures.
 3. Expansion Bolts shall withstand following minimum test loads for specified wedge type anchors:

<u>Anchor Thread Size</u> (diameter in inches)	<u>Tension Test Load</u> (lbs.)	<u>Test Torque</u> (ft-lbs.)
1/4	800	10
3/8	1100	25
1/2	2000	50
5/8	2300	80
3/4	3700	150
1	5800	250

4. Acceptance Criteria:
 - a. Hydraulic Ram Method: Expansion bolt is acceptable if there is no observable movement nor loosening of washer at

- application of tension test load.
 - b. Torque Wrench Method: Expansion bolt is acceptable if the test torque is reached within one-half turn of the nut.
5. Test Timing: Within 24 hours after expansion bolt installation and in the presence of the Inspector of Record.

END OF SECTION

SECTION 054000 – COLD FORMED METAL FRAMING AND SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included: Provide and install cold formed metal framing system as specified, including:
1. Interior Partition, Wall and Soffit assemblies only when shown on Drawings to be included in the Work of this Section.
 - a. Typical interior assemblies are provided in Section 09110 – Interior Wall Framing.
- B. Delegated Design: Provide design of the cold-formed metal framing system including support and anchorage of the cladding systems specified elsewhere, including comprehensive engineering analysis by a qualified professional engineer licensed in the State of Utah, using seismic performance requirements and design criteria indicated.
- C. Framing Types:
1. Galvanized 16-gauge or heavier steel fabrications, including:
 - a. "C" shaped metal studs and coordinated stud tracks.
 - b. "Z" shaped furring channels.
 - c. Miscellaneous Shapes, sizes and profiles as shown on Drawings and as required to achieve the framing configurations indicated.
 - d. Sheet metal and cold-formed metal backing materials.
 - e. Welded, screwed and bolted connections as shown on Drawings and as required to achieve the framing configurations indicated.
- D. Work Specified Elsewhere:
1. Section 05050 – Metal Fasteners.
 2. Section 09250 – Gypsum Board (Interior Gypsum Board Products).

1.2 SYSTEM DESCRIPTION

- A. General: Design work of this Section by qualified Structural Engineer registered in the State of Utah.
- B. Size and arrange components and accessories to support dead loads and to withstand live loads, wind loads and seismic loads. Component sizes, gauges, and spacing shall be considered minimum requirements and shall be increased where required to comply with specified design criteria.
- C. Dead Load: Design system to support the weight of construction materials incorporated into and supported by the Work, including but not limited to walls, roofs, ceilings, finishes, cladding and other similarly incorporated architectural and structural items.
- D. Live Load: Design system to withstand loads produced by the use and occupancy of the building per applicable code.
- E. Wind Load: Design system to withstand maximum positive (inward acting) and negative (outward acting) pressures per the components and cladding provisions of AISC/SEI 7-05, Minimum Design Loads for Buildings and Other Structures, chapter 6, but not less than 20 psf.

1. Basic Wind Speed (3 second gust): 90 mph.
 2. Importance Factor, I_w : 1.15.
 3. Exposure: C
 4. Internal Pressure Coefficient, G_{Cpi} : 0.18
 5. Topographic Factor, K_{ht} : 1.0
 6. Minimum design wind pressure shall be as follows unless substantiated by engineering analysis and approved by the Architect.
 - a. Zone 1: 20 psf inward, 40 psf outward
 - b. Zone 2: 20 psf inward, 62 psf outward
 - c. Zone 3: 20 psf inward, 85 psf outward
 - d. Zone 4: 27 psf inward, 27 psf outward
 - e. Zone 5: 27 psf inward, 50 psf outward
- F. Seismic Load: Design system to withstand force and displacement demands per the seismic design requirements for nonstructural components in AISC/SEI 7-05, Minimum Design Loads for Buildings and Other Structures, chapter 13.
- G. Maximum Allowable Deflection: Design system to withstand 100 percent loading without deflecting beyond the limits specified below.
1. Interior Partitions: $L/360$.
 2. Interior Ceilings: $L/600$, but not more than 1/4-inch deflection.
- H. Design system to withstand movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperatures.
- I. Design system to accommodate vertical deflection of building structural members and construction tolerances.
- J. Design system to accommodate seismic relative displacements. Interstory drift shall be taken as 1.1 inches per floor.
- K. Stud Depth:
1. Interior Partitions: Where shown on Drawings to be provided in the Work of this Section; 3-5/8 inches, unless otherwise noted or as otherwise required to fulfill design criteria.
- L. Stud and Joist Spacing: Not more than 16-inches on center.
- M. Connections: Design screws, welds, anchors, clips and other connection elements as necessary for a complete installation and to support the load combinations as specified in the applicable building code. Comply with the nonstructural component anchorage provisions in ASCE/SEI 7-05 chapter 13.
1. Power actuated fasteners shall not be used for tension load applications.
 2. Friction clips shall not be used for anchorage attachment.
 3. Connections imposing horizontal forces shall not be made to the bottom flange of structural steel framing members.

1.3 SUBMITTALS

- A. Comply with provisions of Section 01330 – Submittal Procedures.
- B. Submit 4 copies of Product Data:
 - 1. Submit manufacturer's product information and installation instructions for each item of cold formed framing and accessories.
- C. Submit 4 copies of the Shop Drawings: Shop drawings shall be signed and stamped by a Structural Engineer registered in the State of Utah.
 - 1. Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
 - 2. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
 - a. Include placing drawings for framing members showing size and gauge designations, number, type, location and spacing. Clearly identify attachments and connections using AWS symbols for welds and standard designations for fasteners.
- D. Engineering Calculations: Submit calculations for loadings and stresses of system members and connections. Calculations shall be signed and stamped by a Structural Engineer registered in the State of Utah.

1.4 QUALITY ASSURANCE

- A. Comply with latest edition of the following standards:
 - 1. American Iron and Steel Institute (AISI): "Specification for Design of Cold-Formed Steel Structural Members."
 - 2. Applicable provisions of AWS D1.1 and D1.3.

1.5 PRE-INSTALLATION CONFERENCE

- A. Conduct meeting one month prior to commencement of work.
- B. Confirm method of attachment and connection of cold formed metal elements.

1.6 DELIVERY AND STORAGE

- A. Comply with requirements in Section 01600 – Product Requirements.
- B. Protect metal framing units from rusting and damage:
 - 1. Deliver to project site in manufacturer's unopened containers or bundles, fully identified with name, brand, type and grade.

2. Store off ground in a dry ventilated space or protect with suitable waterproof coverings.

1.7 PROJECT CONDITIONS

A. Environmental Requirements:

1. When unfavorable weather conditions necessitate interrupting steel work, work shall stop or protection of steel elements shall be made so as to not compromise the quality of work.
2. There shall be no extra cost to the Owner to pay for special protection of steel elements if required by weather conditions.

PART 2 - PRODUCTS

2.1 COLD-FORMED METAL MATERIALS

A. Materials and Finishes:

1. For 16-gauge and heavier units, fabricate metal framing components of structural quality steel sheet with a minimum yield point of 50,000 psi; ASTM A 446, A 570, or A 611.
2. Provide galvanized finish to metal framing components complying with ASTM A 525 for minimum G 60 at all locations.
3. Fasteners: Provide nuts, bolts, washers, screws, and other fasteners with corrosion-resistant plated finish.
4. Electrodes for Welding: Comply with AWS Code and as recommended by stud manufacturer.
5. Galvanizing Repair: Where galvanized surfaces are damaged, prepare surfaces and repair in accordance with procedures specified in ASTM A 780.

B. Partition Top Track:

1. General: Top track screwed to metal studs nested in, but not attached to, 16-gauge compensation channel as shown.

C. "C"-Shape Studs: Manufacturer's standard load-bearing steel studs of size, shape, and gauge indicated, with 1.625 inches flange minimum and flange return lip.

- D. Size: Provide 6-inch-deep by 16-gauge studs at 16-inch centers, unless otherwise shown.
- E. System Components: With each type of metal framing required, provide manufacturer's standard steel runners (tracks), compensation channels, blocking, lintels, clip angles, shoes, reinforcements, fasteners, and accessories as recommended by manufacturer for applications indicated, and as needed to provide a complete metal framing system.

2.2 SHEATHING MATERIALS

- A. Mat-Faced Gypsum Sheathing: Use throughout unless otherwise noted.
 - 1. Typical Finish Board: ASTM C1177, Type X, Dens-Glass Gold Fireguard, as manufactured by Georgia Pacific Company, or equivalent.
 - a. Size: 48 inches by maximum available length to minimize joints. provide metal stud framing or backing as shown at all panel edges.
 - 2. Fasteners: ASTM C954 or ASTM C1002 self-drilling and self-tapping corrosion-resistant screws; minimum No. 6 x 1-1/2 inches at 8 inches on center maximum spacing at perimeter and intermediate framing member and backing.
 - a. Adhesive attachment is not allowed.
 - b. Do not countersink fasteners.

2.2 FABRICATION

- A. General: Framing components may be prefabricated into panels prior to erection.
 - 1. Fabricate panels plumb, square, true to line and braced against racking with joints welded.
 - 2. Perform lifting of prefabricated panels in a manner to prevent damage or distortion.
- B. Fastenings: Attach similar components by welding.
 - 1. Attach dissimilar components by welding, bolting, or screw fasteners, as standard with manufacturer.
 - 2. Comply with AWS requirements.
 - 3. Wire tying of framing components is not permitted.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Prior to commencement of erection, become thoroughly familiar with site conditions.

- B. In the event unsatisfactory site conditions are found, immediately notify the owner's representative in writing, indicating the nature and extent of unsatisfactory conditions.
- C. Do not begin erection until unsatisfactory conditions have been corrected.

3.2 COLD FORMED METAL FRAMING INSTALLATION

- A. Manufacturer's Instructions: Install metal framing systems in accordance with manufacturer's printed or written instructions and recommendations, unless otherwise indicated.
- B. Install continuous tracks sized to match studs.
 - 1. Align tracks accurately to layout at base and tops of studs.
 - 2. Secure tracks as recommended by stud manufacturer for type of construction involved, except do not exceed 24 inches o.c. spacing for nail or powder-driven fasteners, or 16 inches o.c. for other types of attachment, or as shown on Drawings.
 - 3. Provide fasteners at corners and ends of tracks.
- C. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.
- D. Install supplementary framing as follows:
 - 1. Where blocking and bracing in metal framing system indicated to support fixtures, equipment, services, casework, heavy trim and furnishings, and similar work requiring attachment to the wall or partition.
 - 2. Where type of supplementary support is not otherwise indicated, comply with stud manufacturer's recommendations and industry standards in each case, considering weight or loading resulting from item supported.
- E. Installation of Wall Stud System: Secure studs to bottom runner tracks by either welding or screw fastening at both inside and outside flanges. Secure studs to top runner tracks as shown to accommodate building movement.
- F. Wall openings larger than 2 feet-0 inches square:
 - 1. Frame with double stud at each jamb of frame except where more than 2 are either shown or indicated in manufacturer's instructions.
 - 2. Install runner tracks and jack studs above and below wall openings.
 - 3. Anchor tracks to jamb studs with stud shoes or by welding, and space jack studs same as full-height studs of wall.
 - 4. Secure stud system wall opening frame in manner indicated.
- G. Frame both sides of expansion and control joints, with separate studs; do not bridge the joint with components of stud system.
- H. Install horizontal stiffeners in stud system, spaced (vertical distance) at not more than 4 foot-6 inches o.c. Weld at each intersection.

1. Where stud system abuts structural columns or walls, including masonry walls, anchor ends of stiffeners to supporting structure.
- I. Erection Tolerances: Install cold-formed metal framing to a maximum allowable tolerance variation from plumb, level, and true to line of 1/8-inch in 10 feet (1:960) and as follows:
 1. Space individual framing members no more than plus or minus 1/8 inch from plan location.
 2. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.3 EXTERIOR SHEATHING INSTALLATION

A. General Requirements:

1. Sheathing applied as a sub-strata for a specified exterior finish system or assembly shall conform to the written installation requirements for the finish system without exception.
2. Cut panels by scoring and breaking per manufacturers' instructions or by sawing from face side. Smooth all cut edges and ends of gypsum board where necessary, in order to obtain neat jointing.
3. Rated Assemblies: Provide rated assemblies in conformance with Underwriter's Laboratories (UL) listings where indicated on Drawings and as required by the governing codes.
4. At penetrations of rated assemblies, preserve continuity of fire rating with firestopping systems as specified in Section 07840 – Firestopping and Smoke Seals.
5. Protection: Cover and protect exterior sheathing products within the manufacturer's written time limits for exposure to weather and sunlight.

3.4 FIELD PAINTING

- #### A. Touch-up shop-applied protective coatings damaged during handling and installation. Use compatible primer for prime coated surface; Use galvanizing repair paint for galvanized surfaces.

3.5 FIELD QUALITY CONTROL

A. The Owners's Testing Agency will:

1. Inspect shop and field welded connections including, but are not limited to, those for wall studs, headers, tracks, joists, braces, and hangers.
 - a. Visually inspect all structural field welds of all parts of all joints and connections, and all other necessary structural welds.
 - b. Fillet welds shall be inspected in accordance with AWS D1.3.
2. Proof load concrete expansion anchors in accordance with Section 05050 – METAL FASTENERS.

- B. Contractor shall correct deficiencies in the work that inspections have indicated to be not in compliance with the requirements at the Contractor's expense. Any inspections that may be necessary to reconfirm any non-compliance of corrected work shall be at the Contractor's expense.

END OF SECTION

SECTION 057000 – STANDARDS FOR ALUMINUM WORK

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section does not include Work itself but establishes general standards and requirements for architectural aluminum work and is incorporated in other Sections of these specifications where it is referenced.
 - 1. Provide labor, materials, equipment, services, and related Work to complete Aluminum Work in conformance with the requirements of this Section unless otherwise noted in the referenced related Sections.
 - 2. Provide finish standards for aluminum items specified in other Sections unless otherwise noted in the referenced related Sections.

1.2 RELATED SECTIONS

- A. Refer to specific requirements of the following Sections:
 - 1. Section 084113 – Aluminum Entrances and Storefronts.
 - 2. Section 084229 – Sliding Automatic Entrances.

1.3 SUBMITTALS

- A. Comply with provisions of Section 013300 – Submittal Procedures.
- B. Samples: Submit 2 sets of samples of production run materials only as indicated in other sections.
 - 1. Size: Extrusions, not less than 12 inches long; sheet, 8 by 10 inches; castings, full size: thicknesses, as specified or proposed for use.
 - 2. Samples shall show maximum color and texture range proposed for use.
 - 3. Identify pretreatment, gauge, color, finish treatment, and portion of work sample represents.
 - 4. Do not proceed with processing aluminum finishes until approval has been obtained.
- C. Coating Certification: Submit coating applicator's affidavit or certified test report from approved testing agency stating compliance with requirements for coating.

1.4 QUALITY ASSURANCE

- A. Comply with the latest edition of the following Standards:
 - 1. The Aluminum Association (AA):
 - a. "Designation System for Aluminum Finishes".
 - b. "Care of Aluminum."
 - 2. Architectural Aluminum Manufacturers Association "Specification for

3. Organic Coating for Aluminum Extruded Products" (AAMA 603).
Architectural Aluminum Manufacturers Association "Specification for High Performance Organic Coatings on Architectural Extrusions and Panels" (AAMA 605).

- B. Welders' Qualifications: Welders for structural connections shall be qualified in accordance with AWS requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with provisions of Section 016000 – Product Requirements.
- B. Pack, ship, unload, store, and protect materials to prevent abuse, damage, and defacement such as stains, discolorations, scratches, abrasions, or soiling from any source.
- C. Deliver materials only after proper storage facilities are available.
- D. Store indoors in clean, dry location free from dust and corrosive fumes.
- E. Store sheet materials on edge above ground.
- F. Temporary Protection:
 1. From fabrication through construction period, protect aluminum from damage using protective sleeves, polyethylene sheets, boarding, or other suitable means.
 2. Remove protective devices only when required to perform work, or in absence of damage producing conditions prior to the Owner's final acceptance.

1.6 WARRANTY

- A. Comply with provisions of Section 017600 – Guarantees and Warranties.
- B. Special Project Guaranty:
 1. Extend period for correction of work for 4 additional years (total of 5) years.
 2. Include removal and replacement of superimposed work of other trades.
- C. Special Product Warranty:
 1. Extend coincidental product warranty period for 4 additional years (total of 5 years).
 2. Submit written warranty from manufacturer, including specific modifications for project conditions, signed and executed by manufacturer.
- D. Provide special product warranty as follows: Warranty aluminum fluoropolymer finish coatings against abnormal deterioration, discoloration, and failure for a period of 5 years on extrusions and 5 years on brake metal after acceptance of

the work.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General Requirements: Thickness, gauges, and tempers of aluminum products shall be as indicated on Drawings or specified under various sections of these specifications.
1. Where such properties are not indicated, they shall be as required for proper forming operations and structural requirements.
- B. Aluminum: Provide alloy, temper, and thickness recommended by the manufacturer for the type of use and finish indicated and with not less than the strength and durability properties of the alloy and temper designated below for each aluminum form required.
1. Extrusions: 6063 alloy; ASTM B221.
 2. Sheet: 5005 alloy; ASTM B209.
 3. Castings: F214 alloy.
 4. Aluminum Rivets: 6053-T4 or 6061-T6 alloy; ASTM B316.
- C. Fasteners: Provide bolts, nuts, washers, screws, nails, rivets, and other fastenings necessary for proper erection or assembly of aluminum work.
1. Exposed:
 - a. Match adjacent material in color and appearance.
 - b. 300 series stainless steel will be permitted.
 - c. Exposed Screws in Architectural Aluminum: Socket Head, countersunk unless otherwise noted.
 2. Concealed:
 - a. Aluminum: 2024 or 6061 alloy.
 - b. Steel in Contact with aluminum: Cadmium-plated or 300 series stainless steel.
 - c. Steel Not in Contact with Aluminum: Structural or mild steel hot-dip galvanized after fabrication and touched-up if welded.

2.2 ALUMINUM FINISH AND PROTECTIVE MATERIALS

- A. Products for Permanent Protection of Aluminum from Dissimilar Metals and Materials:
1. Zinc Chromate Primer: Fuller-O'Brien Corp. No. 621-08; The Glidden Co. 5229; or approved equivalent.
 2. Rust-Inhibiting Primer: Fuller-O'Brien Corp. No. 62104; The Glidden Co. No. 4570; or approved equivalent.
 3. Aluminum Metal and Masonry Paint: Fuller-O'Brien Corp. "No. 312-05 Heavy Duty Enamel, Chrome Aluminum" the Glidden Co., "No. 992 Metallite Pure Aluminum Paint;" or approved equivalent.
 4. Bituminous Paint: FS TT-C-494A.

5. Compressible Tape: Closed cell black neoprene tape meeting requirements of ASTM C509-77, size as noted, with adhesive system as recommended by the manufacturer.
 6. Sealant: As specified in Section 079200 – Joint Sealants.
- B. Prime Coat: Provide rust-inhibiting primer in conformance with powder coating manufacturer's written recommendation. Tnemec Co. Inc.'s 90-97 Tnemec-Zinc, Keelor & Long's 9700, or equal; zinc-rich urethane not less than 80 percent zinc in dried film.
Provide for Powder Coating as specified in this Section.
- C. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
- D. Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
- E. High-Performance Organic Finish (2-Coat Fluoropolymer): Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2604, 2605 and with coating and resin manufacturers' written instructions.
- F. Electrostatic-Applied Polyester Powder Coat: Conform to AAMA 2604-98; provide two-coat process resulting in a minimum coating thickness of 3.5 mils to 5 mils.
1. Manufacturer: Tiger-Drylac USA, Morton Industries, or equal. Tiger-Drylac Series 28 Powder Coating is reference standard.

2.3 FABRICATION

- A. Preparation: Coordinate details with adjacent work to assure watertightness, proper attachments, sealed joints, tight flashings, and clean junctions.
- B. General:
1. Employ only skilled personnel, especially trained, and experienced in this work.
 2. Perform fabrication operations prior to finishing or anodizing.
 3. Fabricate work true to detail with sharp, clean profiles, straight, and free from defects impairing strength or appearance; fit with proper joints and intersections; provide specified finishes.
 4. Design and fabricate work to prevent objectionable distortions or over-stressed fastenings where metal expands and contracts after installation.
 5. Accurately machine joints.

C. Welding:

1. Use inert gas-shielded arc or fluxless resistance techniques.
2. Design welded assemblies to be anodized so that faying surfaces are free-rinsing and will not trap anodizing solutions.
3. Where at all possible, locate welds in assemblies to be anodized so as to conceal visible discoloration in the heat-affected zone.
4. Where weld metal will be exposed after anodizing, select filler alloys to closely match composition of base metal. Follow parent metal manufacturer's recommendations for such filler alloys.
5. Where welds are to be made on materials that have been previously anodized, remove anodic film from area of fusion prior to welding.
 - a. Parts to be so welded may be masked during anodizing or sanded clean in the weld areas.
 - b. Only welds that will be concealed may be so made.
 - c. Crazeing or discoloring of the anodic coating in weld area will not be acceptable in exposed areas.
6. Grind or polish welds on exposed finished surfaces to match and blend with finish of adjacent parent metal.
7. Structural Welds:
 - a. Meet requirements of AWS D1.1-81.
 - b. Remove dirt, grease, lubricant, or other organic material by vapor de-greasing or suitable solvent.
 - c. Joints Rejected Due to Welding Defects: Repair only by rewelding. Remove defective welds by chipping or machining.
 - d. Flame cutting will not be permitted.
8. Where welding is done in proximity to glass or finished surfaces, protect such surfaces from damage due to weld sparks, spatter, or tramp metal.

2.4 FINISHES - GENERAL

- A. Aluminum finishing shall conform to requirements and recommendations of the Standards previously listed.
- B. Except where coil coated aluminum sheet is specified, commence no finishing operations until fabrication and forming operations have been completed.
- C. Required finishes are specified in the separate Sections of these specifications.
 1. Finish designations are those of the Aluminum Association.
- D. Where finishes are not specified in the separate Sections or noted on the Drawings, all such aluminum shall be finished in a manner consistent with similar work and necessary to conform with the design intent. Concealed work or interior work which is not readily visible may be mill finished as fabricated.

2.5 HIGH PERFORMANCE ORGANIC COATING

- A. General: When identical colors are shown or scheduled on the Drawings, provide single-sourcing of high performance organic coating materials for the Work included in the following Sections to assure color matching at time of sample submittal and throughout the life of the Project.

1. Section 084113 – Aluminum Entrances and Storefronts.
 2. Section 084213 – Aluminum Framed Entrance.
- B. Color and Finish: Match window mullions and storefront.
- C. Pretreatment: Chemically clean and pretreat aluminum before finishing with five tank chemical conversion coating system, in accordance with procedure recommended by manufacturer of coating to be applied.
- D. Aluminum must be pre-treated prior to applying coating.
- E. Apply and cure coating in strict accordance with approved coating manufacturer's directions.
- F. Applied coating shall match in gloss and fall within color range of approved samples.
- G. Cured coating shall be visibly free of waves, streaks, sags, blisters, or other surface imperfections.
- H. Dry film thickness of coating on exposed surfaces, when measured in accordance with ASTM B244-79 shall be not less than 0.8 mils, except channel recesses and internal corners, which shall be visually covered.
- I. High Performance Organic Coating: Fluoropolymer or Polyvinylidene Fluoride (PVDF) Resin Coating consisting of a thermo-cured primer and top coat that meets or exceeds following requirements.
1. Salt Spray Resistance (Five percent salt at 100 degrees Fahrenheit): Pass 1000 hours in accordance with AAMA 605 paragraph 8.2.
 2. Alkali Resistance-Mortar Pat Test: Pass 24 hours (100 percent relative humidity at 100 degrees Fahrenheit) in accordance with AAMA 605 paragraph 7.2.
 3. Acid Resistance: No attack in 15 minutes (10 percent muriatic acid spot test) in accordance with AAMA 605 paragraph 7.1.
 4. Dry Film Thickness: 1.2 mil minimum in accordance with AAMA 605 paragraph 3.3.
 5. Hardness/Eagle Turquoise Pencil: F minimum, in accordance with AAMA 605 paragraph 6.3.
 6. Humidity Resistance (100 percent at 100 degrees Fahrenheit): In accordance with AAMA 605 paragraph 8.1.
 7. Detergent Resistance (immersion, three percent at 100 degrees Fahrenheit): Pass 72 hours in accordance with AAMA 605 paragraph 7.4.
 8. Color Uniformity: Visually controlled in accordance with AAMA 605 paragraph 6.1.
 9. Adhesion: No removal in accordance with AAMA 605 paragraph 6.4. (inch distortion).
 10. Direct Impact 1/10 inch in accordance with AAMA 605 paragraph 6.5.
 11. Abrasion Resistance: Abrasion coefficient value 65.
 12. Weathering-Color Retention: After five years in Southern Florida at a 45 degree angle to ground facing south, maximum 5E units (NBS) in accordance with AAMA 605 paragraph 9.1.1.

13. Coating shall be repairable by use of an exterior grade air-drying touch-up material available from coating manufacturer.

J. Application:

1. Apply coatings either before or after forming and fabricating panels, as required by coating process and as required for maximum coating performance capability.
2. Protect coating either by application of strippable film or by packing plastic film or other suitable material between panels in a manner to properly protect the finish. Furnish air-drying spray finish in matching color for touch-up.

PART 3 - EXECUTION

3.1 CONDITION OF SURFACES

- A. Inspect surfaces to receive metalwork and report any defects which would interfere with the installation.
- B. Do not start installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION AND PROTECTION

- A. Permanent Protection of Aluminum from Dissimilar Metals and Materials:
 1. Dissimilar Metals: Where aluminum is placed in contact with or fastened to dissimilar metals, excepting galvanized steel, zinc, or small areas of stainless steel or nickel silver, treat contacting surfaces by one of following methods.
 - a. Apply coat of zinc chromate primer to dissimilar metal and follow with one coat of approved aluminum metal and masonry paint.
 - b. Apply one coat of bituminous paint to dissimilar material.
 - c. Separate contact surfaces with compressible tape.
 2. Drainage from Dissimilar Metals: Where drainage from dissimilar metals passes over aluminum work, paint dissimilar metals in accordance with 1.a. above.
 3. Concrete, Masonry, and Plaster: Where aluminum contacts or receives drainage from masonry, including lime mortar, concrete, or plaster, apply zinc chromate primer or heavy coat of bituminous paint to aluminum areas affected.
 4. Moisture-Absorbent Materials: Apply one heavy coat of approved bituminous paint or two coats of aluminum metal and masonry paint to absorptive materials and protect aluminum contact surfaces with bituminous paint where:
 - a. Aluminum contacts wood or other absorptive materials subject to repeated wetting.
 - b. Wood treated with preservative not compatible with aluminum.
 - c. Seal joints with approved polyisobutylene sealant.
 5. Un-coated Steel: Apply one heavy coat of rust inhibitive primer to un-coated steel item provided as accessories to aluminum work.
 6. Protection materials applied to exposed surfaces are subject to

approval of the Architect.

3.3 INSTALLATION

- A. Verify measurements at job.
- B. Coordinate metalwork with adjoining work for details of attachment, fitting, etc.
 - 1. Do cutting, shearing, drilling, punching, threading, tapping, etc., required for metal or for attachment of adjacent work.
 - 2. Drill or punch holes; do not use cutting torch.
 - 3. Shearing and punching shall leave true lines and surfaces.
- C. Conceal fastenings where practicable.
 - 1. Thickness of metal and details of assembly and supports shall give ample strength and stiffness.
 - 2. Form joints exposed to weather to exclude water.
- D. Make permanent connections in metal surfaces using welds where possible; do not use bolts or screws where they can be avoided.
- E. Provide lugs, clips, anchors and miscellaneous fastenings necessary for the complete assembly and installation.
- F. Erection: Erect aluminum work plumb, level, square, true to line, free from twist, securely anchored, in proper alignment and relationship to adjoining work, and free from sags, waves, or other defects.
- G. Set items shown or required to be set in sleeves with quick-setting nonshrink, non-metallic, gypsum-free anchor cement as specified in Section 05500 – Metal Fabrication.
 - 1. Prepare and use cement in accordance with manufacturer's directions.
 - 2. Unless otherwise noted, size sleeves for approximately 1/4-inch clearance all around.
 - 3. Brace railings until lead or cement sets.
 - 4. Remove excess cement and leave 1/8-inch built-up sloped away from post.
- H. Make aluminum trim in longest lengths possible. Where joints are not otherwise shown, make pieces of equal length or locate joints symmetrically.
- I. Where items must be incorporated or built into adjacent work, deliver to trade responsible for such work in sufficient time that progress of work is not delayed.
- J. Expansion and Contraction: Anchor in manner to prevent objectionable distortion or serious stress of fastenings.
- K. Do not install anodized aluminum adjacent to other aluminum which shows noticeable difference in color unless specifically noted otherwise.
- L. Minimize number of exposed fasteners.

3.4 TOLERANCES

- A. Variation from plane: 0.03 inches per 3 foot maximum or 0.25 inches per 30 feet, whichever is less.
- B. Misalignment of two adjoining members abutting in plane: 0.015 inches.

3.5 CLEANING

- A. Comply with requirements of Section 017900 – Cleaning.
- B. Upon completion of work, remove protective coverings from exposed surfaces and clean surfaces, free of soil and discoloration.
- C. Clean in accordance with recommendations of AA and aluminum manufacturer using only materials approved by aluminum manufacturer. Where doubt exists, make spot tests.

3.6 PROTECTION

- A. After initial cleaning, apply such protective measures as may be required to prevent damage or discoloration of any kind until acceptance of Project.
- B. Remove protective coverings prior to acceptance of Work.

END OF SECTION

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SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included: Rough carpentry, complete, as shown on Drawings and as specified, including:
 - 1. Miscellaneous fire-treated blocking, backing and plywood as shown and needed.
- B. Work Specified Elsewhere:
 - 1. Section 064123 – Interior Architectural Woodwork.

1.2 REFERENCE STANDARDS

- A. American Plywood Association (APA):
 - 1. Guide to Plywood Grades.
- B. American Wood Preservers Association (AWPA):
 - 1. C20; Structural Lumber - Fire-Retardant Treatment by Pressure Process.
 - 2. C27; Plywood - Fire-Retardant Treatment by Pressure Process.
 - 3. M4; Standard for the Care of Preservative-Treated Wood Products.
- C. West Coast Lumber Inspection Bureau (WCLIB):
 - 1. Standard Grading Rules for West Coast lumber.
- D. Western Wood Products Association (WWPA):
 - 1. Western Lumber Grading Rules.

1.3 SUBMITTALS

- A. Comply with requirements of Section 013300 – Submittal Requirements.
- B. Shop Drawings: Show specially fabricated rough hardware.

1.4 QUALITY ASSURANCE

- A. Comply with latest edition of the following standards:
 - 1. Western Coast Lumber Inspection Bureau (WCLIB) "Standard Grading Rules No. 16."
 - 2. Western Wood Products Association (WWPA) "Grading Rules for Western Lumber."

3. American Plywood Association (APA) "Guide to Plywood Grades."
 4. United States Product Standard (PS) "Construction and Industrial Plywood" (PS 1-74).
 5. American Wood Preserver's Association (AWPA):
 - a. "Structural Lumber - Fire-Retardant Treatment by Pressure Process" (AWPA C27-74).
 - b. "Plywood - Fire-Retardant Treatment by Pressure Process" (AWPA C27-74).
- B. Grade Marks: Identify all wood materials by official grade mark.
1. Lumber: Mark each piece of lumber with grade mark WCLIB (or WWPA) or of agency certified by WCLIB (or WWPA), and accompany each mill shipment to site by certificate of inspection by WCLIB (or WWPA) and FR-S where fire treatment is required.
 2. Softwood Plywood: Show Type, Grade, Class and Identification Index; per APA Guide to Plywood Grades, and per requirements of NBS PS-1.
- C. Fire-Retardant Treatment:
1. Fire-Retardant Treatment: UL classification FR-S.
 2. Obtain each type of fire-retardant treated wood products from one source for both treatment and fire-retardant formulation.
- D. Pressure treatment shall not adversely affect application, permanence, or appearance of finish paint systems.
- 1.5 PRODUCT HANDLING
- A. Facilities: Provide proper facilities for handling and storage of materials to prevent damage to edges, ends, and surfaces.
 - B. Storage: Keep materials dry. Stack materials off ground on level flat forms, fully protected from weather.
- 1.6 PROJECT CONDITIONS
- A. Environmental Requirements: Maintain uniform moisture content of lumber at not more than 19 percent before, during and after installation.
 - B. Sequencing and Scheduling: Coordinate details with other Work supporting, adjoining or fastening to rough carpentry Work.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Wood (all wood shall be fire treated):
 1. Lumber: Douglas fir; No. 3 or construction grade per WCLIB.
 2. Plywood: NBS PS-1 - grade structural one, C-C exterior.
 3. Use only material that is free of urea-formaldehyde.
- B. Fasteners:

1. Nails: Common wire typical.
2. Powder-Actuated Devices (PAD): As specified in Section 050500 – Metal Fasteners.
3. Expansion Bolts: As specified in Section 050500 – Metal Fasteners.
4. Miscellaneous Hardware: Provide common screws, bolts, fastenings, washers and nuts, and other items required to complete rough carpentry Work.
5. Finish: Hot-dip galvanize fasteners for exterior work.

2.2 ROUGH HARDWARE

- A. All exterior hardware shall be hot-dipped galvanized per ASTM A-123 Standards.
1. Nails:
 - a. Common wire for typical framing, blocking, etc. Box nails will not be allowed.
 - b. Annular ring common wire nails for plywood floor.
 2. Bolts: Hexagonal heads, Grade A conforming to ASTM A307.
 3. Washers: Washers for bearing against wood shall be provided under all bolt heads and nuts.
 - a. Malleable iron or steel plate having an area equal to 16 times the area of bolt or lag screw.
 - b. Steel washers shall have a thickness not less than 1/10 the length of the washer's longest side.
 - c. Malleable iron washers shall have a thickness not less than 1/2 the bolt or lag screw diameter and having a bearing surface for the nut or head equal in diameter to not less than the long diameter of the nut or head.
 4. Anchor Bolts: Hexagonal heads, Grade A conforming to ASTM 307, 1-1/2-inch-diameter by 10 inch.
 5. Rough Framing Connectors: KC Metal Products or approved equal. For connector type, see Drawings.
- B. Powder Driven Fasteners, Expansion Bolts and Expansion Anchors: As specified under 050500 – Metal Fasteners.

2.3 FABRICATION

- A. Lumber:
1. Moisture Content: Air- or kiln-dry to 19 percent maximum moisture content at time of surfacing.
 2. Finish: Surfaced four sides, S4S, unless otherwise specified.
 3. Size: Per rules of governing standard. Sizes shown are nominal unless otherwise specified.
- B. Fire-Retardant Treated Lumber and Plywood: Pressure treat rough carpentry materials per Reference Standards to obtain specified UL Classification.
1. Type: Hoover Treated Wood Products, "Exterior Fire-X," or equal.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Examine areas to receive rough carpentry Work and verify following:
1. Completion of installation of building components to receive rough carpentry Work.
 2. That spacing, direction, and details of supports are correct to accommodate installation of blocking, backing, stripping, furring, and nailers.
 3. That surfaces are satisfactory to receive Work. Do not commence installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Provide wood blocking, backing, furring, grounds, nailers, stripping, and similar items as detailed and otherwise required to anchor fixtures and equipment to be installed by other trades. Perform cutting, boring, and similar Work required. Install members true to line. Fit accurately. Secure rigidly. Provide special framing, even if not specifically shown, as required to properly complete Work.
- B. Sills or Plates on Concrete: Set in grout if surface of concrete deviates from true plane by more than 1/16-inch in 4 feet. Anchor with bolts as shown. Use two bolts minimum per piece with one bolt located between 4 inches and 8 inches from each end of each piece of sill.
- C. Nail Joints: Per minimum requirements of applicable code unless otherwise shown.
- D. Plywood: Sheet layout, nailing and edge-blocking as shown. Gap joints 1/16-inch. Butt joints accurately at centerlines of supporting members.
- E. Fasteners:
1. General: Furnish and accurately locate items to be embedded in concrete. Secure such items in place before concrete is poured.
 2. Nails: If wood tends to split, pre-drill holes three-fourths of nail diameter.
 3. Lag Screws: Screw into place; do not hammer. Use soap or other lubricant to ease insertion. Pre-drill holes diameter of shank for unthreaded portion, two-thirds of shank diameter for threaded portion.
 4. Bolts and Nuts: When installed, bear no more than 1/2-inch of threads on wood and allow no more than 1/2-inch of bolt to project beyond nut. Drill bolt holes 1/32-inch oversize. Tighten nuts snug when placed, and re-tighten at end of job or just before closing in.
 5. Sheet Metal Fasteners: Nail or bolt per manufacturer's instructions. Nail or bolt holes. Use nails provided by manufacturer.

3.3 PLYWOOD BACKING FOR TELEPHONE AND ELECTRICAL EQUIPMENT

- A. Panels: Not less than 3/4-inch thick. Use largest sizes practicable.

- B. Joints: Tightly butt vee-joints.
- C. Finish: Slightly ease exposed edges, sandpaper smooth as required.
- D. Fastening: Secure to metal studs and backing plates with flat-head countersunk sheet metal screws at 12-inch centers at panel edges and at 16-inch centers in panel field.

END OF SECTION

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SECTION 064123- INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Work Included: Provide and install Casework, complete, as shown on Drawings and as specified. All casework to be:

AWI Premium Grade Fabrications.

- B. This Section includes the following:

- 1. Plastic-laminate cabinets.
- 2. Plastic-laminate countertops.

- C. Related Sections include the following:

- 1. Division 6 Section "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.
- 2. Division 8 Section "Flush Wood Doors."

1.3 DEFINITIONS

- A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items, unless concealed within other construction before woodwork installation.

1.4 SUBMITTALS

- A. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of material indicated.
 - 1. Plastic laminates.
 - 2. Shop-applied transparent finishes.
- C. Samples for Verification:

1. Plastic laminates, 8 by 10 inches, for each type, color, pattern, and surface finish.
2. Solid-surfacing materials, 6 inches square.
3. One sample door with required hardware.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed architectural woodwork similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Fabricator Qualifications:
 1. Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
 2. Shop is a certified participant in AWI's Quality Certification
- C. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork, construction, finishes, and other requirements.
 1. Provide AWI certification labels or compliance certificate indicating that woodwork complies with requirements of grades specified.
- D. Single-sourcing materials: It is the intent of the Contract Documents to single-source plastic laminate and solid surface materials specified in this section when scheduled on the drawings to assure matching of specified finishes.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with

fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide materials that comply with requirements of the AWI quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.
- B. Wood Species and Cut for Transparent Finish: see finish schedule – coordinate w/ owner.
- C. Wood Products: Comply with the following:
 - 1. Hardboard: AHA A135.4.
 - 2. Softwood Plywood: DOC PS 1, Medium Density Overlay.
 - 3. Hardwood Plywood and Face Veneers: HPVA HP-1.
- D. Thermoset Decorative Overlay: Particleboard complying with ANSI A208.1, Grade M-2, or medium-density fiberboard complying with ANSI A208.2, Grade MD, with surface of thermally fused, melamine-impregnated decorative paper complying with LMA SAT-
- E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated, or if not indicated, as required by woodwork quality standard.
 - 1. Manufacturer: Subject to compliance with requirements, provide high-pressure decorative laminates by the following:
 - a. Wilsonart International; Div. of Premark International, Inc.
- F. Adhesive for Bonding Plastic Laminate: Contact cement.
- G. Edge-banding:
 - 1. Edge-banding for cabinet body parts shall be purified 3 mm PVC applied with hot melt glue by automatic edge-banding equipment.
 - 2. Edge-banding for door and drawer fronts shall be purified 3 mm PVC applied with hot melt glue by automatic edge-banding equipment. Edges and corners shall be rounded with a 3 mm radius and scraped free from machining or chatter marks.
 - 3. Color shall match vertical laminate at cabinets or as selected by Architect from manufacturer's full color range for solids and patterns.

- H. Cores:
1. All sides, tops, countertops, bottoms, doors, drawer fronts, and partitions shall have minimum $\frac{3}{4}$ " thick multi-core premium grade panel product cores manufactured for uses as a core material for laminated casework. Provide 1-inch thickness for bottom panel of wall hung units (same as shelves).
 2. Shelf Cores: Shelves shall have the same core material as specified for the cabinet body except provide 1-inch thickness.
 3. Multi-Core Panel Products:
 - a. Simpson Plyron, Simpson.

2.2 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets.
- B. Hardware Standard: Comply with BHMA A156.9 for items indicated by referencing BHMA numbers or items referenced to this standard.
- C. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 170 degrees of opening.
- D. Door and Drawer Pulls: Back mounted, 4 inches long, bow style pull.
- E. Catches: Magnetic catches, BHMA A156.9, B03141.
- F. Shelf Rests: BHMA A156.9, B04013.
- G. Drawer Slides: Side-mounted, full-extension, zinc-plated steel drawer slides with steel ball bearings, BHMA A156.9, B05091, and rated for the following loads:
1. Box Drawer Slides: 100 lbf.
 2. Pencil Drawer Slides: 45 lbf.
- H. Door Locks: BHMA A156.11, E07121.
- I. Drawer Locks: BHMA A156.11, E07041.
- J. Grommets for Cable Passage through Countertops: 2-1/2-inch black, molded-plastic grommets and matching plastic caps with slot for wire passage.
- K. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
1. Satin Chromium Plated: BHMA 652 for steel base.
- L. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.3 INSTALLATION MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

2.4 FABRICATION, GENERAL

- A. Interior Woodwork Grade: Provide **Premium Grade** interior woodwork complying with the referenced quality standard.
- B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.
- C. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

2.5 INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

- A. Quality Standard: Comply with AWI Section 300.
- B. Grade: **Premium.**

2.6 PLASTIC-LAMINATE CABINETS

- A. Quality Standard: Comply with AWI Section 400 requirements for laminate cabinets.
- B. Grade: **Premium.**
- C. AWI Type of Cabinet Construction: Flush overlay.
- D. Laminate Cladding for Exposed Horizontal Work-Surfaces: High-pressure decorative laminate complying with the following requirements:
 - 1. Horizontal Surfaces (Worksurfaces, Countertops): Acid Resistant Laminate "Chemsurf" Type 390.
- E. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:
 - 1. Horizontal Surfaces Other Than Tops: HGS.
 - 2. Vertical Surfaces: HGS.
 - 3. Edges: PVC T-mold matching laminate in color, pattern, and finish.
 - 4. Countertop and Backsplash: Chemical resistant plastic laminate.

- F. Materials for Semi-exposed Surfaces: Provide surface materials indicated below:
1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, Grade VGS.
 2. Drawer Sides and Backs: Solid-hardwood lumber.
 3. Drawer Bottoms: Hardwood plywood.
- G. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
1. Field Verify to match plastic laminate cabinet and countertop with the adjacent existing in the following categories:
 - a. Solid colors.
 - b. Patterns.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Condition woodwork to average prevailing humidity conditions in installation areas before installation.
- B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

- A. Quality Standard: Install woodwork to comply with AWI Section 1700 for the same grade specified in Part 2 of this Section for type of woodwork involved.
- B. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.
- C. Scribe and cut woodwork to fit adjoining work, and refinish cut surfaces and repair damaged finish at cuts.
- D. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation.
- E. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 36 inches long, except where shorter single-length pieces are necessary.
- F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in

openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 2. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches o.c. with No. 10 wafer-head screws sized for 1-inch penetration into wood framing, blocking, or hanging strips.
- G. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
1. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 2. Secure backsplashes to tops and to walls.
 3. Calk space between backsplash and wall with sealant specified in Division 7 Section "Joint Sealants."
 4. Cut circular openings in countertop for electrical cord access below countertop. Provide a grommet around opening for finish appearance. Color of grommet to match countertop. The number of openings required will be determined by the Owner but will not exceed 10.
 5. Cut openings in countertops for the installation of grilles as indicated on the drawings and as approved by Architect.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean woodwork on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION

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SECTION 078413 – PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide materials, fabrications and installation of firestopping and smoke seals, and associated accessory items, for locations listed under System Description.

1.2 SYSTEM DESCRIPTION

- A. Provide firestopping and smoke seals at locations indicated on the drawings, and including the following areas:
 - 1. All openings in fire or smoke rated floors, partitions, and walls in both void spaces and those spaces accommodating penetrating items such as cables, conduits, pipes, ducts, etc.
 - 2. Openings at building perimeter between floor slab edges and exterior wall assemblies.
 - a. Wall assemblies composed of metal framing and sheathing products specified in Section 054000 – Cold-formed Metal Framing.
 - b. Window Wall specified in Section 084113 and 085113 – Aluminum Windows.
 - 3. Openings between tops of partitions and connecting floors or roof assemblies.
 - 4. Fire barriers for seismic joints in fire-rated walls and floors.
 - 5. Openings at each floor level in shafts or stairwells.
- B. Fire-rated and/or Smoke-rated assemblies identified on Drawings by an Underwriter's Laboratories (UL) listing number shall strictly conform to the listed assembly. Any deviations from the UL assembly shall be approved by the code enforcement authority having jurisdiction for the Project before undertaking work.

1.3 SUBMITTALS

- A. Comply with provisions of Section 013300 – Submittal Procedures.
- B. Submit manufacturer's printed product data indicating product characteristics, performance and limiting criteria.
- C. Submit manufacturer's shop drawings and installation instructions for each type of firestop or smoke seal required by the Project. Shop drawings shall indicate the detailing of all necessary anchorages, reinforcements and fastenings required.

- D. Mock-Ups: Prepare a job-site mock-up of each fire-stop and smoke seal assembly proposed for use in the Project for review by Owner and code enforcement authority having jurisdiction for the Project. Accepted mock-ups may be left in place as part of the finished project and will constitute the standard for remaining work.
- E. Qualification Data: For firms and persons specified in Quality Assurance article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of Architects and Owners, and other information specified.

1.4 QUALITY ASSURANCE

- A. Comply with latest edition of the following standards:
 - 1. American Society for Testing Materials (ASTM), ASTM E 814.
 - 2. Underwriters' Laboratories, Inc.'s "Building Materials Directory" (UL).
 - 3. Warnock Hersey, "Certification Listings" (WHI).
- B. Firestopping or smoke seal materials shall conform to both Flame (F) and Temperature (T) ratings per ASTM E 814 or UL 1479 fire tests, and shall restrict the transmission of temperature as well as the passage of flame, gasses, smoke and water.
- C. Firestopping and smoke seal work shall be performed by an installer trained or approved by the firestop or smoke seal manufacturer. Equipment used shall be in accordance with firestop or smoke seal manufacturer's written installation instructions.
 - 1. Openings between tops of partitions and connecting floors or roof assemblies and at partition terminations at exterior wall:
 - a. For top of partition conditions, Architect to select two nominal 10-linear foot rated wall assemblies including parallel to, and perpendicular to, metal deck flutes for Mock-Up. For termination of partition at exterior wall, Architect to select a representative example for each type of rated wall assembly and each type of exterior wall system for Mock-Up. Location shall provide convenient access for review and be early in Contractor's Project Schedule.
 - b. After review and acceptance by Architect, Mock-Ups shall set performance standards for subsequent Work and may be incorporated into the Work.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Comply with requirements in Section 016000 – Product Requirements.
- B. Deliver all materials in original unopened packages fully identified with manufacturer's name, trade name and UL label.
 - 1. Leave seals unbroken and labels intact until time of use.
 - 2. Remove from job site any rejected or damaged packages found unsuitable for use.

- C. Store materials in a dry place, off of the ground or floor, and away from other material subject to sweating or attraction of moisture or dampness.

1.6 PROJECT CONDITIONS

- A. Conform to the manufacturer's printed instructions for installation and, when applicable, curing in accordance with the manufacturer's recommendations regarding temperature and humidity.
- B. Conform to all required ventilation and safety requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Provide products as manufactured by:
 - 1. Firestop Systems, Inc.
 - 2. Dow Corning Corp.
 - 3. 3M Electrical Products Division.
 - 4. International Protective Coatings (IPC).
 - 5. RectorSeal/Bio-Fireshield.

2.2 MATERIALS

- A. General: Firestopping and smoke seal materials shall be asbestos free.
 - 1. The F rating must be a minimum of 1 hour, but not less than the fire resistance rating of the assembly being penetrated, when tested per ASTM E 814.
 - 2. Materials being applied in openings between elements of differing fire ratings shall conform to the most restrictive rating.
 - 3. Fire tests shall be conducted with a minimum positive pressure differential of 0.03 inches of water column.
 - 4. Material shall be noncombustible, with flame spread of 25 or less, and smoke development of 50 or less, when tested in accordance with ASTM E 84.
- B. Firestop or Smoke Seal Mortar: Single component portland cement fly ash mortar, requiring no special supports or anchoring devices to pass water hose stream tests.
- C. Firestop or Smoke Seal Sealant: Single or multiple component silicone sealant. Provide a flexible, air-tight, water proof seal that bonds to building materials.
- D. Firestop or Smoke Seal Sleeve: Prefabricated device used around plastic pipes in fire-rated floors and walls. The sleeve shall be made of a steel collar lined with an intumescent material.
- E. Intumescent Mastic Sealant: Single component, water-based intumescent for use at openings and sleeves involving plastic pipe, insulated pipe or flexible cable.
- F. Mineral fiber board, mineral fiber matting, and mineral fiber putty-forming and

damming materials shall be used to contain the fluid material mixture prior to and during filling of penetrations and voids.

1. Fire tested and functionally approved forming materials may be left in place to become an integrally part of the foamed penetration seal.
 2. Combustible forming and damming materials may be used for containment during installation of materials only, and must be removed from the final completed penetration seal system.
- G. Cementitious Seal: W.R. Grace's Monokote MK-6, or approved equivalent.
- H. Provide primers as required which conform to manufacturer's recommendations for various substrates and conditions.
- I. Thermal Spray-on Elastomeric Smoke Seal: Specified Technologies Inc. Series AS200 Elastomeric Spray, or approved equivalent.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine all work upon which firestopping or smoke seal material is to be applied.
- B. Notify the Contractor in writing, of conditions detrimental to the timely completion of the work.
- C. Do not proceed with work until all unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prior to application of firestopping or smoke seal material.
1. Clean all steel of loose material, including excessive mill scale or rust, paint, grease or other material which would preclude the successful application and retention of bond to the substrate.
 2. Do not apply firestops or smoke seals to surfaces previously painted or treated with a sealer, curing compound, water repellent or other coatings unless tests have been performed to ensure compatibility of materials.
 3. Remove coatings as required in compliance with manufacturer's instructions.
- B. Provide primers as required which conform to manufacturer's recommendations for various substrates and conditions.
- C. Mask where necessary to protect adjoining surfaces. Remove excess material and stains on surfaces as required.
- D. Coordinate locations and sizes of all sleeves which will be required by the work of other Sections.

3.3 INSTALLATION

- A. Install in strict accordance with manufacturer's printed instructions to provide a Flame (F) rating of at least 1 hour, but not less than the fire resistance rating of the assembly being penetrated.
- B. Ensure that anchoring devices, back-up materials, clips, sleeves, supports and other materials used in the actual fire test are installed.
- C. Install firestops or smoke seals with sufficient pressure to properly fill and seal openings to ensure an effective smoke seal.
- D. Install fire resistant filler in all openings through floors and rated walls:
 - 1. Dam bottom of vertical openings and one side of horizontal openings with temporary containment forms or, where required to achieve fire resistance ratings, provide permanent mineral composition board forms.
 - 2. On horizontal penetrations, provide partial face containment forms where required for material placement.
 - 3. Allow installed fillers to cure, and remove temporary forms; trim ragged edges with sharp knife; inspect and fill voids with additional filler to form uniform thickness of filler.
- E. Spillage: Do not allow sealants to overflow or spill onto adjoining surfaces, or to migrate into voids of adjoining surfaces. Clean adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage.
- F. Recess exposed edges of gaskets and exposed joint fillers slightly behind adjoining surfaces, unless otherwise shown, so that compressed units will not protrude from joints.
- G. Tool or trowel exposed surfaces. Remove excess firestop or smoke seal material promptly as work progresses and upon completion.
- H. Apply firestop or smoke seal material at penetrations of insulated piping after the insulation is installed.
 - 1. The material used shall have been tested for compatibility and rating in conjunction with the use of the insulation material being used.
 - 2. Calcium silicate, or other pipe insulation, may be substituted for fiberglass pipe insulation through the sleeve, if the insulation is part of an assembly which meets the requirements specified for firestopping or smoke sealing.
- I. Firestopping or smoke sealing materials for filling voids in floors having openings of 4-inches or greater, shall be installed to support the same load as the floor system, unless the area is protected by a permanent barrier preventing loading or traffic on the firestopped or smoke sealed area.
- J. Walls and Partitions:
 - 1. Penetrations: Install firestopping and smokestopping material at wall and partition openings which contain penetrating sleeves, piping, ductwork, conduit and other items requiring firestopping and smokestopping.
 - 2. Systems for Partition to Overhead Floor and Roof Deck Intersections: Use one of following at Contractor's option:

- a. Premolded Firestops: Firestop openings and joints per manufacturer's recommendations and UL or WHI-listed assembly with pre-molded firestops, firestop moldings, and unfaced safing.
***** OR *****
- b. Cementitious Seal Firestops: Firestop openings and joints per manufacturer's recommendations and UL or WHI-listed assembly with spray-applied or trowel-applied cementitious seal.
***** OR *****
- c. Firedam Spray Seal and Safing Firestops:
 - 1) General: 3M Firedam Spray. Provide 1- and 2-hour-rated firestopping assembly at head of partition with double-track construction at 1/2-inch relief joint at gypsum board in conformance with Warnock Hersey, Inc. Designs, 495-1266 and 495-PSV-1083.
 - 2) Safing: Fill space between tracks with 3/4-inch-thick by stud width strip of 3.5 PCF density mineral wool.
- K. Floor Slab Edge and Exterior Wall Intersection: Firestop Systems, Inc. **System CW-S-1002**, 2-hour firestop joint per manufacturer's recommendations with 8-pound mineral wool, 3-1/2-inch-thick SP5100 sealant, or approved equal system with UL or WHI-listed 2-hour assembly.
- L. Continuity: Maintain integrity over entire area to form continuous firestop system.

3.4 CURE AND PROTECTION

- A. Cure firestopping and smoke seal materials in compliance with manufacturer's instructions and recommendations.
- B. Installer shall advise Contractor of procedures required for protection of firestopping and smoke seals during remaining construction period.

3.5 FIELD QUALITY CONTROL

- A. Examine each firestop or smoke seal application after completion of installation, to ensure proper installation and full compliance with this specification.
- B. Correct unacceptable firestops or smoke seals and provide additional inspection to verify compliance with this specification at no additional cost.
- C. Maintain accessibility to all areas of work until completion of inspection by the applicable Code authorities.
- D. Where finished work will be visible after completion of the Project, remove temporary dams after initial cure of firestops or smoke seals.
 - 1. Clean adjacent surfaces in accordance with Manufacturer's printed instructions.
 - 2. Remedy any staining and discoloring on adjacent surfaces caused by the work of this Section.

3.6 CLEAN UP

- A. Comply with requirements of Section 017900 – Cleaning.
- B. After completion of application of firestopping or smoke seal materials, remove all debris, excess materials and all equipment, and broom clean all exposed wall and floor areas.

END OF SECTION

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SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes sealants for the following applications, including those specified by reference to this Section:

1. Exterior joints in the following vertical surfaces and nontraffic horizontal surfaces:
 - a. Perimeter joints between materials listed above and frames of doors and windows.
2. Exterior joints in the following horizontal traffic surfaces:
 - a. Control, expansion, and isolation joints in cast-in-place concrete slabs.
3. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:
 - a. Vertical control joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
 - b. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
 - c. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - d. Other joints as indicated.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

1.4 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.

- B. Store and handle materials in compliance with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer.
- B. Joint-Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
- C. Joint-Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

PART 2 - PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products indicated for each type in the sealant schedules at the end of Part 3.

2.2 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range for this characteristic.

2.3 ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealant Standard: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant in the Elastomeric Joint-Sealant Schedule at the end of Part 3, including those referencing ASTM C 920 classifications for type, grade, class, and uses.

2.4 ACOUSTICAL JOINT SEALANTS

- A. Acoustical Sealant for Exposed and Concealed Joints: For each product of this description indicated in the Acoustical Joint-Sealant Schedule at the end of

Part 3, provide manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and the following:

1. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

2.5 JOINT-SEALANT BACKING

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

2.6 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants with joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions and the following requirements:
 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and com-

- patibility by sealant manufacturer), old joint sealants, oil, grease, water-proofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include the following:
 - a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 3. Remove laitance and form-release agents from concrete.
- B. Joint Priming: Prime joint substrates where recommended in writing by joint sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Acoustical Sealant Application Standard: Comply with recommendations of ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.
- D. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
- E. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and back of joints.
- F. Install sealants by proven techniques to comply with the following and at the same time backings are installed:
 1. Place sealants so they directly contact and fully wet joint substrates.
 2. Completely fill recesses provided for each joint configuration.

3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- G. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealants from surfaces adjacent to joint.
 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.

3.4 CLEANING

- A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from the original work.

3.6 ELASTOMERIC JOINT-SEALANT SCHEDULE

- A. Multicomponent Nonsag Polysulfide Sealant: Where joint sealants of this type are indicated, provide products complying with the following:
1. Products: Provide one of the following:
 - a. cm-60; W.R Meadows, Inc.
 - b. T-2235-M; Morton International, Inc.
 - c. T-2282; Morton International, Inc.
 - d. Thiokol 2P; Morton International, Inc.
 - e. GC-5 Synthacalk; Pecora Corporation.
 - f. Two-Part Sealant; Sonneborn Building Products Div., ChemRex Inc.
 2. Type and Grade: M (multicomponent) and NS (nonsag).
 3. Class: 25.
 4. Uses Related to Exposure: T (traffic)

3.7 LATEX JOINT-SEALANT SCHEDULE

- A. Latex Sealant: Where joint sealants of this type are indicated, provide products complying with the following:
1. Products: Provide one of the following:
 - a. Chem-Calk 600; Bostik Inc.
 - b. NuFlex 330; NUCO Industries, Inc.

- c. LC 160 All Purpose Acrylic Caulk; Ohio Sealants, Inc.
- d. AC-20; Pecora Corporation.
- e. PSI-701; Polymeric Systems, Inc.
- f. Sonolac; Sonneborn Building Products Div., ChemRex, Inc.
- g. Tremflex 834; Tremco.

3.8 ACOUSTICAL JOINT-SEALANT SCHEDULE

- A. Acoustical Sealant for Exposed and Concealed Joints: At all sound partitions and where joint sealants of this type are indicated, provide products complying with the following:
 - 1. Products: Provide one of the following:
 - a. AC-20 FTR Acoustical and Insulation Sealant; Pecora Corporation.
 - b. SHEETROCK Acoustical Sealant; USG Corp., United States Gypsum Co.
- B. Acoustical Sealant for Concealed Joints: At all sound partitions and where joint sealants of this type are indicated, provide products complying with the following:
 - 1. Products: Provide one of the following:
 - a. Pro-Series SC-170 Rubber Base Sound Sealant; Ohio Sealants, Inc.
 - b. BA-98; Pecora Corporation.
 - c. Tremco Acoustical Sealant; Tremco.

END OF SECTION

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

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. Standard and custom hollow metal doors and frames.
2. Steel sidelight, borrowed lite and transom frames.
3. Louvers installed in hollow metal doors.
4. Light frames and glazing installed in hollow metal doors.

B. Related Sections:

1. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
2. Division 08 Section "Flush Wood Doors".
3. Division 08 Section "Glazing" for glass view panels in hollow metal doors.
4. Division 08 Section "Door Hardware".
5. Division 08 Section "Access Control Hardware".
6. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.

C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
8. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

9. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
10. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
11. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
12. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
13. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.
14. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
15. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
16. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.
- B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.
- C. Shop Drawings: Include the following:
 1. Elevations of each door design.
 2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 4. Locations of reinforcement and preparations for hardware.
 5. Details of anchorages, joints, field splices, and connections.
 6. Details of accessories.
 7. Details of moldings, removable stops, and glazing.
 8. Details of conduit and preparations for power, signal, and control systems.
- D. Samples for Verification:
 1. Samples are only required by request of the architect and for manufacturers that are not current members of the Steel Door Institute.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.
- B. Quality Standard: In addition to requirements specified, furnish SDI-Certified manufacturer products that comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".

- C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL10C (neutral pressure at 40" above sill) or UL 10C.
 - 1. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies, attach construction label certifying doors are built to standard construction requirements for tested and labeled fire rated door assemblies except for size.
 - 2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
 - 3. Smoke Control Door Assemblies: Comply with NFPA 105.
 - a. Smoke "S" Label: Doors to bear "S" label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.
- D. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Provide labeled glazing material.
- E. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.
 - 1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.7 COORDINATION

- A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
- B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide steel doors and frames from a SDI Certified manufacturer:
 - 1. CECO Door Products (C).
 - 2. Curries Company (CU).

2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
- C. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.3 HOLLOW METAL FRAMES

- A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.
- B. Interior Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.
 - 1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
 - 2. Frames: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.
 - 3. Manufacturers Basis of Design:
 - a. Curries Company (CU) - M Series.

- C. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.
- D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

2.4 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
 - 2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch thick.
 - 3. Compression Type for Drywall Slip-on (Knock-Down) Frames: Adjustable compression anchors.
- B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.
- C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.5 LIGHT OPENINGS AND GLAZING

- A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator's shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.
- B. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.
- C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames.
- D. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.

2.6 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.7 FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.
- B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.
- C. Hollow Metal Frames:
1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
 - a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.
 3. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
 4. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.
 5. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
 6. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
 7. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.
 8. Electrical Knock Out Boxes: Factory weld 18 gauge electrical knock out boxes to frame for electrical hardware preps; including but not limited to, electric through wire transfer hardware, electrical raceways and wiring harnesses, door position switches, electric strikes, magnetic locks, and jamb mounted card readers as specified in hardware sets in Division 08 Sections "Door Hardware" and "Access Control Hardware".
 - a. Provide electrical knock out boxes with a dual 1/2-inch and 3/4-inch knockouts.
 - b. Conduit to be coordinated and installed in the field (Division 26) from middle hinge box and strike box to door position box.
 - c. Electrical knock out boxes to comply with NFPA requirements and fit electrical door hardware as specified in hardware sets in Division 08 Section "Door Hardware".
 - d. Electrical knock out boxes for continuous hinges should be located in the center of the vertical dimension on the hinge jamb.

9. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
 10. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Two anchors per jamb up to 60 inches high.
 - 2) Three anchors per jamb from 60 to 90 inches high.
 - 3) Four anchors per jamb from 90 to 120 inches high.
 - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
 - b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 - 5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.
 11. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".
- D. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
 2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
 3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
 4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

2.8 STEEL FINISHES

- A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.
1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer

manufacturer for substrate; and compatible with substrate and field-applied coatings.

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 the Work.
- B. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for square, level, twist, and plumb condition.
- C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."
- D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.
 - 1. Set frames accurately in position, plumbed, leveled, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
 - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
 - 3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.

4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.
- C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Standard Steel Doors:
 - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
- D. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow metal work immediately after installation.
- C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

END OF SECTION

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SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Solid core doors with wood veneer faces.
2. Factory finishing wood doors.
3. Factory fitting wood doors to frames and factory machining for hardware.
4. Light frames and glazing installed in wood doors.

B. Related Sections:

1. Division 08 Section "Door Schedule".
2. Division 08 Section "Hollow Metal Doors and Frames".
3. Division 08 Section "Glazing".
4. Division 08 Section "Door Hardware".
5. Division 08 Section "Access Control Hardware".

C. Standards and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ANSI A208.1 - Wood Particleboard.
3. Intertek Testing Service (ITS Warnock Hersey) - Certification Listings for Fire Doors.
4. NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
5. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
6. UL 10C - Positive Pressure Fire Tests of Door Assemblies; UL 1784 - Standard for Air Leakage Tests of Door Assemblies.
7. Window and Door Manufacturers Association - WDMA I.S.1-A Architectural Wood Flush Doors.

1.3 SUBMITTALS

- A. Product Data: For each type of door indicated. Include details of core and edge construction, louvers, trim for openings, and WDMA I.S.1-A classifications. Include factory finishing specifications.
- B. Shop Drawings shall include:

1. Indicate location, size, and hand of each door.
 2. Indicate dimensions and locations of mortises and holes for hardware.
 3. Indicate dimensions and locations of cutouts.
 4. Indicate requirements for veneer matching.
 5. Indicate location and extent of hardware blocking.
 6. Indicate construction details not covered in Product Data.
 7. Indicate doors to be factory finished and finish requirements.
 8. Indicate fire protection ratings for fire rated doors.
- C. Samples for Initial Selection: For factory finished doors.
1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.
 2. Corner sections of doors, 8 by 10 inches, with door faces and edges representing actual materials to be used.
 - a. Provide samples for each species of veneer and core material.
 - b. Finish veneer faced door samples with same materials proposed for factory finished doors.
 3. Frames for light openings, 6 inches long, for each material, type, and finish required.
- D. Warranty: Provide sample of manufacturer's warranty.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer wherever possible.
- B. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, latest edition, "Industry Standard for Architectural Wood Flush Doors".
- C. Fire Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing at positive pressure according to NFPA 252 (neutral pressure at 40" above sill) or UL10C.
1. Oversize Fire Rated Door Assemblies: For units exceeding sizes of tested assemblies provide manufacturer's construction label, indicating compliance to independent 3rd party certification agency's procedure, except for size.
 2. Temperature Rise Limit: Where required and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire test exposure.
 3. Smoke Control Door Assemblies: Comply with NFPA 105.
 - c. Smoke "S" Label: Doors to bear "S" label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.

- D. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for receiving, handling, and installing flush wood doors.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package pre-finished doors individually in plastic bags and wrap bundles of doors in plastic sheeting.
- C. Mark each door on top rail with opening number used on Shop Drawings.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weather tight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.7 WARRANTY

- A. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
 - b. Telegraphing of core construction in wood face veneers exceeding 0.01 inch in a 3-inch span.
 - 2. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.
 - 3. Warranty Period for Solid Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 DOOR CONSTRUCTION – GENERAL

- A. WDMA I.S.1-A Performance Grade: Extra Heavy Duty; Aesthetic Grade: Custom.
- B. Fire Rated Doors: Provide construction and core as needed to provide fire ratings indicated.
 - 1. Category A Edge Construction: Provide fire rated door edge construction with intumescent seals concealed by outer stile (Category A) at 45, 60,

and 90 minute rated doors. Comply with specified requirements for exposed edges.

2. Pairs: Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
 - a. Provide fire retardant stiles that are listed and labeled for applications indicated without formed steel edges and astragals.
 - b. Where required for concealed hardware, provide formed steel edges and astragals with intumescent seals. Finish steel edges and astragals with baked enamel.

2.2 CORE CONSTRUCTION

A. Structural Composite Lumber Core Doors:

1. Structural Composite Lumber: Engineered hardwood composite wood products tested in accordance with WDMA I.S.1A, Testing Cellulosic Composite Materials for Use in Fenestration Products containing no added Urea Formaldehyde.
2. LEED: Meet requirements of IEQ4.4.

B. Particleboard Core Doors:

1. Particleboard: Wood fiber based materials complying with ANSI A208.1 Particleboard standard. Grade LD-2.
2. Adhesive: Fully bonded construction using Polyurethane (PUR) glue.
3. Blocking: As indicated under article "Blocking".

C. Fire Resistant Composite Core Doors:

1. Core: Non-combustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire protection rating indicated.
2. Blocking: As indicated under article "Blocking".
3. Edge Construction: At hinge stiles, provide laminated edge construction with improved screw holding capability and split resistance. Comply with specified requirements for exposed edges.

2.3 BLOCKING

A. Fire Rated Doors:

1. Provide blocking as indicated below:
 - a. HB1: 5 inch in doors indicated to have closers and overhead stops.

2.4 VENEERED DOORS FOR TRANSPARENT FINISH

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ASSA ABLOY Wood Doors (GR): GPD Series.
2. VT Industries (VT): Artistry Series.

3. Oshkosh Door Company
- B. Interior Solid Core Doors:
1. Grade: Custom.
 2. Faces: Veneer grades as noted below; veneer minimum 1/50-inch (0.5mm) thickness at moisture content of 12% or less.
 - a. Field verify to match with adjacent existing door veneer.
 3. Match between Veneer Leaves: Book match.
 4. Assembly of Veneer Leaves on Door Faces:
 - a. Running Match.
 5. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
 6. Transom Match: Continuous match.
 7. Vertical Edges: Matching same species as faces. Wood or composite material, one piece, laminated, or veneered. Minimum requirements per WDMA section P-1, Performance Standards for Architectural Wood Flush Doors.
 8. Horizontal Edges: Solid wood or structural composite material meeting the minimum requirements per WDMA section P-1, Performance Standards for Architectural Wood Flush Doors
 9. Construction: Five plies. Stiles and rails are bonded to core, then entire unit sanded before applying face veneers.
 10. At doors over 40% of the face cut-out for lights and or louvers, furnish engineered composite lumber core.

2.5 LIGHT FRAMES AND GLAZING

- A. Wood Beads for Light Openings in Wood Doors up to and including 20-minute rating:
1. Wood Species: Same species as door faces.
 2. Profile:
 - a. M1 Flush Bead.
 - b. At wood core doors with 20-minute fire protection ratings, provide wood beads and metal glazing clips approved for such use.
- B. Metal Frames for Light Openings in Fire Rated Doors over 20-minute Rating: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated.
1. Manufacturers:
 - a. Air Louver (LV).
 - b. All Metal Stamping (AP).
 - c. Anemostat (AN).
 - d. Pemko (PE).
- C. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with the flush wood door manufacturer's written instructions.

2.6 FABRICATION

- A. Factory fit doors to suit frame opening sizes indicated.
 - 1. Comply with requirements in NFPA 80 for fire rated doors.
 - 2. Undercut: As required per manufacturer's templates and sill condition.
- B. Factory machine doors for hardware that is not surface applied. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.
 - 1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
 - 2. Metal Astragals: Factory machine astragals and formed steel edges for hardware for pairs of fire rated doors.
- C. Openings: Cut and trim openings through doors in factory.
 - 1. Light Openings: Trim openings with moldings of material and profile indicated.
 - 2. Glazing: Comply with applicable requirements in Division 08 Section "Glazing."
 - 3. Louvers: Factory install louvers in prepared openings.
- D. Electrical Raceways: Provide flush wood doors receiving electrified hardware with concealed wiring harness and standardized Molex™ plug connectors on both ends to accommodate up to twelve wires. Coordinate connectors on end of the wiring harness to plug directly into the electrified hardware and the through wire transfer hardware or wiring harness specified in hardware sets in Division 08 "Door Hardware". Wire nut connections are not acceptable.

2.7 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
 - 1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.
- B. Transparent Finish: Provide a clear protective coating over the wood veneer allowing the natural color and grain of the selected wood species to provide the appearance specified. Stain is applied to the wood surface underneath the transparent finish to add color and design flexibility.
 - 1. Finish: Meet or exceed WDMA I.S. 1A TR8 UV Cured Acrylated Polyester finish performance requirements.
 - 2. Staining:
 - a. Custom stain to match architect's sample.
 - 3. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames before hanging doors.
 - 1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 - 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Hardware: For installation, see Division 8 Section "Door Hardware."
- B. Installation Instructions: Install doors and frames to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.
 - 1. Install fire rated doors in corresponding fire rated frames according to NFPA 80.
- C. Factory Fitted Doors: Align in frames for uniform clearance at each edge.
- D. Factory Finished Doors: Restore finish before installation if fitting or machining is required at Project site.
- E. Field modifications to doors shall not be permitted, except those specifically allowed by manufacturer or fire rating requirements.

3.3 ADJUSTING

- A. Operation: Re-hang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

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SECTION 083113 – ACCESS PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included: Provide and install access panels, complete, as shown on Drawings as specified, and if not shown on Drawings, as required to access mechanical, electrical, plumbing and other equipment in conformance with governing codes and workplace safety guidelines.

1. Ceiling-mounted access panels.

- B. Work Specified Elsewhere:

1. Section 092216 – Non-Structural Metal framing
2. Section 092900 - Gypsum Board.
4. Section 099123 – Interior Painting.

1.2 SUBMITTALS

- A. Conform to the requirements of Section 013300 – Submittal Requirements.
- B. Product Data: Submit manufacturer's specifications, catalog cuts, and installation instructions. Submit approved test data or State Fire Marshal listing for fire-rated assemblies.
- C. Shop Drawings: Show attachment to partition, soffit, and ceiling framing at each typical condition.

1.3 PRODUCT HANDLING

- A. Delivery and Storage: Deliver and store panels in manufacturer's standard protective packaging.
- B. Protection: Do not remove protective packaging until time of installation.

PART 2 - PRODUCTS

2.1 ACCESS PANELS FOR CEILINGS

1. Glass Fiber Reinforced Gypsum (GFRG) Type 1:

- A. Manufacturer: Bauco Access Panel Solutions Inc.
- i. Baucoplus-II series: Non-rated recessed access doors with concealed hardware and gypsum board inlay for flush installation.
- ii. Material Overview: Extruded aluminum alloy 6063-T6 frames and supports complete with 5/8" (15.9 mm) or 1/2" (12.7 mm) moisture

- and mold resistant gypsum board inlay and galvanized internal steel corner reinforcing. Zinc-plated hardened steel screws, free pivot hinge, safety cable with carabineer hook, vinyl screw caps, and EPDM rubber gaskets.
- iii. Door: Fabricate using 2.8 mm thick extruded aluminum alloy 6063-T6 frame, screwed in place gypsum board inlay complete with galvanized internal steel corner reinforcing. Exposed top edge of frames shall have a concave meniscus rise to 0.5mm thick to accept finishing compound allowing a near invisible flush frame finish.
 - iv. Frame: Recessed aluminum frame shall provide an edge similar to drywall bead against which the ceiling or wall surface shall be finished allowing a near invisible flush frame finish. Fabricate using 2.8mm thick extruded aluminum alloy 6063-T6 frame, complete with galvanized internal steel corner reinforcing. Frame opening complete with perimeter EPDM gasket maintaining the STC of gypsum board assembly. Frame model specification: BPII 58 - for 5/8 board.
 - v. Board: Access Panel inlay shall equal the wall & ceiling specifications to ensure acoustic integrity. Board Inlay specification: Baucoplus-II moisture and mold resistant gypsum board inlay.
 - vi. Hinge Detail: Concealed, galvanized steel free pivot hinge shall allow all doors to open 120 degrees. All access panel doors shall be fully removable and complete with a safety cable to secure doors to panel frames with a safety cable, test rated for 135lb (61kg), nylon coated, with crimp connections and spring snap aluminum carabiner.
 - vii. Hinge Location: Baucoplus-II panels for ceiling installation will be hinged on the longest side unless specified. When Baucoplus-II panels are used in a wall installation, the hinges must be located on the floor side. The last 2 digits of the product code will always be the hinge location, and always the horizontal measurement for a wall installation.
 - viii. Latching/Locking devices: Concealed touch latch – standard.
 - ix. Finish: Baucoplus-II series access panels require finishing using common trade tools. For best results, setting-type gypsum finishing compound is recommended. Apply compound separately to the door leaf and surrounding wall or ceiling area up to recessed access panel frame. No taping required. Door shall receive the same finish and paint as the surrounding surfaces. When installed and finished the access panel shall be completely flush with the wall or ceiling surface and only a one sixteenth of an inch shadow gap shall be visible.
 - x. General Access Panel Dimensions For 5/8" Gypsum board: Baucoplus-II series shall come in the following standard sizes:
Size: 24" x 24"
Model Number: 20-58-2424
Description: 24" x 24" (610mm x 610mm) Baucoplus II access panel, 5/8" gypsum inlay, non-rated, concealed touch latch, free pivot hinge.
 - xi. Access Panel Sizing: Baucoplus-II dimensions in model number refer to clear opening in door.
 - xii. Framing: For a proper fit between framing members the rough framed opening will be 2 1/2" greater than product code sizing. This 2 1/2" allowance provides the door frame size 1 1/8" plus 1/8" allowance on all sides of the panel.

B. FABRICATION

- i. Manufacture each access panel assembly as an integral unit ready for site installation.
- ii. Furnish number of latches required to hold door flush for a smooth uniform panel appearance when closed.
- iii. Larger sizes bracing will be added to add rigidity and/or prevent sagging.
- iv. Supply rear of panel door with acoustic treatment when specified.
- v. Provide installation instructions with each panel.
- vi. Rear of panel door leaf label indicating product model and size.

C. EXECUTION

- i. EXAMINATION
 - a. Examine areas to receive access doors. Notify Architect if areas are not acceptable. Do not begin installation until unacceptable conditions have been corrected.
- ii. PREPARATION
 - a. Advise installers of work relating to access panel installation including rough opening dimensions, locations of supports, and anchoring methods. Coordinate delivery with other work to avoid delay.
- iii. INSTALLATION
 - a. Follow manufacturer's instructions for installing access panels. Install access doors plumb, level, and square.
 - b. Anchor frames securely in place.
 - c. Set frames to proper alignment with the wall or ceiling.
 - d. Position access panels for proper access to concealed equipment requiring access.
- iv. ADJUST AND CLEAN
 - a. Adjust panel after installation for proper operation. Remove drywall compound from hinge, frame and door leaf edge. Clean the frame and door with a damp cloth.
 - i. Remove and replace panels or frames that are warped, bowed, or damaged.

2. Metal Types:

- A. Manufacturers: Karp Associates, Inc., Larsen's Manufacturing Co., Milcor, Nystrom, Inc., JL Industries, or equal. Karp specified as standard.
- B. Non-Rated Gypsum Board Partitions: Karp Type KDW, flush panel type with frame flanges for joint compound concealment, 16-gauge steel frames and 14-gauge steel doors.
- C. Fire-Rated Gypsum Board Partitions: Karp Type KRP-250FR, 16-gauge steel doors and frames. Provide UL label.
- D. Exterior Cement Plaster Soffits: Karp Type DSC-210 PL; frame of 13-gauge and door of 16-gauge galvanized steel finished with baked enamel, recessed, and lined with galvanized self-furring steel lath. Provide concealed pivoting rod hinge and key-operated stainless steel lock.

2.2 MISCELLANEOUS MATERIALS

- A. General: Provide fastening devices, masonry anchors, casing beads, and other items as required to secure door and frame in place.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Examine construction to receive access panels and verify correctness of dimensions and other supporting or adjoining conditions. Do not install panels until unsatisfactory conditions have been corrected. Verify that locations serve portion of work to which access is required.

3.2 INSTALLATION

- A. General: Install, per manufacturer's recommendations, securely to framing in locations required to give access to plumbing, mechanical, electrical, or similar devices concealed in walls or ceilings.
- B. GFRG Access Panels: Conceal joint between GFRG frame and gypsum board with tape and joint compound as specified under Section 092900.
- C. Coordination: Coordinate with other trades to verify correct sizes and locations of access panels.

3.3 ADJUSTMENT

- A. General: Following installation, adjust access panels for smooth operation.

3.4 CLEANING

- A. General: Thoroughly clean surface of grease, oil, or other impurities, touch up abraded prime coats and otherwise prepare for finish painting.

END OF SECTION

SECTION 084229 – SLIDING AUTOMATIC ENTRANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This section includes the following types of automatic entrance doors:
 - 1. Interior, single and bi-parting, sliding automatic entrance doors for Clean Room applications.
- B. Related Sections:
 - 1. Division 7 Sections for caulking to the extent not specified in this section.
 - 2. Division 8 Section "Aluminum-Framed Entrances and Storefronts" for entrances furnished separately in Division 8 Section.
 - 3. Division 8 Section "Door Hardware" for hardware to the extent not specified in this Section.
 - 4. Division 8 Section "Glazing" for materials and installation requirements of glazing for automatic entrance doors.
 - 5. Division 26 and 28 Sections for electrical connections including conduit and wiring for automatic entrance door operators and access control devices.

1.3 REFERENCES

- A. References: Refer to the version year adopted by the Authority Having Jurisdiction.
 - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
 - 2. ICC/IBC - International Building Code.
 - 3. CUL – Approved for use in Canada.
 - 4. NFPA 70 - National Electrical Code.
 - 5. NFPA 101 - Life Safety Code.
- B. American National Standards Institute (ANSI) / Builders Hardware Manufacturers Association (BHMA).
 - 1. ANSI/BHMA A156.10 American National Standard for Power Operated Pedestrian Doors.
 - 2. ANSI Z97.1 Standards for Safety Glazing Material Used in Buildings.
- C. Underwriters Laboratories (UL).

1. UL 325 Standard for Safety for Door, Drapery, Gate, Louver and window Operators and Systems.
- D. American Association of Automatic Door Manufacturers (AAADM).
- E. American Society for Testing and Materials (ASTM).
1. ASTM B221 Standard Specification for Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Profiles and Tubes.
 2. ASTM B209 Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate.
- F. American Architectural Manufacturers Association (AAMA).
1. AAMA 611 Voluntary Specification for Anodized Architectural Aluminum.
- G. National Association of Architectural Metal Manufacturers (NAAMM).
1. Metal Finishes Manual for Architectural Metal Products.
- H. International Code Council (ICC).
1. IBC: International Building Code Building Code.

1.4 DEFINITIONS

- A. Activation Device: Device that, when actuated, sends an electrical signal to the door operator to activate the operation of the door.
1. Knowing act: Consciously initiating the opening of a power operated door using acceptable methods including wall mounted switches such as push plates and controlled access devices such as keypads, card readers and key switches.
- B. Safety Device: A device that detects the presence of an object or person within a zone where contact could occur and provides a signal to stop the movement of the door.
- C. AAADM: American Association of Automatic Door Manufacturers.

1.5 PERFORMANCE REQUIREMENTS

- A. General: Provide doors that have been designed and fabricated to comply with specified performance requirements, as demonstrated by testing manufacturer's corresponding standard systems.
- B. Compliance:
1. ANSI/BHMA A156.10 American National Standard for Power Operated Pedestrian Doors.
 2. UL 325 listed.

- C. Automatic door equipment that has been tested and approved for use in an ISO 3 (Class 1) clean room environment.
- D. Automatic door equipment accommodates medium to heavy pedestrian traffic.
- E. Automatic Door equipment accommodates up to the following weights for active leaf doors:
 - 1. Bi-part doors: 300 lbs (136 kg) per active breakout leaf.
 - 2. Single doors: 300 lbs (136 kg) per active breakout leaf.
- F. Operating Temperature Range: -31° F to 122° F (-35° C to 50° C).
- G. Entrapment Force Requirements:
 - 1. Power Operated Sliding Doors: Not more than 30 lbf (133 N) required to prevent stopped door from closing.
 - 2. Sliding doors provided with a breakaway device shall require no more than 50 lbf (222N) applied 1 inch (25 mm) from the leading edge of the lock stile for the breakout panel to open.

1.6 SUBMITTALS

- A. Comply with Division 01 - Submittal Procedures.
- B. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, fabrication, operational descriptions and finishes.
- C. Shop Drawings: Submit manufacturer's shop drawings, including elevations, sections and details, indicating dimensions, materials, and fabrication of doors, frames, sidelites, operator, motion /presence sensor control device, anchors, hardware, finish, options and accessories.
- D. Samples: Submit manufacturer's samples of aluminum finish.
- E. Informational Submittals: Manufacturer's product information and applicable sustainability program credits that are available to contribute towards a LEED rated project certification.
 - 1. Credit MR 4.1 and 4.2: Manufacturer's or fabricator's certificate indicating percentage of post-consumer recycled content by weight and pre-consumer recycled content by weight for each Product specified under this Section.
- F. Manufacturers Field Reports: Submit manufacturer's field reports from AAADM certified technician of inspection and approval of doors for compliance with ANSI/BHMA A156.10 after completion of installation.
- G. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door opening installation in quantity as required in Division 01, Closeout Submittals. The manual

to include the name, address, and contact information of the manufacturers providing the hardware and their nearest service representatives. The final copies delivered after completion of the installation test to include spare parts list.

- H. Warranties and Maintenance: Special warranties and maintenance agreements specified in this Section.

1.7 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 10 years of documented experience in manufacturing of doors and equipment of similar to that indicated for this Project and that have a proven record of successful in-service performance.
 - 1. A manufacturer with company certificate issued by AAADM.
- B. Installer Qualifications: Installers, trained by the primary product manufacturers, with a minimum 3 years documented experience installing and maintenance of units similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- C. Certified Inspector Qualifications: Certified by AAADM.
- D. Source Limitations for Automatic Entrances: Obtain each type of door, frame, operator and sensor components specified in this Section from a single source, same manufacturer unless otherwise indicated.
- E. Power-Operated Pedestrian Door Standard: ANSI/BHMA A156.10 (current version).
- F. Emergency Exit door requirements: Comply with requirements of authorities having jurisdiction for automatic entrance doors serving as a required means of egress.

1.8 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings to receive automatic entrances by field measurements before fabrication and indicate on shop drawings.

1.9 COORDINATION

- A. Coordinate sizes and locations of recesses in concrete floors for recessed tracks and thresholds if applicable. Concrete, reinforcement and formwork are specified in Division 03.
- B. Electrical System Roughing-in: Coordinate layout and installation of automatic entrances with connections to power supplies and access control system as applicable.

1.10 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Automatic Entrance Doors shall be free of defects in material and workmanship for a period of One (1) year from the date of substantial completion.
- C. During the warranty period a factory-trained technician shall perform service and affect repairs. A safety inspection shall be performed after each adjustment or repair and a completed inspection form shall be submitted to the Owner.
- D. During the warranty period all warranty work, including but not limited to emergency service, shall be performed during normal business hours.
- E. Manufacturer shall have in place a dispatch procedure that shall be available 24 hours a Day, 7 Days a week for emergency call back service.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Manufacturer: ASSA ABLOY Entrance Systems, 1900 Airport Road, Monroe, NC 28110. Toll Free (877) SPEC-123. Phone (704) 290-5520 Fax (704) 290- 5555 Website www.assaabloyentrance.com contact: specdesk.na.aaes@assaabloy.com
- B. Substitutions: Requests for substitution and product approval in compliance with the specifications must be submitted in writing and in accordance with the procedures outlined in Division 1, Section, "Substitution Procedures". Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 SLIDING AUTOMATIC ENTRANCES

- A. Model: **Besam SL500 SA-PP** Clean Room sliding automatic doors. (Basis of Design):
 - 1. Aluminum doors and frames with sidelites and active door leaves.
 - 2. Overhead concealed, electro-mechanical, microprocessor controlled, sliding door operator.
 - 3. Operator housing, guide system and door carriers.
 - 4. Non-shedding type weather-stripping.
- B. Sliding Automatic Entrance Doors Configuration:
 - 1. Single slide, surface mounted, door system.
 - a. Configuration: Single slide door unit without sidelite unit; using a fixed sidelite guide track.
 - b. Traffic Pattern: Two-way.
 - c. Dimensions: Clear opening width: 42". Overall Frame Height: 91". See architectural drawings.

2.3 ALUMINUM DOORS AND FRAMES

- A. Doors and Frames: Extruded Aluminum, Alloy 6063-T5.
1. Door panels shall have a minimum .125 inch (3.2 mm) structural wall thickness including adjoining horizontal members and perimeter frames where applicable.
 2. Door Construction shall be by means of an integrated corner block with 3/8 inch all-thread through bolt from each stile.
 3. Glass stops shall be .062 inch (15.8 mm) wall thickness and shall provide security function as a standard by means of a fixed non-removable exterior section with glazing to be performed from the interior only. Glazing stops that allow for glass removal from the exterior shall not be deemed as equivalent.
 - a. 45 degree sloped horizontal glass stops.
 4. The sliding door system shall include two interlocks securing the leading stile of the sidelite and the butt stile of the sliding door panel together.
 5. Vertical Stiles shall be narrow stile 2-1/8 inch (54 mm).
 6. Bottom Rails shall be standard 4 inch (102 mm).
 7. Gasketing shall be slide-in type, replaceable pile non-shedding Santoprene seals retained by the aluminum extrusions. The following types of gasketing are required: complementing gasketing on the joining vertical stiles of the sidelite and sliding door panels, complementing gasketing on the lead edge of the lock stiles of bi-parting doors, gasketing between the carrier and the header, gasketing on the lead edge stile of single slide door panels, gasketing on the pivot stile of breakout sidelite panels, and gasketing on the butt stile of fixed sidelite panels.
- B. Glass: Glazing shall comply with ANSI Z97.1, thickness as indicated.
1. Glazing Active Door Panels: 1/4" (6 mm) tempered, unless otherwise specified.
 2. Glazing Installation: See Division 8 Section Glazing for requirements.
- C. Door Carriers: Manufacturer's standard carrier assembly that allows vertical adjustment.
1. Carriage Assembly: Carriage bar with two wheel assemblies. Each assembly shall have tandem roller wheels.
 2. Roller Wheels: Two heavy duty Delrin roller wheels per wheel assembly, for a total of four (4) roller wheels, 1-7/16 inch (36.51 mm) diameter, per active door leaf for operation over a replaceable aluminum track. Single journal with sealed oil impregnated bearings.
 3. Two (2) heavy duty self-aligning anti-risers per leaf.
- D. Framing Members: Provide automatic entrances as complete assemblies. Manufacturer's standard extruded aluminum framing reinforced as required to support loads.
1. Vertical Jambs shall be 1-3/4 inches (44.5 mm) by 4-1/2 inches (114.3 mm).

- E. Header: Manufacturer's standard one-piece extruded aluminum header with a replaceable aluminum track extending full width of entrance unit. Header to conceal door operators, carrier assemblies, and roller track; complete with hinged access panel for service of door operator, and controls.
1. Span: Maximum 16'-0" (4.9 m) without intermediate supports when using 1/4-inch glass.
 - a. Capacity: Capable of supporting active breakout leafs up to maximum of 300 lb (136 kg) per leaf when header is supported per manufacturer's recommendations.
 2. Size: 4-1/2 inches (114.3 mm) wide by 7 inches (177.8 mm) high.
 - a. Header height including the sensor plate cap which spans the clear door opening width is 8-1/2 inches (215.9 mm) high.
 3. Hinge Point: Continuous hinge at top of header allows for complete access to operator and internal electronic and mechanical assemblies.
 4. Design: Manufacturer's standard closed header.
- F. Hardware: Provide manufacturer's standard hardware as required for operation indicated.
1. Breakaway arms and bottom pivot assemblies shall be supplied by the manufacturer and shall be adjustable to comply with applicable codes.
 - a. Magnetic catch(s) to retain breakout door and sidelite panels in the closed position.
 2. Locking hardware shall be provided as indicated.
 - a. Electrified slide lock shall automatically lock the sliding function of the entrance when the door panels are in the closed position.
 - 1) Fail secure operation: Slide lock shall lock the sliding function of the door panels upon loss of power.
- G. Guide Track/Threshold: Manufacturer's threshold as indicated.
1. Aluminum fixed sidelite guide track mounted along the face of the wall.

2.4 SLIDING DOOR OPERATOR

- A. Door Operator and Controller:
1. Electro-mechanical controlled unit utilizing a high-efficiency, energy efficient, DC motor requiring a maximum of 3 amp current draw, allowing 5 operators on one 20 amp circuit. The supplied system shall have the capability to operate at full performance well beyond a brown out and high line voltage conditions (85V – 265V) sensing changes and adjusting automatically. The operator shall allow an adjustable hold open time delay of 0 to 60 seconds and have internal software to incorporate a self-diagnostic system.
- B. Microprocessor Control Box:
1. Modular control unit to allow for changing technology. Factory-adjusted configuration with opening and closing speeds set to comply with ANSI/BHMA A156.10 requirements and electronic dampening to reduce

wear on drive train. Should the drive train operations deviate from design criteria ranges, Watchdog Control Circuit Monitoring will assume command of the system and shut down the automatic function allowing a secondary supervisory circuit to perform as a backup. Control unit shall allow the following functions:

- a. Diagnostics with the ability to produce application data.
2. Mode Selector Control:
 - a. Multi-position rotary knob mode selector switch to be interior jamb mounted and shall allow selection of the indicated functions to be engaged when switch is turned to the appropriate setting.
 - b. Mode selector control to allow the following functions:
 - 1) "Off"
 - 2) "Exit Only" one way traffic with automatic operation from the interior.
 - 3) "Two Way Traffic" allowing automatic operation from exterior and interior.
 - 4) "Partial Opening" energy saving door position allows door to automatically adjust opening width based on amount of usage, that is, full open during high use and partial open during low use. The control for this setting is programmable allowing adjustment to both the usage setting and the opening width.
 - 5) "Hold Open" doors activated and held in the full open position.

2.5 ACTIVATION AND SAFETY CONTROL DEVICES

- A. General: Provide the types of activation and safety devices specified in accordance with ANSI/BHMA standards, for the condition of exposure and for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated. Coordinate activation and safety devices with door operation and door operator mechanisms.
- B. Knowing Act Activation Device:
 1. Touchless Sensor Switch: Stainless steel 4-1/2 inch x 4-1/2 inch faceplate, black hand icon graphics, hard wired. Infra-red microburst sensing technology with an adjustable operating range of 1 inch to 28 inches.
 - a. Light ring to provide red-blue-green visual indication of door status.
 - b. Adjustable time delay 3 to 30 seconds.
 - c. See "Door Interlock System" for operation.
 - d. Touchless Sensor Switch: "CM-331/WS-SGLR" by Camden Door Controls (2 required per sliding entrance).

2.6 DOOR INTERLOCK SYSTEM

- A. Locking Hardware: Electrified slide locks shall be connected to the door interlock control system as indicated to allow operation of only one entrance within the interlock circuit at any given time.

- B. Door Interlock System: Provide an interlock system to interlock three (3) sliding entrances into Ante Room B133.
1. Sequence of operation: The interlock system shall prevent the opening of another interlocked entrance when one of the interlocked doors in the circuit is in the open position.
 - a. The interlock system shall allow operation of a door after all interlocked doors in the circuit are returned to the closed and locked position.
 - b. The resettable emergency push switch shall provide emergency release of an interlocked entrance.
 2. Door Interlock Components: Provide all components required for a complete operable system including the following:
 - a. Door interlock controller: "ES550" by Electronic Solutions.
 - b. Door position switches: "DPS" by Securitron (1 required per opening).
 - c. Resettable emergency push switch:
 - 1) "CM-4085R" with pneumatic timer by Camden Door Controls (1 required per opening unless indicated otherwise).
 - 2) "CM-5085PTER" with pneumatic timer by Camden Door Controls (1 required per opening unless indicated otherwise; mounted egress side).
 - d. Power supply: "BPS-24" by Securitron.
 - e. Activation Device with red-blue-green visual indication: See "Activation and Safety Control Devices."
 - 1) Red Visual Indicator: A door in the interlock system is in the open position. Activation is not available.
 - 2) Green Visual Indicator: All doors in the interlock system are in the closed position. Activation is available.

2.7 ELECTRICAL

- A. High-Efficiency DC Motor: Maximum of 3 amp current draw, allowing 5 operators to run on one 20 Amp circuit.
- B. Power: Self-detecting line voltage capable control. 120 VAC through 240 VAC, 50/60 Hz, 3 amp minimum incoming power with solid earth ground connection for each door system.
- C. Key Impulse Input: Input for card readers or remote activation with independent adjustable hold open delay.
- D. Wiring: Separate internal channel raceway free from moving parts.
- E. Brown out / high voltage capability: System has capability to operate at full performance well beyond brown out and high voltage line conditions (85 V – 265 V) sensing changes and adjusting automatically.

2.8 ALUMINUM FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Anodized Finish:
 - 1. AAMA 611, Clear, AA- M12C22A41, Class I, 0.018 mm.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, wall and floor construction, and other conditions affecting performance.
- B. Examine roughing-in for electrical source power to verify actual locations of wiring connections.
- C. Proceed only after such discrepancies or conflicts have been resolved.

3.2 INSTALLATION

- A. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure non-movement joints.
- B. Entrances: Install automatic entrances plumb and true in alignment with established lines and grades without warp or rack of framing members and doors. Anchor securely in place.
 - 1. Install surface mounted hardware using concealed fasteners to greatest extent possible.
 - 2. Set headers, carrier assemblies, tracks, operating brackets and guides level and true to location with anchorage for permanent support.
- C. Door Operators: Connect door operators to electrical power distribution system as specified in Division 26 Sections.
- D. Glazing: Glaze sliding automatic entrance door panels in accordance with the Glass Association of North America (GANA) Glazing Manual, published recommendations of glass product manufacturer, and published instructions of automatic entrance system manufacturer.
- E. Sealants: Comply with requirements specified in division 7 Section "Joint Sealants" to provide air tight installation.
 - 1. Set thresholds, bottom guide and track systems and framing members in full bed of sealants.
 - 2. Seal perimeter of framing members with sealant.

- F. Signage: Apply signage on both sides of each door and sidelite as required by ANSI/BHMA A156.10 and manufacturers installation instructions.

3.3 FIELD QUALITY CONTROL

A. Manufacturers Field Services:

1. Manufacturer's representative shall provide technical assistance and guidance for installation of doors.
2. Before placing doors into operation, AAADM certified technician shall inspect and approve doors for compliance with ANSI/BHMA A156.10. Certified technician shall be approved by manufacturer.

3.4 ADJUSTING

- A. Adjust door operators, controls and hardware for smooth and safe operation and for weather tight closure. Adjust doors in compliance with ANSI/BHMA A156.10.

3.5 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door installation.
- B. Clean glass and metal surfaces promptly after installation. Remove excess sealants, compounds, dirt and other substances. Repair damages finish to match original finish.
 1. Comply with requirements in Division 08 Section Glazing for cleaning and maintaining glass.

3.6 DEMONSTRATION

- A. Engage a factory-authorized representative to train Owner's maintenance personnel to adjust, operate, and maintain safe operation of the door.

END OF SECTION

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SECTION 087100 – DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes commercial door hardware for the following:
 - 1. Swinging doors.
 - 2. Sliding doors.
 - 3. Other doors to the extent indicated.
- B. Door hardware includes, but is not necessarily limited to, the following:
 - 1. Mechanical door hardware.
 - 2. Electromechanical door hardware, power supplies, back-ups and surge protection.
 - 3. Cylinders specified for doors in other sections.
- C. Related Sections:
 - 1. Division 08 Section “Door Hardware Schedule”.
 - 2. Division 08 Section “Hollow Metal Doors and Frames”.
 - 3. Division 08 Section “Interior Aluminum Doors and Frames”.
 - 4. Division 08 Section “Flush Wood Doors”.
 - 5. Division 08 Section “Access Control Hardware”.
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
 - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
 - 2. ICC/IBC - International Building Code.
 - 3. NFPA 80 - Fire Doors and Windows.
 - 4. NFPA 101 - Life Safety Code.
 - 5. NFPA 105 - Installation of Smoke Door Assemblies.
 - 6. State Building Codes, Local Amendments.
- E. Standards: All hardware specified herein shall comply with the following industry standards:
 - 1. ANSI/BHMA Certified Product Standards - A156 Series
 - 2. UL10C – Positive Pressure Fire Tests of Door Assemblies

1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - 1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
 - 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
 - 3. Content: Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Shop Drawings: Details of electrified access control hardware indicating the following:
 - 1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
 - a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
 - b. Complete (risers, point-to-point) access control system block wiring diagrams.

2. Electrical Coordination: Coordinate with related Division 26 Electrical Sections the voltages and wiring details required at electrically controlled and operated hardware openings.
- D. Keying Schedule: Prepared under the supervision of the Owner, separate schedule detailing final keying instructions for locksets and cylinders in writing. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner to approve submitted keying schedule prior to the ordering of permanent cylinders.
- E. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals. The manual to include the name, address, and contact information of the manufacturers providing the hardware and their nearest service representatives. The final copies delivered after completion of the installation test to include "as built" modifications made during installation, checkout, and acceptance.
- F. Warranties and Maintenance: Special warranties and maintenance agreements specified in this Section.

1.4 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Installer Qualifications: Installers, trained by the primary product manufacturers, with a minimum 3 years documented experience installing both standard and electrified builders hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor in good standing by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
 1. Scheduling Responsibility: Preparation of door hardware and keying schedules.
- D. Source Limitations: Obtain each type and variety of Door Hardware specified in this Section from a single source, qualified supplier unless otherwise indicated.
 1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
 2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

- E. Regulatory Requirements: Comply with NFPA 70, NFPA 80, NFPA 101 and ANSI A117.1 requirements and guidelines as directed in the model building code including, but not limited to, the following:
1. NFPA 70 "National Electrical Code", including electrical components, devices, and accessories listed and labeled as defined in Article 100 by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
 2. Where indicated to comply with accessibility requirements, comply with Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)," ANSI A117.1 as follows:
 - a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
 - b. Door Closers: Comply with the following maximum opening-force requirements indicated:
 - 1) Interior Hinged Doors: 5 lbf applied perpendicular to door.
 - 2) Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
 - c. Thresholds: Not more than 1/2 inch high. Bevel raised thresholds with a slope of not more than 1:2.
 3. NFPA 101: Comply with the following for means of egress doors:
 - a. Latches, Locks, and Exit Devices: Not more than 15 lbf to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.
 - b. Thresholds: Not more than 1/2 inch high.
 4. Fire-Rated Door Assemblies: Provide door hardware for assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252 (neutral pressure at 40" above sill) or UL-10C.
 - a. Test Pressure: Positive pressure labeling.
- F. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.
- G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
1. Function of building, purpose of each area and degree of security required.
 2. Plans for existing and future key system expansion.
 3. Requirements for key control storage and software.
 4. Installation of permanent keys, cylinder cores and software.

5. Address and requirements for delivery of keys.
- H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
1. Prior to installation of door hardware, arrange for manufacturers' representatives to hold a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
 2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
 3. Review sequence of operation narratives for each unique access controlled opening.
 4. Review and finalize construction schedule and verify availability of materials.
 5. Review the required inspecting, testing, commissioning, and demonstration procedures
- I. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.

- C. Door and Frame Preparation: Related Division 08 Sections (Steel, Aluminum and Wood) doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
 - 1. Structural failures including excessive deflection, cracking, or breakage.
 - 2. Faulty operation of the hardware.
 - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 4. Electrical component defects and failures within the systems operation.
- C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.
- D. Special Warranty Periods:
 - 1. Seven years for heavy duty cylindrical (bored) locks and latches.
 - 2. Five years for exit hardware.
 - 3. Ten years for heavy duty floor closers.
 - 4. Two years for shallow depth floor closers.
 - 5. Two years for electromechanical door hardware.

1.8 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.
- B. Continuing Service: Beginning at Substantial Completion, and running concurrent with the specified warranty period, provide continuous (6) months full maintenance including repair and replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door opening operation. Provide parts and supplies as used in the manufacture and installation of original products.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
1. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
 - a. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
 - B. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

- A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles as specified in the Door Hardware Sets.
1. Quantity: Provide the following hinge quantity, unless otherwise indicated:
 - a. Two Hinges: For doors with heights up to 60 inches.
 - b. Three Hinges: For doors with heights 61 to 90 inches.
 - c. Four Hinges: For doors with heights 91 to 120 inches.
 - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
 2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
 - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
 - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
 3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
 - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
 - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

4. Hinge Options: Comply with the following where indicated in the Hardware Sets or on Drawings:
 - a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the following applications:
 - 1) Out-swinging exterior doors.
 - 2) Out-swinging access controlled doors.
 - 3) Out-swinging lockable doors.
5. Acceptable Manufacturers:
 - a. McKinney Products (MK).

2.3 DOOR OPERATING TRIM

- A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified automatic, self-latching, and manual flush bolts and surface bolts. Manual flush bolts to be furnished with top rod of sufficient length to allow bolt location approximately six feet from the floor. Furnish dust proof strikes for bottom bolts. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
 1. Acceptable Manufacturers:
 - a. Rockwood Manufacturing (RO).

2.4 MECHANICAL LOCKS AND LATCHING DEVICES

- A. Cylindrical Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.2, Series 4000, Grade 1 certified cylindrical (bored) locksets furnished in the functions as specified in the Hardware Sets. Lock chassis fabricated of heavy gauge steel, zinc dichromate plated, with through-bolted application. Furnish with solid cast levers, standard 2 3/4" backset, and 1/2" (3/4" at rated paired openings) throw brass or stainless steel latchbolt. Locks are to be non-handed and fully field reversible.
 1. Acceptable Manufacturers:
 - a. Corbin Russwin Hardware (RU) – CL3300 Series.
- B. Lock Trim Design: As specified in Hardware Sets.

2.5 LOCK AND LATCH STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
 3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
- B. Standards: Comply with the following:
1. Strikes for Mortise Locks and Latches: BHMA A156.13.
 2. Strikes for Bored Locks and Latches: BHMA A156.2.
 3. Strikes for Auxiliary Deadlocks: BHMA A156.5.
 4. Dustproof Strikes: BHMA A156.16.
 5. Acceptable Manufacturers:
- C. Corbin Russwin Hardware (RU) – 3300 Series
- D. All door closers specified herein shall meet or exceed the following criteria:
1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.
 2. Standards: Closers to comply with UL-10C and UBC 7-2 for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
 3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.
 4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
 - a. Where closers are indicated to have mechanical dead-stop, provide heavy duty arms and brackets with an integral positive stop.
 - b. Where closers are indicated to have mechanical hold open, provide heavy duty units with an additional built-in mechanical holder assembly designed to hold open against normal wind and traffic conditions. Holder to be manually selectable to on-off position.

- c. Where closers are indicated to have a cushion-type stop, provide heavy duty arms and brackets with spring stop mechanism to cushion door when opened to maximum degree.
 - d. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics. Provide drop plates or other accessories as required for proper mounting.
5. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates, and through-bolt or security type fasteners as specified in the door Hardware Sets.
- E. Door Closers, Surface Mounted (Commercial Duty): ANSI/BHMA 156.4, Grade 1 certified surface mounted, institutional grade door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck, closing sweep, and latch speed control valves. Provide non-handed units standard.
1. Acceptable Manufacturers:
 - a. Corbin Russwin Hardware (RU) - DC6000 Series.

2.6 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
3. Metal Protection Plates: ANSI/BHMA A156.6 certified metal protection plates (kick, armor, or mop), beveled on four edges (B4E), fabricated from the following.
 - a. Stainless Steel: .050-inch thick, with countersunk screw holes (CSK).
 - b. Brass or Bronze: .050-inch thick, with countersunk screw holes (CSK).
 - c. Laminate Plastic or Acrylic: 1/8-inch thick, with countersunk screw holes (CSK).
4. Fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets.
5. Metal Door Edging: Door protection edging fabricated from a minimum .050-inch thick metal sheet, formed into an angle or "U" cap shapes, surface or mortised mounted onto edge of door. Provide appropriate leg overlap to account for protection plates as required. Height to be as specified in the Hardware Sets.

6. Acceptable Manufacturers:
 - a. Rockwood Manufacturing (RO).

2.7 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
 1. Acceptable Manufacturers:
 - a. Rockwood Manufacturing (RO).

2.8 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
 1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and UBC 7-2, Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated, based on testing according to ASTM E 1408.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Acceptable Manufacturers:
 1. Pemko Manufacturing (PE).

2.9 ELECTRONIC ACCESSORIES

- A. Power Supplies: Provide Nationally Recognized Testing Laboratory Listed 12VDC or 24VDC (field selectable) filtered and regulated power supplies. Include battery backup option with integral battery charging capability in addition to operating the DC load in event of line voltage failure. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.
 - 1. Acceptable Manufacturers:
 - a. Securitron (SU) - BPS Series.

2.10 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.11 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

- B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
 - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
 - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - 2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
 - 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
 - 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

- A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to

operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. and provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SCHEDULE

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
- B. Manufacturer's Abbreviations:

1. SD – Security Door Controls
2. MK - McKinney
3. RF - Rixson
4. RO - Rockwood
5. SU - Securitron
6. RU - Corbin Russwin
7. HS – HES
8. PE - Pemko

Hardware Schedule**Set: 1.0**

Doors: A126A, A126B

2 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 CBP-CE-72	Communicating Bathroom Pkg	US26D	SD
1 Cylinders	Match Existing Bldg Standard		
1 Card Reader	BY SECURITY CONTRACTOR		
	Prep A126B for Wire Chase Onsite		
1 Wall Stop	409	US32D	RO
1 Gasketing	S773D		PE

Set: 2.0

Doors: A128A, A129A

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Cylindrical Lock (privacy set)	CL3320 NZD	626	RU
1 Wall Stop	409	US32D	RO
1 Gasketing	S773D		PE

No Cylindrical Lock required for A128A

Set: 3.0

Doors: A130A, A131A

All Hardware by Door
Manufacturer**Set: 4.0**

Doors: A133B, A135A

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Cylindrical Lock (storeroom)	CL3357 NZD	626	RU
1 Electric Strike	1600-12/24	630	HS
1 Closer (surface)	DC6210	689	RU
1 Kickplate	K1050 10" X 2"LDW 3BE CSK	US32D	RO
1 Wall Stop	409	US32D	RO
1 Gasketing	S773D		PE
1 Power Supply	BPS-24-1		SU
1 Card Reader	By Security Contractor		

END OF SECTION 087100

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section. Refer to specifications section 084243 and construction documents for requirements of switchable privacy glass at ICU room doors, nurse charting windows & exterior insulated glazing:
 - 1. Doors.
 - 2. Glazed entrances.

1.3 DEFINITIONS

- A. Manufacturers of Glass Products: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.
- C. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.
- D. Deterioration of Insulating Glass: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

- B. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:
1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:
 - a. Specified Design Wind Loads: As indicated.
 - b. Design Wind Loads: Determine design wind loads applicable to Project from basic wind speed indicated in miles per hour at 33 feet above grade, according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 6.5, "Method 2-Analytical Procedure," based on mean roof heights above grade indicated on Drawings.
 - c. Specified Design Snow Loads: As indicated, but not less than snow loads applicable to Project as required by ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 7.0, "Snow Loads."
- C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.5 SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. Samples: For the following products, in the form of 12-inch-square Samples for glass and of 12-inch-long Samples for sealants. Install sealant Samples between two strips of material representative in color of the adjoining framing system.
1. Each color of tinted float glass.
 2. Ceramic-coated spandrel glass.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. For insulating-glass units that will be exposed to substantial altitude changes, comply with insulating-glass manufacturer's written recommendations for venting and sealing to avoid hermetic seal ruptures.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 - 1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F.

1.9 WARRANTY

- A. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form, made out to Owner and signed by insulating-glass manufacturer agreeing to replace insulating-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

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. Product: Subject to compliance with requirements, provide product specified. Match with the adjacent existing glazing at the facility.

2.2 GLASS PRODUCTS

- A. Float Glass: ASTM C 1036, Type I (transparent flat glass), Quality-Q3; of class indicated.
- B. Heat-Treated Float Glass: ASTM C 1048; Type I (transparent flat glass); Quality-Q3; of class, kind, and condition indicated.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.
 2. Provide Kind HS (heat-strengthened) float glass in place of annealed float glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.
 3. Provide Kind FT (fully tempered) float glass in place of annealed or Kind HS (heat-strengthened) float glass where safety glass is indicated.
- C. Ceramic-Coated Spandrel Glass: ASTM C 1048, Condition B (spandrel glass, one surface ceramic coated), Type I (transparent flat glass), Quality-Q3, and complying with other requirements specified.
- D. Insulating-Glass Units, General: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units and with requirements specified in this Article and in Part 2 "Insulating-Glass Units" Article.
1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.
 2. Provide Kind FT (fully tempered) glass lites where safety glass is indicated.
 3. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating-glass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.
 4. Sealing System: Dual seal, with primary and secondary sealants as follows:
 - a. Manufacturer's standard sealants.
 5. Spacer Specifications: Manufacturer's standard spacer material and construction.

2.3 GLAZING GASKETS

- A. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock-strips, complying with ASTM C 542, black.

2.4 GLAZING SEALANTS

- A. General: Provide products of type indicated, complying with the following requirements:
1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
- B. Elastomeric Glazing Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
1. Single-Component Neutral- and Basic-Curing Silicone Glazing:
 - a. Available Products:
 - 1) GE Silicones; SilPruf SCS2000.
 - 2) Polymeric Systems Inc.; PSI-641.
 - 3) Sonneborn, Div. of ChemRex, Inc.; Omniseal.
 - 4) Tremco; Spectrem 3.
 - b. Type and Grade: S (single component) and NS (nonsag).
 - c. Class: 50.
 - d. Use Related to Exposure: NT (nontraffic).

2.5 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.

2.6 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

2.7 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with outdoor and indoor faces.
- C. Grind smooth and polish exposed glass edges and corners.

2.8 MONOLITHIC FLOAT-GLASS UNITS

- A. Uncoated Clear Float-Glass Units: Class 1 (clear) Kind HS (heat-strengthened) float glass, Kind FT (fully tempered) float glass.
 - 1. Thickness: 6.0 mm.
- B. Uncoated Tinted Float-Glass Units: Class 2 (tinted), Kind HS (heat-strengthened), Kind FT (fully tempered) float glass.
 - 1. Basis-of-Design Product: PPG Industries, Inc.
 - 2. Thickness: 6.0 mm.
 - 3. Tint Color: "Solar Gray". Field Verify adjacent existing.
 - 4. Visible Light Transmittance: 67 percent minimum.
 - 5. Solar Heat Gain Coefficient: 0.50 maximum.
 - 6. Outdoor Visible Reflectance: 7 percent maximum.

2.9 MONOLITHIC CERAMIC-COATED SPANDREL-GLASS UNITS

- A. Ceramic-Coated Spandrel-Glass Units:
 - 1. Basis-of-Design Product: PPG Industries, Inc. or a comparable product by one of the following:
 - 2. Class 1 (clear) float glass.
 - 3. Kind HS (heat strengthened), FT (fully tempered).
 - 4. Thickness: 6.0 mm.
 - 5. Ceramic Coating Color: As selected by Architect to match glass color.
 - 6. Coating Location: Second surface.
- B. Tinted Insulating-Glass Units:
 - 1. Basis-of-Design Product: PPG Industries, Inc.
 - 2. See specifications section 084243 for switchable privacy glass required at the exterior insulated glass.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing glazing, with Installer present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - 2. Presence and functioning of weep system.
 - 3. Minimum required face or edge clearances.
 - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.
- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where length plus width is larger than 50 inches as follows:
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face

clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.

2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Do not remove release paper from tape until just before each glazing unit is installed.

3.5 GASKET GLAZING (DRY)

- A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Install gaskets so they protrude past face of glazing stops.

3.6 CLEANING AND PROTECTION

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection,

contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.

- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

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SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
 - 2. Suspension systems for interior gypsum ceilings, soffits, and grid systems.

1.3 SUBMITTALS

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 FRAMING SYSTEMS

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
 - 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
 - 2. Protective Coating: ASTM A 653/A 653M, G40 (Z120) hot-dip galvanized unless otherwise indicated.
- B. Studs and Runners: ASTM C 645. Use either steel studs and runners or dimpled steel studs and runners.

1. Steel Studs and Runners (or Dimpled Steel Studs and Runners):
 - a. Minimum Base-Metal Thickness: As indicated on Drawings.
 - b. Depth: As indicated on Drawings.
- C. Slip-Type Head Joints: Where indicated, provide one of the following:
 1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch- (51-mm-) deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches (305 mm) of the top of studs to provide lateral bracing.
 2. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
- D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
 1. Minimum Base-Metal Thickness: As indicated on Drawings.
- E. Cold-Rolled Channel Bridging: Steel, 0.053-inch (1.34-mm) minimum base-metal thickness, with minimum 1/2-inch- (13-mm-) wide flanges.
 1. Depth: 1-1/2 inches (38 mm).
 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38 by 38 mm), 0.068-inch- (1.72-mm-) thick, galvanized steel.
- F. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
 1. Minimum Base-Metal Thickness: 0.033 inch (0.84 mm).
 2. Depth: 7/8 inch (22.2 mm).
- G. Resilient Furring Channels: 1/2-inch- (13-mm-) deep, steel sheet members designed to reduce sound transmission.
 1. Configuration: hat shaped.
- H. Cold-Rolled Furring Channels: 0.053-inch (1.34-mm) uncoated-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges.
 1. Depth: 3/4 inch (19 mm).
 2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum uncoated-steel thickness of 0.033 inch (0.8 mm).
 3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.59-mm-) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire.

2.3 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.59-mm-) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire.
- B. Hanger Attachments to Concrete:
 1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.

- a. Type: Post-installed, expansion anchor.
 2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.
- C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch (4.12 mm) in diameter.
- D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.053 inch (1.34 mm) and minimum 1/2-inch- (13-mm-) wide flanges.
1. Depth: 1-1/2 inches (38 mm).
- E. Furring Channels (Furring Members):
1. Cold-Rolled Channels: 0.053-inch (1.34-mm) uncoated-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges, 3/4 inch (19 mm) deep.
 2. Steel Studs and Runners: ASTM C 645.
 - a. Minimum Base-Metal Thickness: 0.033 inch (0.84 mm), unless noted otherwise.
 - b. Depth: 1-5/8 inches (41 mm) unless noted otherwise.
 3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch (22 mm) deep.
 - a. Minimum Base-Metal Thickness: 0.033 inch (0.84 mm).
 4. Resilient Furring Channels: 1/2-inch- (13-mm-) deep members designed to reduce sound transmission.
 - a. Configuration: hat shaped.
- F. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Armstrong World Industries, Inc.; Drywall Grid Systems.
 - b. Chicago Metallic Corporation; Drywall Grid System.
 - c. USG Corporation; Drywall Suspension System.

2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
 - 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
 - 1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C 841 that apply to framing installation.
 - 2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.
 - 3. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C 844 that apply to framing installation.
 - 4. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- C. Install bracing at terminations in assemblies.
- D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Single-Layer Application: 16 inches (406 mm) o.c. unless otherwise indicated.
 2. Multilayer Application: 16 inches (406 mm) o.c. unless otherwise indicated.
 3. Tile Backing Panels: 16 inches (406 mm) o.c. unless otherwise indicated.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (13-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
 6. Curved Partitions:
 - a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
 - b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches (150 mm) o.c.
- E. Direct Furring:
1. Screw to wood framing.
 2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.

3.5 INSTALLING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
1. Hangers: 48 inches (1219 mm) o.c.
 2. Carrying Channels (Main Runners): 48 inches (1219 mm) o.c.
 3. Furring Channels (Furring Members): 16 inches (406 mm) o.c.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of unistrut or equivalent devices.
 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 5. Do not attach hangers to steel roof deck.
 6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
 8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.
- F. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

- G. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet (3 mm in 3.6 m) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION

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SECTION 092220 – ACOUSTICAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide materials, fabrications and installation of acoustical insulation and associated accessories.

1.2 SUBMITTALS

- A. Comply with requirements of Section 013300 – Submittal Procedures.
- B. Manufacturer's product data and literature describing each type of insulation.

1.3 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Insulation shall be certified by the manufacturer to comply with California standards for insulating materials.
 - 2. Insulating materials shall be installed in compliance with Flame Spread Rating and Smoke Density requirements of IBC.
- B. Fire Performance Characteristics: Provide insulation materials whose fire performance characteristics have been determined per the ASTM test method indicated below. Identify products with appropriate markings of applicable testing and inspecting organization.
 - 1. Surface Burning Characteristic: ASTM E84
 - 2. Fire Resistance Ratings: ASTM E119
 - 3. Combustion Characteristics: ASTM E136
- C. Single Source Responsibility for Insulation Products: Obtain each type of building insulation from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of Section 016000 – Product Requirements.
- B. Deliver and store packaged materials in original containers bearing identification of manufacturer's name, thermal resistance rating, and fiber materials. Maintain seals unbroken and labels intact until time of use.
- C. Keep materials dry by storing off ground under watertight covers.

1.6 PROJECT CONDITIONS

- A. Comply with requirements of Section 013100 – Project Management and Coordination.
- B. Do not install insulation until construction has progressed to a point that inclement weather will not damage or wet insulation.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Acoustical Insulation: Unfaced, friction-fit, flexible sound attenuation batt of fiberglass.
 - 1. Provide thermal resistance rating of R-13, Unless otherwise shown.
 - 2. Comply with requirements of ASTM C 665-84, Type I.
 - 3. Manufacturers: Owens-Corning Fiberglass Corp. "Unfaced Fiberglass Insulation, "Schuller- "Unfaced Fiberglass Insulation" or Certainteed Products Corp. "Rigid Fit Unfaced Fiberglass Insulation."

2.2 ACCESSORIES

- A. Electrical Box Acoustical Sealer: Resilient sealer pads; "Electrical Box Pads" manufactured by 3M, or approved equivalent.
- B. Insulation Support: String wire, staples, nails as required.
- C. Stick Fasteners: Rust-resistant metal fasteners and washers adhesively applied to substrate. Stic-Klip Mfg. Co. "Type A or N" with Speed Washers or Miracle Adhesives Corp. "Stuk-Ups, Prong or Spindle and Washer".
- D. Adhesive for Stick Fasteners: Type as recommended by fastener manufacturer.
- E. Sealing Tape: Type as recommended by the thermal insulation manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive insulation for conditions that will adversely affect installation and performance.
- B. Do not start work until defects have been corrected.
- C. Coordination: Ensure that all work that will be concealed by the work of this Section, such as electrical and plumbing work, that require inspection, have received all required inspections and been accepted by the inspecting authority.

3.2 INSTALLATION OF INSULATION

A. General Requirements:

1. Comply with insulation manufacturer's instructions applicable to products and application indicated. If printed instructions are not available or do not apply to project conditions, consult manufacturer's technical representative for specific recommendations before proceeding with installation of insulation.
2. Install insulation to fit snugly between framing members and around pipes, conduits, and outlet boxes as necessary to maintain integrity of insulation.
3. Provide means to prevent displacement where required.

B. Acoustical Insulation:

1. Fill spaces between studs with acoustical insulation.
2. Cover rear surface of all recessed mechanical and electrical outlet boxes with outlet box acoustical isolation pad.

3.3 DEFECTIVE WORK

- A. Remove any wet insulation or material deemed defective by the Architect and replace with new material.
- B. Restore other work to original condition which was damaged by repair or replacement of defective insulation work.
- C. Remove damaged materials from project.

3.4 PROTECTION

- A. General: Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes.
- B. Provide temporary coverings or enclosures where insulation will be subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

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SECTION 092900 – GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included: Provide and Install gypsum board panels and cementitious panels, complete as shown, including finishing materials and accessories.
1. Interior gypsum board walls, ceilings and soffits:
 - a. Fire/smoke-rated assemblies.
 - b. Acoustic assemblies.
 - c. Water-resistant assemblies.
 - d. Impact-resistant gypsum board wall assemblies.
 - e. General wall assemblies, including multi-layer assemblies to facilitate reveals and other decorative features.
 - f. Cementitious backer board for interior tile assemblies.
 2. Interior finishing materials and accessories:
 - a. Tapes, joint treatments, and coating materials to prepare wall surfaces for painting by others.
 - b. Corner beads, reveals, and other trims.
 - c. Neoprene tapes for sealing to work by others.
 - d. Fasteners, adhesives and sealants.
 - e. Special trim and accessories.
 3. Projectile Resistant Backing: ballistic-proof fiberglass backing for Pharmacy wall assemblies and where shown on Drawings.
- B. Work Specified Elsewhere:
1. Section 092216 – Non-Structural Metal Framing.
 2. Section 099123 – Interior Painting.

1.2 SUBMITTALS

- A. Comply with requirements of Section 013300 – Submittal Procedures.
- B. Provide manufacturers' data describing products and installations.

1.3 QUALITY ASSURANCE

- A. Comply with the latest edition of the following standards:
1. American Society for Testing and Materials ASTM C 840, Standard Specification for Application and Finishing of Gypsum Board.
 2. Gypsum Association (GA) File Numbers in GA-600 Fire Resistance Design Manual.
- B. Fire rated gypsum board systems shall satisfy minimum fire ratings as noted and shall conform to methods approved by applicable Building Code.

- C. Tolerances of Installed Trims and Accessories:
 - 1. Horizontal Variation from Level: 1/8-inch in 12 feet.
 - 2. Vertical Variation from Plumb: 1/8-inch in 8 feet.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Comply with requirements of Section 016000 – Product Requirements.
- B. Deliver materials to the project site with manufacturers' labels intact and legible.
- C. Keep materials dry by storing inside building and fully protect from weather.
- D. Stack gypsum board neatly and flat, with care to avoid damage to edges, ends and surfaces.

1.6 PROJECT CONDITIONS

- A. Environmental Requirements: Establish and maintain application and finishing environment in accordance with ASTM C 840.
- B. Provide adequate ventilation to eliminate excessive moisture within building during this work.

PART 2 - PRODUCTS

2.1 MATERIALS - INTERIOR APPLICATIONS

- A. Interior Gypsum Board: Use 5/8-inch-thick, Type 'X' gypsum board throughout, unless otherwise noted.
 - 1. Typical Finish Board, use throughout unless otherwise noted. ASTM C 36, Type X; tapered, or beveled taper edge, 48 inches wide by maximum length to minimize number of joints.
 - 2. Water-Resistant Gypsum Backing Board: Provide USG's Fiberock Brand "Aqua-Tough"; Georgia-Pacific (GP) "DensShield Tile Guard"; or equal; Glass-Mat, Water-Resistant Backing Board through core gypsum board panels per ASTM C 1178, Type FRX-G; tapered, or beveled taper edge, 48 inches wide by maximum length to minimize number of joints.
 - a. Locations: Use at high humidity/moisture locations, including Kitchen and Servery areas.
 - 3. High Abuse, Impact Resistant Board: Provide National Gypsum Hi-Abuse Kal-Kore, USG's Fiberock Brand "Aqua-Tough"; or equal. 5/8-inch-thick, ASTM C1278, Type X; fiber reinforced gypsum panels; tapered, or beveled taper edge, 48 inches wide by maximum length to minimize number of joints.
 - a. Gypsum core wall panel with additives to enhance surface indentation resistance, and impact resistance of the core and surface with abrasion-resistant paper on front and long edges with heavy liner paper bonded to the back side and

- conforming to ASTM C36.
 - b. Impact Resistance: No failure after 100 impacts when tested in accordance with ASTM E695, modified.
 - c. Indentation Resistance: Not less than the following loads to produce the indicated depth of the surface indentation when tested in accordance with ASTM D1037, modified:
 - 1) 0.100-inch at 260 pounds.
 - 2) 0.200-inch at 524 pounds.
 - d. Locations: Cashier and Credit Union.
 - 4. 1/4-inch Flexible Type: Provide board manufactured to bend to fit tighter radii than specified regular-type gypsum board.
 - a. Provide only at non-rated curved layouts that exceed maximum allowable bending radii of specified standard thickness gypsum board.
 - b. Thickness: 1/4 inch. Provide minimum 2 layer application with staggered joints.
 - c. Long Edges: Tapered.
 - 5. Early-install/Concealed locations (Contractor Option): Provide Georgia Pacific DensGlass Ultra Shaft and DensAmor Plus in conformance with ASTM D 3273; products inherently mold and mildew resistant for use in shaft walls, concealed locations above finished ceilings, internal layers of multi-layer assemblies and other locations approved by Architect to allow installation before the building enclosure is 100-percent complete.
 - a. Use at Shaft-side of shaft assemblies and any location where early install is required prior to closing in of the building.
- B. Cementitious Backer Board: Per ANSI A108.1; Provide Custom Building Product's "Wonderboard"; USG's "Durock Cement Board"; or equal. Panels of high-density portland cement surface coating on both faces of lightweight portland cement and expanded ceramic aggregate core, nominal 5/8-inch-thick and 3.2 to 3.8 pounds per square foot.
 - 1. General: Provide as shown on Drawings for tile assemblies specified in Section 093000 – Tile. (Typical at all restrooms) At fire-rated wall assemblies and inside faces of exterior walls, apply over gypsum board base layer as shown on Drawings
- C. Interior Joint Finishing Materials:
 - 1. General: Comply with ASTM C 475/C 475M.
 - 2. Joint Tape:
 - a. Interior Gypsum Wallboard: Paper.
 - b. Tile Backing Panels: As recommended by panel manufacturer.
 - 3. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
 - a. Prefilling: At open joints, beveled panel edges, and damaged surface areas, use setting-type taping compound.
 - b. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping or drying-type, all-purpose compound as recommended by the

manufacturer to obtain best results from actual project conditions.

- 1) Use setting-type compound for installing paper-faced metal trim accessories.
 - c. Fill Coat: For second coat, use drying-type, all-purpose compound.
 - d. Finish Coat: For third coat, use drying-type, all-purpose compound.
 - e. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.
4. Joint Compound for Tile Backing Panels:
- a. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.
 - b. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
 - c. Cementitious Backer Units: As recommended by backer unit manufacturer.
- E. Fasteners:
1. Screws: ASTM C 954 or ASTM C 1002 self-drilling and self-tapping steel screws with double-lead thread design as approved by system manufacturer for standard and heavier gauge load bearing steel framing.
 2. Nails: ASTM C 514, annular ring type as approved by system manufacturer.
 3. Staples: Galvanized, as recommended to approved accessory manufacturer.
- F. Metal Backing: Refer to Section 092216 – Non-Structural Metal Framing.
- G. Metal Accessories: ASTM C 1047 Electro-galvanized steel corner beads and trim (casing beads) formed for application of joint cement and manufactured specifically for gypsum board construction, minimum base steel 0.014 inch thick.
- H. Special Trims and Accessories:
1. General: Provide extruded aluminum trims and accessories in conforming to profiles and shapes as shown on Drawings and as specified.
 - a. Provide double-layer gypsum board assemblies at locations shown on Drawings to receive recessed reveal trims.
 - b. Material: Extruded aluminum alloy 6063 T5.
 - c. Manufacturer: Provide products manufactured by Gordon, Fry Reglet Company, Flannery Company, or equal.
 - d. Accessories: For each trim profile noted below, provide factory fabricated where required by layouts shown on Drawings, including:
 - 1) Mitered assemblies for "T-intersections" and "X-intersections".
 - 2) Finished end caps.

2. Partition "End Cap" Trims: Provide for providing finished ends to gypsum board walls including chemical conversion coating. Typical where gypsum board walls butt mullions of window or window wall assemblies, allowing attachment of partition cap to mullion prior to construction of gypsum board wall.
 - a. Overall Width: Provide width matched to partition assembly, including:
 - 1) 4-inch stud walls with 5/8-inch gypsum board each side.
 - 2) 6-inch stud walls with 5/8-inch gypsum board each side.
 - b. Tape/screw Flanges: Nominal 7/8-inch.
 - c. Manufacturer: Provide "910 Series" Final Forms by Gordon or equivalent products manufactured by Fry Reglet Company, Flannery Company, or equal.
3. Reveal "Top Track" Trim: Provide for top of wall or partial height partition top cap termination where shown on Drawings.
 - a. Reveal Depth: Nominal 5/8-inch for use with 5/8-inch gypsum board panels.
 - b. Reveal Width: As shown on Drawings.
 - c. Overall Width: Provide width matched to partition assembly, including:
 - 1) 4-inch stud walls with 5/8-inch gypsum board each side.
 - 2) 6-inch stud walls with 5/8-inch gypsum board each side.
 - d. Tape/screw Flanges: Nominal 7/8-inch.
 - e. Manufacturer: Provide "922 Series" Final Forms by Gordon or equivalent products manufactured by Fry Reglet Company, Flannery Company, or equal.
4. Reveal "Field" Trims: Provide for creating square-edged vertical and horizontal reveal lines in gypsum board wall assemblies where shown on Drawings.
 - a. Depth: Nominal 5/8-inch for use with 5/8-inch gypsum board panels.
 - b. Reveal Width: As shown on Drawings.
 - c. Tape/screw Flanges: Nominal 7/8-inch.
 - d. Manufacturer: Provide "500 Series" double-sided Final Forms reveals by Gordon or equivalent products manufactured by Fry Reglet Company, Flannery Company, or equal.
5. Reveal "Edge" Trim: Provide for finished vertical and horizontal reveal edges at top and sides of gypsum board panels where shown on Drawings.
 - a. Reveal Depth: Nominal 5/8-inch for use with 5/8-inch gypsum board panels.
 - b. Reveal Width: As shown on Drawings.
 - c. Tape/screw Flanges: Nominal 7/8-inch.
 - d. Manufacturer: Provide "200 Series" Final Forms by Gordon or equivalent products manufactured by Fry Reglet Company, Flannery Company, or equal.
6. Reveal "Base" Trim: Provide for recessed base at bottom of gypsum board panels at floor where shown on Drawings.
 - a. Reveal Depth: Nominal 5/8-inch for use with 5/8-inch gypsum board panels.
 - b. Reveal Width: 4-inches.
 - c. Tape/screw Flanges: Nominal 7/8-inch.
 - d. Manufacturer: Provide "800 Series" Final Forms by Gordon or

equivalent products manufactured by Fry Reglet Company, Flannery Company, or equal.

7. Special Fabrications: Provide factory fabricated mitered assemblies for "T-intersections" and "X-intersections" where shown on Drawings.
 8. Finish: Special trims to be primed and painted to match adjacent wall surfaces as specified in Section 099123 – Interior Painting.
- I. Adhesive for Laminating Board: As recommended by approved board manufacturer.
 - J. Acoustical Sealant: As specified in Section 079200 – Joint Sealants.
 - K. Electrical Box Sealer:
 1. Non-rated Locations: As specified in Section 079200 – Joint Sealants.
 2. Fire-rated Locations: As specified in Section 078413 – Penetration Firestopping.
 - L. Concealed, Non-Rated Access Panels: As specified in Section 08310 – Access Panels.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect areas and surfaces scheduled to receive gypsum board and verify that:
 1. Support systems are in proper alignment, straight and true.
 2. Required blocking, bracing and backing members of support systems are installed.
- B. Do not start work until unsatisfactory conditions are corrected.

3.2 PREPARATION

- A. Coordinate details with other work supporting, adjoining, or fastening to gypsum board.

3.4 INSTALLATION - INTERIOR GYPSUM BOARD

- A. General Requirements:
 1. Apply and finish gypsum board in accordance with requirements of ASTM C 840 unless otherwise noted.
 2. Cut gypsum board by scoring and breaking or sawing from face side. Smooth all cut edges and ends of gypsum board where necessary, in order to obtain neat jointing.
 3. Scribe ceiling board neatly in casing bead where it meets surfaces in other planes.
 4. Apply first to the ceiling at right angles to framing members, then to

- walls. Use boards of maximum practical length so that a minimum number of end joints occur.
5. Apply in either vertical or horizontal direction with ends and edges falling on framing members or other solid backing except where edge joints are at right angles to support. Bring ends and edges into contact with adjoining board, but do not force into place.
 6. Lay out joints at openings so that no end joint aligns with edges of opening unless control joints will be installed at these points.
 - a. All joints running parallel to framing shall be centered as near as possible on face of framing member.
 - b. Stagger end joints and arrange joints on opposite sides of partition to occur on different studs.
 - c. At external corners, butt and fit board to provide solid edge.
 7. Hold gypsum board nominal 1/4-inch above floor or curb typical.
 8. Where gypsum board is carried full height to structure above, provide for deflection of structure by undercutting board nominal 3/8 inch and seal top edge of board to structure in continuous bead to form elastic closure.
 9. Cut board to fit electrical outlets, pipes, or other items as required.
 - a. Cut gypsum board by scoring on face and back in outline before removal or by cutting with a saw or other suitable tool.
 - b. Smooth all cut out where necessary.
 10. After trim is applied and prior to decoration, correct surface damage and defects.
 11. Provide gypsum backer board gusset at double stud walls where studs are less than 3-5/8 inches thick.
 12. Fastening:
 - a. Attach board from center to edges and ends, pressing firmly against supports. Place fasteners approximately not more than 1 inch nor less than 3/8 inch from edges with heads just below gypsum board surfaces; but do not break paper.
 - b. Walls: Space screws maximum 12 inches on center for ceilings and maximum 16 inches on center for walls in field and along abutting edges.
 - c. Suspended Ceilings: Space screws maximum 12 inches on center in field and along abutting edges.
- B. Curved Surfaces:
1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch-long straight sections at ends of curves and tangent to them.
 2. 1/4-inch Board Application: For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.
 - a. Continue double layer 1/4-inch board application to closest adjacent inside or outside corners. Do not "shim" double board to align with adjacent 5/8 thick gypsum board.
 3. Fire-rated Assemblies: Provide in strict conformance with referenced UL-listed assembly. Use on standard thickness type "X" board bent per manufacturer's written instructions.

C. Joint Treatment:

1. Apply tape and cement to joints and corners in strict accordance with directions of gypsum board manufacturer.
2. Pre-fill V-grooves formed by the abutting beveled or rounded wrapped edges with joint compound as per manufacturing recommendations.
3. Use tape and cement, allow to dry between coats. Use number of coats required by level of finish specified.
4. Work final coat to smooth level plane surface.
5. Protect external corners with metal corner beads unless otherwise noted.
6. Treat fastening head dimples same as joints; tape may be omitted.
7. Joints and fastening head dimples in backer board need only be treated as required to preserve fire rating.
8. Seal joints shown on Drawings and where gypsum board meets dissimilar material with specified sealant. Tool to neat surface, ready for paint; remove excess material.

D. Fire-Rated Conditions:

1. At penetrations of rated assemblies, preserve continuity of fire rating with firestopping systems as specified in Section 07840 – Firestopping and Smoke Seals.
2. Where adjacent interior spaces have suspended ceilings of different heights, extend separating partition finish on both faces of studs to at least 3 inches above higher ceiling finish.
3. Conform to applicable codes and authorities for requirements of taping and cementing joints and fastener heads.

E. Sound Retardant Partitions:

1. Construct partitions in accordance with Drawings and as herein specified.
2. Hold face layers and base layers 1/4 inch clear from abutting surfaces, floors, walls and overhead structure. Seal with specified sealant and tape. Tape not required at floors.
3. Provide airtight closures at wall penetrations (outlet boxes, pipes, duct work and other items) by neatly cutting gypsum board to clear penetrations. Seal void with specified sealant and apply joint tape to both gypsum board and penetrating object.
4. Seal airtight the backs and sides of electrical junction boxes with resilient sealer pads.

F. Furring over Recessed Light Fixtures: At non-rated lighting fixtures, construct furring from gypsum board as indicated on Drawings.

G. Water-Resistant Board: During board application, coat all cut edges with approved water resistant adhesive as recommended by manufacturer for the application.

H. Enclosure System: Install in strict accordance with requirements of approved manufacturer's system using metal components, gypsum components, and other accessories as required.

- I. Cementitious Backer Board:
 1. General: Install cementitious backer board in strict conformance with the requirements of the tile assemblies specified in Section 093000 – Tile.
 2. Provide support systems so that all edges of cementitious backer boards are supported.
 3. Use only corrosion-resistant fasteners.

3.5 FINISHING INTERIOR GYPSUM BOARD ASSEMBLIES

- A. Levels of Gypsum Board Finish: Provide the following levels of gypsum board finish per USG "Gypsum Construction Handbook, Centennial Edition".
 1. Level 1: for ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistive-rated assemblies and sound-rated assemblies.
 2. Level 2: where water-resistant gypsum backing board panels form substrates for tile, and where indicated.
 3. Level 3: not used.
 4. Level 4: Typical, for all gypsum board surfaces unless otherwise indicated.
 5. Level 5: for gypsum board surfaces, at specific locations shown on Drawings or as required for specified finishes, including:
 - a. All curved Gypsum Board Wall assemblies.
 - b. Surfaces scheduled to receive multi-color paint finishes as specified in Section 099123 – Interior Painting when recommended by the finish manufacturer.
 - c. Other locations as shown on Drawings.
- B. Level 4 gypsum board finish: Embed tape in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads, and accessories. Touch up and sand between coats and after last coat as needed to produce a surface free of visual defects and ready for decoration. Use the following joint compound combination:
 1. Embedding and First Coat: Ready-mixed, drying-type, all-purpose or taping compound.
 2. Fill (Second) Coat: Ready-mixed, drying-type, all-purpose or topping compound.
 3. Finish (Third) Coat: Ready-mixed, drying-type, all-purpose or topping compound.
- C. Where Level 5 gypsum board finish is indicated: apply joint compound combination specified for Level 4 plus a thin, uniform skim coat of joint compound over entire surface.
 1. Use joint compound specified for the finish (third coat) or a product specially formulated for this purpose and acceptable to gypsum board manufacturer.
 2. Produce surfaces free of tool marks and ridges ready for decoration of type indicated.
- D. Where Level 2 gypsum board finish is indicated, apply joint specified for first

coat in addition to embedding coat.

- E. Where Level 1 gypsum board finish is indicated, apply joint compound specified for embedding coat.
- F. Finish water-resistant gypsum backing board forming base for mortar-set ceramic tile to comply with ASTM C 840 and board manufacturer's directions for treatment of joints behind tile.
- G. Impact-Resistant Gypsum Board:
 - 1. Construct partitions in accordance with Drawings and as herein specified.
 - 2. General: Install to a height of no less than 4 feet above finish floor at locations shown on Drawings.

3.6 CLEANING AND PROTECTION

- A. Remedy any fastener popping or ridging.
- B. Promptly remove any residual joint compound from adjacent surfaces.
- C. Provide final protection and maintain conditions, in a manner suitable to Installer, that ensures gypsum board assemblies remain without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 095113 – ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included: Provide and install acoustical ceilings panels and accessories, complete, as shown and specified, including:
 - 1. Mineral core acoustical ceiling panels.
- B. Work Specified Elsewhere:
 - 1. Section 092216 – Non-Structural Metal Framing.
 - 2. Division 23 – Mechanical (Air Supply, Ducts, and Connections).
 - 3. Division 26 – Electrical (Lighting Fixture Attachments).

1.2 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM):
 - 1. C635; Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings.
 - 2. C636; Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
- B. Ceiling and Interior System Contractors Association (CISCA):
 - 1. Ceiling Systems Handbook.

1.3 SYSTEM DESCRIPTION

- A. Performance Criteria:
 - 1. Fire-Hazard Classification: Provide acoustical ceilings that are identical to those tested for following fire hazard characteristics, per ASTM test method indicated below, by UL or other testing and inspecting organizations acceptable to authorities have jurisdiction. Identify acoustical ceiling components with appropriate markings of applicable testing and inspecting organization.
 - a. Test Method: ASTM E84.
 - b. Flame Spread: 25 or less.
 - c. Smoke Developed: 50 or less.

1.4 SUBMITTALS

- A. Comply with requirements of Section 013300 – Submittal Procedures.
- B. Product Data: Manufacturer's specifications, data, and installation instructions.

- C. Shop Drawings:
1. Coordination Drawings: Reflected ceiling plans drawn accurately to scale and coordinating penetrations and ceiling-mounted items. Show following:
 - a. Ceiling suspension members.
 - b. Method of attaching hangers to building structure.
 - c. Ceiling-mounted items including light fixtures; air outlets and inlets; speakers; sprinkler heads; and special moldings at walls, column penetrations, and other junctures with adjoining construction.
- D. Samples:
1. For Initial Selection: Manufacturer's standard sample sets consisting of actual acoustical units or sections of units showing full range of colors, textures, and patterns available for each type of unit indicated.
 2. For Verification: 12-inch-square sample of each type of exposed finish specified or selected and of same thickness and material indicated for final unit of Work. Where finishes involve normal color and texture variations, include sample sets showing full range of variations expected.
- E. Qualification Data: For firms and persons specified in Quality Assurance article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of Architects and Owners, and other information specified.
- F. Research Reports: Or evaluation reports of model code organization acceptable to authorities having jurisdiction that show compliance of acoustical ceiling system and components with building code in effect for Project.
- G. Product Test Reports: From qualified independent testing agencies that are based on its testing or current products for compliance of acoustical ceiling systems and components with requirements.

1.5 QUALITY ASSURANCE

- A. Qualifications of Installer: Engage experienced Installer who has successfully completed acoustical ceilings similar in material, design, and extent to those indicated for Project.
- B. Single-Source Responsibility: Obtain each type of acoustical ceiling unit from single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of Work.
- C. Coordination of Work: Coordinate layout and installation of acoustical ceiling units and suspension system components with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system components (if any), and partition system (if any).

1.7 PRODUCT HANDLING

- A. Delivery and Storage: Deliver acoustical ceiling units to Project site in original, unopened packages and store them in fully enclosed space protected against damage from moisture, direct sunlight, surface contamination, and other causes.
- B. Handling: Handle acoustical ceiling units carefully to avoid chipping edges or damaging units in any way.

1.8 PROJECT CONDITIONS

- A. Storage: Before installing acoustical ceiling units, permit them to reach room temperature and stabilized moisture content.
- B. Space Enclosure: Do not install acoustical ceilings until space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above ceilings is complete, and ambient conditions of temperature and humidity will be continuously maintained at values near those expected for final occupancy.

PART 2 - PRODUCTS

2.1 MINERAL CORE ACOUSTICAL PANELS

- A. Manufacturer: Provide products manufactured by Armstrong World Industries; USG; or equal.
 - 1. Basis-of-Design: Armstrong World Industries products are specified as the basis of design. Field Verify to match existing.
- B. Mineral Core Acoustical Panel Types:
 - 1. See ceiling plans for basis of design tile required. Field verify to match existing.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Examine substrates and structural framing to which ceiling system attached or abuts, with Installer present, for compliance with requirements specified in this and other sections that affect installation and anchorage of ceiling system. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install acoustical ceiling systems per Reference Standards and manufacturer's instructions.

B. Acoustical Ceiling Tiles:

1. General: Make joints straight and true to line with exposed surfaces flush and level. Tightly butt tiles with corners and arises full and without broken edges.
2. Suspended System:
 - a. Concealed Grid: Install tile with concealed metal splines in kerfed edges between tiles to form concealed mechanical joints.
 - b. Edge Units: Install spring steel spacers where supported on edge trim.
 - c. Access Tile: Install units by concealed saddle and notched hook spline method.
 - d. Identification Markers: Install one per access tile; locate on tile as directed.

3.3 CLEANING

- A. Cleaning: Clean exposed surfaces of acoustical ceiling panels. Comply with manufacturer's instructions for cleaning and touch-up of minor finish damage. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 096100 – MOISTURE VAPOR EMISSION CONTROL

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Pre-formed moisture suppression membrane installed over concrete subfloor as a floor covering underlayment

1.2 RELATED SECTIONS

- A. Section 096519 – Resilient Flooring

1.3 REFERENCES

- A. ASTM International (ASTM):
 1. ASTM D2646-05- Standard test Methods for Backing Fabric Characteristics of Pile Yarn Floor Coverings.
 2. ASTM G31-15- Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
 3. ASTM D5197 – 09e1 – Standard Test Method for Determination of Formaldehyde and Other Carbonyl Compounds in Air (Active Sampler Methodology).
 4. ASTM D5729-97 (2004)e1 – Standard Test Method for Thickness of Nonwoven Fabrics.
 5. ASTM E96-05 – Standard Test Methods for Water Vapor Transmission of Materials.
 6. ASTM F710 – Standard Practice Preparing Concrete Floors.
 7. ASTM F2170 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

1.4 SUBMITTALS

- A. Submit under provisions of Section 013300.
- B. Product Data: Manufacturer's data indicating product physical characteristics, performance criteria, and limitations of use, including:
 1. Preparation instructions and recommendations.
 2. Storage and handling requirements and recommendations.
 3. Installation methods.
- C. Warranty Registration: Manufacturer's warranty registration with concrete subfloor moisture test results and building ambient air temperature and relative humidity test results.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Minimum 5 year experience manufacturing similar products.
- B. Installer Qualifications: Minimum 2 year experience installing similar products.
- C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
 - 1. Finish area designated by Architect.
 - 2. Do not proceed with remaining work until workmanship is approved by Architect.
 - 3. Refinish mock-up area as required to produce acceptable work.

1.6 PRE-INSTALLATION MEETINGS

- A. Convene minimum two weeks prior to starting work of this section.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.
- B. Handling: Handle materials to avoid damage.

1.8 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.9 SEQUENCING

- A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.10 COORDINATION

- A. Coordinate the work of this section and directly related sections with concrete floor construction and repair.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: GCP Applied Technologies; Tel 925-864-7186, E-mail: Jennifer.chambers@gcpat.com. Web: <http://www.gcpat.com>

2.2 MOISTURE SUPPRESSION SYSTEM FOR FLOORING PRODUCTS

- A. Product: VersaShield MBX Flooring Underlayment as manufactured by GCP Applied Technologies
 - 1. Material: Free-standing, dimensionally stable, 4-ply composite product, engineered as a moisture suppression membrane to be used on concrete floors where high moisture exists.
 - 2. Dimensions: 144 feet long by 5 feet wide (43.9 m by 1.52 m) standard roll.
 - 3. Mold, Mildew and Fungal Resistance, ASTM G21: Passed
 - 4. Moisture Vapor Transmission rate, ASTM E96: Less than 0.01 g/hr/ sq m

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Concrete Subfloor:
 - 1. Verify internal RH of the concrete according to ASTM F-2170.
 - 2. Record readings and submit with manufacturer's warranty registration.
 - 3. Do not install VersaShield MBX if relative humidity levels within the concrete exceed 99.5% RH.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 PREPARATION

- A. Concrete Sub Floor:
 - 1. Prepare floor according to manufacturer's instructions including removal of existing materials on concrete surface, grinding protrusions flat, and filling low spots with water-resistant cementitious patching or leveling compound. Patch cracks greater than 1/8 inch (3.2 mm) width using manufacturer's approved crack mending compound.
 - 2. Remove debris and excessive dust from the surface.

3.4 UNDERLAYMENT INSTALLATION

- A. Install underlayment in all areas where new slab on grade is applied as well as on existing slab on grade where new finishes are called out.
- B. Install in accordance with manufacturer's instructions.
- C. Install moisture suppression membrane with smooth film side facing concrete slab.
- D. Install in accordance with membrane manufacturer's current written installation instructions.
 - 1. Install in accordance with membrane manufacturer's current **3' x 2'-6" Box Grid** installation instructions.
- E. If any jobsite condition interferes with compliance with manufacturer's instructions, contact manufacturer and obtain written job-specific procedures. Notify Architect or Owner's representative describing the interfering jobsite condition and manufacturer's job-specific instructions.

3.5 FLOORING INSTALLATION

- A. Adhesives: Apply adhesive to mineral-coated surface of moisture suppression membrane. Use only water-based, non-porous adhesives. Do not use solvent-based adhesives.
- B. Protection: Protect moisture suppression membrane from damage during flooring installation. Do not tear, rip, puncture, or delaminate membrane when applying trowel-on adhesive. Repair damaged areas according to membrane manufacturer's instructions before flooring installation. Provide continuous, intact moisture suppression membrane under entire designated flooring area.
- C. Sheet Vinyl/LVT: Adhere directly to VersaShield MBX only. Installation requires review by Halex Technical Services prior to installation. Call (800) 576-1636 to get Job Specification warranty form and installation instructions.

3.6 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 096519 – RESILIENT FLOORING

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included: Provide and install resilient flooring, resilient base and accessories, complete as shown on Drawings and as specified, including:
1. Luxury Vinyl Tile and Luxury Vinyl Plank
 2. Homogeneous sheet vinyl, heat welded including integral coved base.
 3. Heterogeneous Sheet Flooring
 4. Resilient Base at sealed concrete floors.
 5. Edge Strips, Reducer Strips and other floor-edge transitions.
 6. Cap trim, cove-shaped furring, and accessories for cove base installations.
 7. Hot Weld Strips and cold seam materials.
 8. Adhesives and other accessory materials as required to provide complete floor assemblies as specified.
- B. Work Specified Elsewhere:
1. Section 035300 – Concrete Toppings.
 2. Section 087100 – Door Hardware.
 3. Section 093000 – Tile.

1.2 REFERENCE STANDARDS

- A. Resilient Floor Covering Institute (RFCI).
- B. American Society for Testing and Materials (ASTM):
1. ASTM E-1907-98: "Standard Practices for Determining Moisture-Related Acceptability of Concrete Floors to Receive Moisture-Sensitive Finishes".
 2. ASTM F-1869-89: "Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride".

1.3 SUBMITTALS

- A. Comply with requirements of Section 013300 – Submittal Procedures.
- B. General: Schedule submittals as required to provide a minimum of 60-days from flooring materials order day to start of installation.
- C. Shop Drawings: Provide seaming diagrams for public spaces including corridors.
- D. Samples:
1. Edge, Reducer and Transition Strips: Each specified type and color, 12 inches long.

2. Resilient Tile Flooring: 2 samples, each type and color specified, 12 inches square.
 3. Resilient Sheet Flooring: 2 samples, each type and color specified, 12 inches square.
 4. Resilient Base: 2 samples each type and color, 12 inches long. None required for black color.
- E. Product Data: Manufacturer's specifications, data, and installation instructions.
- F. Qualifications: Submit Contractor's and Installer's project lists and specified manufacturer certifications, including project names and addresses and contact names and telephone numbers.
- G. Maintenance Manuals: Manufacturer's written maintenance instructions.

1.4 QUALITY ASSURANCE

- A. Qualifications of Installer: Minimum of three project installations of extent comparable to proposed Project.
- B. Regulatory Requirement: Materials shall have the following flammability ratings, according to NFPA 253:
1. Smoke Density: 45 or less.
 2. Critical Radiant Flux: Class I - Minimum 0.45 watts per square centimeter. (Class II - Minimum 0.22 watts per square centimeter.)
- C. Slip Resistance: Static coefficient of friction for installed flooring shall be equal to or greater than .06 when measured with a James Machine per ASTM D2047.

1.5 PRODUCT HANDLING

- A. Comply with requirements of Section 016000 – Product Requirements.
- B. Delivery: Deliver materials to Project site in manufacturer's unopened containers clearly marked with manufacturer's name, brand, size, thickness, grade, color, graining, and design.
- C. Storage: Store materials per manufacturer's recommendations and at not less than 70 degrees F for at least 24 hours before installation.

1.6 PROJECT CONDITIONS

- A. Environmental Requirements: Maintain temperature in spaces to receive resilient flooring at 70 degrees F minimum at least 48 hours before, during, after installation; thereafter, maintain a 55 degrees F minimum.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Basis-of-Design: Tile Products as scheduled on the Drawings provide a "Basis-of-Design" for each scheduled Resilient Flooring Product and have been selected and approved for use by the Owner based manufacturer's samples provided to the Architect, and have been fully coordinated with finish materials specified elsewhere.
- B. Resilient Flooring substitution requests will only be considered for acceptance by the Architect when the following conditions are met:
 - 1. Proposed substitution Resilient Flooring meets or exceeds the specified material, construction and performance criteria.
 - 2. Proposed Resilient Flooring substitution visually matches scheduled types for thickness, textures, patterns, color, and reflectance and other surface characteristics as determined by the Architect.
 - 3. Acceptance of a proposed substitution Resilient Flooring by the Architect shall incur no additional cost to the Owner, including costs incurred to re-select adjacent finishes specified elsewhere as required to coordinate and match substituted Resilient Flooring for color, texture or pattern.

2.2 RESILIENT BASE AND ACCESSORIES

- A. Manufacturer: Provide products manufactured by Mannington.
- B. Adhesive for Resilient Bases: Waterproof type recommended in writing or supplied directly by base manufacturer.
- C. Resilient Base Materials: Thermoplastic Rubber, Type TP- Premium Edge wall base. Finish: Smooth Matte Finish. Corners- Factory pre-formed. Thickness- 1/8"; 4-foot minimum length.
 - 1. Provide colors as scheduled on Drawings and specified and as required to match Architect's samples.
 - 2. Provide manufacturer's standard black at casework bases.
- D. Resilient Base Types:
 - 1. Rubber Wall Base by Mannington
 - a. Color: As scheduled on Drawings.
 - b. Height: 4-inches.
 - c. Seal rubber base to resilient flooring with continuous clear silicon sealant.
- E. Locations: Provide resilient base at locations shown or scheduled on Drawings, including:
 - 1. Exposed, Sealed and Painted Concrete floors.
 - 2. Floors finished with materials specified in this Section.
 - 3. Plywood.

2.4 HOMOGENEOUS SHEET VINYL FLOORING

- A. General: Provide PVC-Free Resilient Sheet Flooring in conformance with ASTM F-1303, Type I, Grade 1, Class B Backing, for types, compositions, and other characteristics indicated.
1. Manufacturer: Provide “**BIOSPEC MD**” by **Mannington** Commercial Flooring.
 2. Homogeneous Vinyl Flooring Types:
 - a. As scheduled on Drawings.
- B. Performance Requirements:
1. Fire Resistance: 450 or less when tested per ASTM E-662/NFPA 258 (Smoke Density). 0.45-watts/cm² or better (Class 1 or better) when tested per ASTM E-648/NFPA 253 (Critical Radiant Flux).
 2. Static Load Limit: 750-pounds per square inch or better when tested per ASTM F-970.
 3. Slip Resistance: equal or exceed specified requirements.
- C. Homogeneous Sheet Vinyl Flooring Accessories:
1. Adhesive: Provide Solvent-free Adhesives recommended by each Homogeneous Sheet Vinyl Flooring Manufacture in writing for use with each type of specified Homogeneous Sheet Vinyl Flooring and for the actual conditions at the project area.
 - a. Adhesive Trowel: Use appropriate trowel tooth patterns as recommended by the Adhesive Manufacturer in writing for use with the specified Homogeneous Sheet Vinyl Flooring types.
 2. Sub-Floor Primer and Sealer: Provide sub-floor Sealers or Primers where recommended by the Resilient Sheet Flooring Manufacturer(s) in writing where required by the Sub-Floor conditions at the project area at the project area noted during verification of conditions.
 3. Welding Rods: For Homogeneous Sheet Vinyl Flooring shown on Drawings or scheduled to receive heat-welded seams, provide 4-mm welding rod as recommended in writing by the manufacturer of each specified type of Flooring. Provide single-sourcing of welding rods and sheet vinyl flooring for each specified type of Resilient Sheet Flooring.
 - a. Colors: Provide welding rods to match Architect's samples or as selected by Architect from manufacturer's full range of colors.
 4. Homogeneous Sheet Vinyl Flooring Initial Cleaning: Typical at all locations, follow Resilient Sheet Flooring manufacturer's written instructions recommending process and product for each specified type.
 - a. Finish Sheen: to be Matte.

2.5 LUXURY VINYL TILES AND PLANK

- A. General: Provide Luxury Vinyl Tiles and Planks in conformance with ASTM F-1700, Class 3, Type B for types, compositions, and other characteristics indicated.
1. Manufacturer:
 - a. Provide 18" x 18" LVT “**Walkway TILE**” by **Mannington** Commercial Flooring. See finish schedule on drawings.
 2. Luxury Vinyl Tile and Plank Types:
 - a. As scheduled on Drawings.

B. Performance Requirements:

1. Fire Resistance: 450 or less when tested per ASTM E-662/NFPA 258 (Smoke Density). 0.45-watts/cm² or better (Class 1 or better) when tested per ASTM E-648/NFPA 253 (Critical Radiant Flux).
2. Static Load Limit: 750-pounds per square inch or better when tested per ASTM F-970.
3. Slip Resistance: equal or exceed specified requirements.

C. Luxury Vinyl Tile and Plank Accessories:

1. Adhesive: Provide Solvent-free Adhesives recommended by the Luxury Vinyl Plank Manufacturer(s) in writing for use with each type of specified Vinyl Composition Tile and for the conditions at the project area.
 - a. Adhesive Trowel: Use appropriate trowel tooth patterns as recommended by the Adhesive Manufacturer in writing for use with the specified Luxury Vinyl Plank types.
2. Sub-Floor Primer and Sealer: Provide sub-floor Sealers or Primers where recommended by the Luxury Vinyl Plank Manufacturer(s) in writing where required by the Sub-Floor conditions at the project area at the project area noted during verification of conditions.
3. Luxury Vinyl Plank Sealer: Typical at all locations, provide sealer coat for Luxury Vinyl Plank floors as recommended by each Luxury Vinyl Plank manufacturer in writing for each specified type.
4. Wax for Luxury Vinyl Plank: not recommended.

2.6 MATERIALS FOR COVERED BASE AT RESILIENT FLOORS

A. General: Provide materials as required to install cove base at locations shown or scheduled on Drawings. Not all specified resilient sheet flooring types may require cove base; some resilient flooring types may be scheduled to receive several base treatments, including cove base.

B. Materials:

1. Fillet Cove Strips: Provide redwood cove strips as recommended by each specified resilient sheet flooring manufacturer in writing to coordinate with each specified resilient sheet flooring type.
2. Outside Corner for Resilient Sheet Coved Base: Provide the each specified manufacturer's outside pre-molded corner to match each specified resilient sheet flooring type. Provide types and color(s) as scheduled on Drawings and as specified.
3. Cap Strip: Vinyl cap to be Mercer Mouldings #040 by Mannington. Single-source one cap strip type and finish for use through-out entire scope of project. Provide cap strips in the longest length practical to minimize butt joints. See finish schedule for color. Provide caulking where cap meets wall surfaces.

2.7 REDUCER STRIPS, EDGE STRIPS AND TRANSITIONS

A. Manufacturer: Where Manufacturer's standard products are scheduled on Drawings and specified, provide the specific products indicated or materials complying with the requirements set forth in this Section.

- B. Adhesive for reducer, edge and transition strips: Waterproof type recommended in writing or supplied directly by base manufacturer.
- C. Locations: Provide reducer, edge and transition strips at locations where different floor finishes meet, as required to protect the transition joint and/or provide a gentle transition between floor finishes of differing thicknesses, including:
 - 1. Exposed, Sealed and Painted Concrete floors: to any other floor finish.
 - 2. Section 093000 – Tile: to any floor finish specified in this Section and Section 096813 – Tile Carpeting.
 - 3. Floor finishes specified in this Section:
 - a. All locations between two different floor finish materials specified in this Section.
 - b. Between two different floor finish colors of the same material specified in this Section when shown or scheduled on Drawings.
 - c. Between floor finishes specified in this Section and at transitions to carpet specified in Section 096813 – Tile Carpeting.
- D. Manufacturer: Provide reducer, edge and transition strips by Johnsonite, Mercer, or equal.
 - 1. Provide reducer, edge and transition strips at all level differences in flooring. Center on door frame where possible.
 - a. Colors: As selected by the Architect from the manufacturer's full range of standard colors.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Examine substrates and adjoining construction and conditions under which Work will be installed. Give written notification of deficiencies detrimental to proper or timely installation; do not proceed until corrected.
- B. Slab Moisture Test:
 - 1. General: Test substrates to determine acceptable dryness prior to application of resilient flooring. Use ASTM F-1869-89, "Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride", as applicable for the specified flooring as recommended by resilient flooring manufacturer.
 - 2. Slab-Moisture Content Testing: Perform tests at locations not more than 50 feet apart in every direction, but no less than one test per 1000-square feet. Verify the following performance criteria are equaled or exceeded before beginning floor installation:
 - a. Vapor and moisture barrier shall reduce vapor transmissions from concrete slabs-on-grade and above-grade concrete and metal deck assemblies to 3 pounds or less per 1000-square feet in a 24-hour period when tested per ASTM F-1869-89.
 - b. Alkalinity: Maximum pH of 10.

3. Contingency for High Moisture Readings: Report all unacceptable test results to Architect.
- C. Air-Moisture Content Testing:
1. General: Determine relative humidity of air in rooms to receive resilient flooring, using wet-bulb and dry-bulb sling psychrometer. Do not install resilient flooring when relative humidity exceeds 45 percent.
- D. Adhesion Test:
1. Secure one, three-foot-square piece of each specified type of resilient sheet or 3-foot by 3-foot area of each specified type of tile in each typical area that has passed the specified moisture test, using adhesive(s) as specified and recommended by manufacturer(s).
 2. The test pieces shall remain in place for 72 hours.
 3. Determine if the adhesive is bonding the material satisfactorily to the surface. Resilient flooring should not be able to be removed without severe deformation, tearing, or destruction of the sample(s).
 4. Where there is evidence of unsatisfactory bonding, manufacturer's representative is to be notified in order that they may verify and evaluate the conditions.
 5. Notify Architect immediately if, in the opinion of manufacturer's representative, the adhesion test results are unsatisfactory.
 6. Remove successful test pieces and adhesive prior to commencing final installation.

3.2 PREPARATION

- A. Surface Preparation: Clean substrate of deleterious materials which impair bonding of resilient flooring. Do Work on smooth, even troweled finish. Remove rough areas and protrusions from concrete by gridding. Fill cracks, rough areas, and other surface defects with an acceptable plastic filler.
- B. Primer/Sealer Coat: Apply primer to concrete surfaces; work well into surfaces; use minimum quantity that will assure complete surface coverage with a non-absorptive base. Allow primer to thoroughly dry before applying adhesive.
1. Prime coat may be omitted if recommended by resilient flooring manufacturer in writing based on review of the project area. Review the requirements for each specified type of resilient flooring for each project area.
 2. Do not combine different specified flooring types under one manufacturer's recommendation.

3.3 INSTALLATION

- A. Edge Strips:
1. General: Install in continuous lengths at door openings and other exposed edges of resilient flooring, unless otherwise shown. Install edge strips before applying primer.
 2. Metal: Anchor strips solidly to substrate with countersunk non-magnetic stainless steel screws; use lead shields for anchoring into concrete;

- space screws 1-inch from each end and not more than 9-inch centers at intermediate points.
3. Vinyl: Set in and securely bond to substrates with adhesive per manufacturer's recommendations.
- B. Prime Coat: Apply primer to concrete surfaces; work well into surfaces; use minimum quantity that will assure complete surface coverage with a non-absorptive base.
1. Allow primer to thoroughly dry before applying adhesive.
 2. Prime coat may be omitted if recommended by resilient flooring manufacturer.
- C. Adhesive: Apply to substrate with properly notched steel trowels; allow adhesive to become tacky before applying resilient flooring.
- D. Resilient Flooring: Extend flooring, and fit neatly and tightly, into breaks and recesses, against bases, around pipes and penetrations, around permanent casework, equipment, and under-casework recesses.
- E. Sheet Material:
1. General: Lay sheet material with minimum number of joints with bottom surface securely bonded to substrate and top surface left smooth, clean, and free from imperfections.
 - a. Make joints straight, tight, and inconspicuous.
 - b. Roll each sheet from center to edges to assure complete bond and tight joints.
 2. Joints: Provide Chemically Weld; Adhesive Weld; Heat Weld as scheduled on Drawings and in conformance with sheet flooring manufacturer's written instructions.
 3. Coved Bases:
 - a. Install a continuous redwood cove strip at intersection of floor and vertical surfaces prior to laying sheet material.
 - b. Use cove strip with a 3/4-inch radius; make bases 4 inches high, unless otherwise shown; butt ends; miter corner; secure with acceptable type fasteners.
 - c. Apply cove strips and sheet material to solid backing.
 - d. Roll sheet material into adhesive; hold in place until complete adhesion is assured.
 - e. Make top of base level and straight; terminate top edge into a metal trim cap.
 - f. Securely screw trim cap to backing before applying sheet material; use single lengths where possible; make neat mitered corners and butted ends.
 - g. Use standard aluminum alloy or stainless steel trim cap of standard design as selected, unless otherwise shown.
 4. Perimeter Bond System: At Contractor's option, a perimeter bond system may be used for installation of sheet vinyl flooring.
 - a. Do work with manufacturer's approved and trained applicators per manufacturer's recommendations and supervision.
 - b. Install sheet vinyl flooring with adhesive spread only at seam lines, projections, and wall lines.
 - c. Cut seams with an electrically operated cutting machine made for purpose.

F. Resilient Bases:

1. General: Where base is scheduled, install around perimeter of room or space, at base of partitions, walls, columns, pilasters, casework, and other permanent fixtures.
 - a. Install top-set coved type bases throughout, except install straight type bases at carpet.
 - b. Secure bases to surfaces with waterproof adhesive; make joints tight; keep top and bottom edges in firm contact with adjacent surfaces.
 - 1) Provide a continuous seal of the resilient base to both the wall surface at the upper edge and the floor surface at the bottom edge.
 - c. Use longest lengths possible; straight pieces less than 24 inches long not permitted.
 - d. Miter or cope inside corners.
2. Coved Type: Provide with premolded end stops and premolded one-piece external corners.
3. Straight Type: Provide with preformed one-piece external corners.
4. Edges and Seams: Match edges at seams. Double cut adjoining lengths. Make tight butt joints.

3.4 CLEANING

- A. General: Not more than four days before Substantial Completion, thoroughly clean work per resilient flooring manufacturer's recommendations. Use of solvents, wet mopping, or washing is prohibited.
- B. Defective and Damaged Work: Replace with acceptable Work at no additional cost to Owner.

3.5 PROTECTION

- A. General: Protect Work from traffic during construction period so Work will be without indication of use or damage at time of Substantial Completion.

END OF SECTION

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SECTION 099123- PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included: Interior painting, complete as shown on Drawings and as specified.
1. Work includes, but is not limited to, painting of following items, materials, and spaces:
 - a. Paint every interior exposed-to-view unfinished surface, except as otherwise shown on Drawings or as specified.
 - b. Paint the following exposed mechanical and electrical items to match adjacent surfaces even if the items are factory-finished:
 - 1) Wall and ceiling diffusers/registers installed in gypsum board assemblies at any location.
 - 2) Access doors at any location except when concealed above suspended ceilings.
 - 3) Flush-mounted electrical panelboards and cabinets in gypsum board assemblies at any location.
 - 4) All exposed piping, conduit, duct work and similar surfaces in Stair Enclosures and Fire Control Room (except items with factory "red" finish).
 - c. Paint semi-visible areas behind registers, grilles, diffusers, screen vents as required to "black out".
 - d. Paint auxiliary rails of smoke containment screens with high-temperature coating.
 - e. Stairs: Paint all exposed ferrous metal assemblies, concrete landings and treads, including hazard striping as required by code.
 2. Do not paint the following items:
 - a. Factory-finished items specified in various Sections.
 - b. Pre-finished wall, ceiling, and floor coverings.
 - c. Concrete traffic or walking decks, walks, steps, and ramps.
 - d. Code-Required Labels: Keep equipment identification and fire rating labels free of paint.
 - e. Surfaces concealed in walls and above ceilings except as specifically indicated otherwise.
 - f. Ducts, piping, conduit, and equipment concealed in walls and ceilings, unless specifically indicated otherwise.
 - g. Do not paint "Shell Areas" as shown on drawings except paint all sides of doors and frames at walls into finished areas.
 - h. Mechanical or elevator shafts not requiring periodic cleaning.
 - i. Mechanically-finished nonferrous metal, such as stainless steel, aluminum, and bronze, except exposed mechanical and electrical items.
 - j. Interior spaces specifically noted as unpainted.
 3. Note: This Section includes a comprehensive listing of paint finish types. Not all paint systems included herein may be required by the Scope of Work of this Project, or the scope of some finishes may be very limited.

The responsibility of the Contractor to schedule the Work so that all specified and required Painting Scope is included in the Scope of Work for the Project.

- B. Work Specified Elsewhere:
 - 1. Section 050500 – Metal Fasteners.
 - 2. Section 079200 – Joint Sealants.

1.2 SUBMITTALS

- A. Comply with requirements of Section 013300 – Submittal Procedures.
- B. Product Data: Submit complete list of materials proposed for use, together with manufacturer's data and specifications.
- C. Samples:
 - 1. Opaque Colors and Finishes: Submit samples, on hardboard, using materials accepted for Project, of each color and paint finish selected with texture to simulate actual conditions. Prepare three samples, 8-1/2 inches by 11 inches, with required number of paint coats clearly visible.
 - 2. Transparent and Stained Finishes: Prepare samples on species and quality of wood to be used in the Work. Re-submit as requested until acceptable sheen, color, and texture are achieved. Label and identify each sample as to location and application.

1.3 QUALITY ASSURANCE

- A. Labeling: Include following on label of each container:
 - 1. Manufacturer's name and product name.
 - 2. Generic type of paint.
 - 3. Manufacturer's stock number.
 - 4. Color.
 - 5. Instructions for reducing, where applicable.
- B. Special Requirements of Regulatory Agencies: Use materials for Work of this Section which comply with volatile organic compound limitations and other regulations of local Air Quality Management District and other local, state, and federal agencies having jurisdiction.
- C. Project Mock-Up: As directed by the Architect, apply on actual wall surfaces where designated, samples of each and any color selected for final review.
 - 1. On at least 100 square feet of surface as directed, provide full-coat finish samples until required sheen, color and texture are obtained.
 - 2. Duplicate painted finishes of prepared samples.
 - 3. Simulate finished lighting conditions for review of in-place work.

1.4 PRODUCT HANDLING

- A. Comply with requirements of Section 016000 – Product Requirements.
- B. Delivery: Deliver material in sealed containers with labels legible and intact.
- C. Storage of Materials:
 - 1. Store only acceptable Project materials on Project site.
 - 2. Store in suitable location.
 - 3. Restrict storage to paint materials and related equipment.
 - 4. Comply with health and fire regulations.

1.5 PROJECT CONDITIONS

- A. Environmental Requirements:
 - 1. Comply with manufacturer's recommendations as to environmental conditions under which coatings and coating systems can be stored and applied.
 - 2. Do not apply finish in areas where dust is being generated.
- B. Protection: Cover or otherwise protect finished work of other trades and surfaces not being painted concurrently or not to be painted.

1.6 SCHEDULING

- A. Gypsum Board: Verify that a fully-cured skim coat has been applied to Gypsum Board specified for Level 5 finish and scheduled to receive semi-gloss or gloss paint finishes. Do not proceed until completed.

1.7 MAINTENANCE

- A. Extra Materials: At completion of Work, deliver to Owner extra stock of paint of one gallon of each color used of each coating material used. Tightly seal and clearly label containers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Primers and Single-color Paints: Provide paint systems as manufactured by the following manufacturers. Unless otherwise specified, single source all components of a paint system from a single manufacturer, including primer/sealer/undercoat and body and finish coats to assure compatibility.
 - 1. Basis of Design: Sherwin Williams (2-part epoxy) paint for clean room applications.

2.2 MATERIALS

- A. General: Provide materials selected for coating system for each type of surface which are the product of single manufacturer.
- B. Thinner: As recommended by each manufacturer for his respective product.
- C. Unsuitability of Specified Products: Claims concerning unsuitability of any materials specified will not be entertained, unless such claim is made in writing to the Architect before Work is started.

2.3 COLORS

- A. Color and Sheen: Field verify color to match adjacent existing (or as selected by Architect if not scheduled on Drawings) based on standard color chips provided by one or more of the listed manufacturers.
- B. Mixing: Deliver paints and stains ready mixed to Project site.

2.4 MILDEW RESISTANCE

- A. General: Add fungicidal agent to paint per manufacturer's recommendations. Add agent to paint at factory. Clearly indicate on labels that paint is mildew resistant.

2.5 PRODUCT LIST

- A. Interior Products:

	<u>BM</u>	<u>ICI</u>	<u>S/W</u>	<u>FRA</u>
Alkyd Sealer	C245	1310	B49WZ2	367
PVA Sealer	284	1030	B28W200	061
Alkyd Enamel Undercoater	C245	1120	B49WZ2	367
Latex Enamel Undercoater	284	1020	B28W200	065
Concrete Sealer	066	3210	A24W300	065
Ferrous Metal Primer	M04	4160	B50NZ2	661F774
Galvanized Metal Primer	M04	4120	B66W1	661F774
Aluminum Primer	M04	4120	B66W1	661F774
Acrylic Epoxy Undercoater	M08/ M09	3210	B67W002 13-16	266
Latex Wall Paint, Eggshell	274	1403	B20W200	022
Latex Enamel, Semi-Gloss	276	1406	B31W200	128
Acrylic Epoxy, Semi-Gloss	M43/ M44/ M86	4406	B67V002 00-16	-----
Industrial Maintenance Enamel	M28	4328	B54WZ	648/628
Aluminum Paint	055/	4318-	B59S11	Sheffield

	<u>BM</u>	<u>ICI</u>	<u>S/W</u>	FRA
	170/ M29	9020		Alum.
High-Temperature Coatings	M28	4328	850 Series	Ameron Hi- Heat

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Examine surfaces scheduled to receive paint and finishes for conditions that might adversely affect execution, permanence, or quality of work and which cannot be put into acceptable condition through preparatory work. Proceed with preparation or coating application only when conditions are satisfactory.
- B. Review all questions regarding the scope of painting with Owner prior to proceeding with Work.

3.2 SURFACE PREPARATION

- A. General: Remove scale, dirt, dust, grit, rust, wax, grease, efflorescence, loose material, and other foreign matter detrimental to proper adhesion of paint.
- B. Gypsum Board:
1. Narrow, Shallow Cracks and Small Holes: Fill with spackling compound.
 2. Deep, Wide Cracks and Deep Holes: Rake out, dampen with clear water, and fill with thin layers of gypsum board joint compound.
 3. Curing: Allow to dry.
 4. Sanding: Sand smooth after drying; do not raise nap of paper on gypsum board.
- C. Metals:
1. Chipped or Abraded Areas in Shop Coatings: Touch-up using appropriate primer.
 2. Galvanized Surfaces: Apply a wash coat made by dissolving 8 ounces copper acetate or copper sulfate in one gallon of water; apply with brush.
 3. Stainless Steel: Scarify surfaces before applying prime coat.
- D. Wood:
1. General: If required, sandpaper surfaces smooth before applying primer. Thoroughly clean knots; apply thin coat of knot sealer over surfaces shown to receive opaque finish.
 2. Back Priming: Back prime surfaces installed against cementitious surfaces; give particular attention to sealing cross-grained surfaces.

3. Puttying:
 - a. General: Fill nail holes, cracks, and other depressions flush with putty after prime coat application. Allow putty to dry; sandpaper smooth before applying body coat.
 - b. For Opaque Finish: Linseed oil type putty.
- E. Protection:
 1. General: Properly protect floors and other adjacent work by drop cloths or other suitable coverings. In areas scheduled for painting, maintain wrappings and factory-applied protection provided by other trades.
 2. Hardware and Other Obstructions: Remove or protect factory finished items such as hardware, plates, lighting fixtures, grilles, and similar items placed prior to painting. Reposition or remove protection upon completion of each space. Equipment adjacent to surfaces requiring paint disconnected, moved, reset, and reconnected by respective trades.
 3. Fire Precautions: At end of each work day, place in metal containers or remove from premises, solvent soaked cloths, waste, and other materials which constitute a fire hazard.
- F. Moisture Content: Do not apply initial coating until moisture content of surface is within limitations recommended by paint manufacturer.

3.3 APPLICATION

- A. General: Apply paint per manufacturer's instructions and as specified. Thoroughly stir paint and keep at uniform consistency during application. Apply paint evenly, free from drops, ridges, waves, laps, and brush marks; finished surface uniform in sheen, color, and texture. Apply succeeding coats to unscarred and completely integral base coats; slightly vary color of undercoats to distinguish them from preceding coat. Allow sufficient time between coats to assure proper drying. Sandpaper smooth interior finishes between coats.
- B. Prime Coat: Do not thin primers in excess of manufacturer's printed directions. Apply by brush, unless otherwise specified, within 8 hours after cleaning.
- C. Body and Finish Coats: Do not thin; apply by brush, roller or spray.
- D. Drying Time: Comply with recommendations of product manufacturer for drying time between succeeding coats.
- E. Moldings and Ornaments: Leave clean and true to details with no undue amount of paint in corners and depressions.
- F. Edges of Paint: Where adjoining other materials or colors, make clean and sharp with no overlapping.
- G. Refinishing: Refinish entire wall where portion of finish is deemed not acceptable.

- H. Precaution: Do not paint over fusible links, UL labels, or sprinkler heads.
- I. Exposed Plumbing and Mechanical Items: Finish items without factory finish such as conduits, pipes, access panels, and items of similar nature to match adjacent wall and ceiling surfaces, unless otherwise directed.

3.4 CLEANING

- A. General: Touch up and restore finish where damaged. Remove spilled, splashed, or spattered paint from surfaces. Do not mar surface finish of item being cleaned.
- B. Storage Space: Leave clean and in condition required for equivalent spaces in Project.

3.5 PAINT SYSTEMS

- A. Schedule: Only major areas are scheduled. Treat miscellaneous and similar items and areas within room or space with similar system.
- B. Number of Coats: Where number of coats are specified, it is only as a minimum requirement. Apply additional coats, at no additional cost to Owner, if necessary to completely hide base material, produce uniform color, and provide satisfactory finish result.
- C. Thickness of Coats: For each paint system product, provide the manufacturer's recommended mil-thickness for each applied coat.
- D. Systems Specifications: These specifications are a guide and are meant to establish procedure and quality. Confer with Architect to determine exact finish desired.
- E. Acceptance of Final Colors: Do not apply final coats of paint for either exterior and interior systems until colors have been reviewed and accepted by the Architect.

3.6 INTERIOR PAINT SYSTEMS (Field Verify to match adjacent existing)

- A. Interior Gypsum Board – Flat:
 - 1. General: Provide as follows unless otherwise scheduled on Drawings or noted as follows in this Section.
 - 2. 1st Coat: Gypsum Board Primer.
 - 3. 2nd Coat: Acrylic Paint, Flat.
 - 4. 3rd Coat: Acrylic Paint, Flat.
- B. Interior Gypsum Board – Eggshell/Satin:
 - 1. General: Provide as follows unless otherwise scheduled on Drawings or noted as follows in this Section.
 - 2. 1st Coat: Gypsum Board Primer.
 - 3. 2nd Coat: Acrylic Paint, Eggshell/Satin.
 - 4. 3rd Coat: Acrylic Paint, Eggshell/Satin.

- C. Interior Gypsum Board – Semi-gloss:
1. General: Provide at stairs, service areas and where scheduled.
 2. 1st Coat: Gypsum Board Primer.
 3. 2nd Coat: Acrylic Paint, Semi-Gloss.
 4. 3rd Coat: Acrylic Paint, Semi-Gloss.
- D. Interior Gypsum Board – 2-part Epoxy Coatings: (for clean rooms, ante rooms, and restrooms)
1. General: Provide 2-part epoxy coatings at Clean Rooms, Ante Rooms, Restrooms and other gypsum surfaces as scheduled on Drawings and required by the governing Health Codes:
 2. 1st Coat: Primer for Epoxy Paint.
 3. 2nd Coat: Epoxy Semi-Gloss.
 4. 3rd Coat: Epoxy Semi-Gloss.
- E. Interior Ferrous Metal:
1. General: Shop and field-applied paint finishes for the Work of Section 050500 – Metal Fabrications, is included in the Scope of Work for those Sections.
 2. For other exposed-to-view ferrous metal items, including items specified in DIVISION 23 – Mechanical; and DIVISION 26 – Electrical, provide the finishes as follow:
 3. Bare Metal Items; High Performance Coating System:
 - a. Pre-treatment: Conform with the requirements of Section 050500 – Metal Fabrications.
 - b. First Base Coat: Tnemec Co. Inc.'s 90-97 Tneme-Zinc, Keelor & Long's 9700, or equal; zinc-rich urethane with not less than 80 percent zinc in dried film; not less than 2.5 mils dry film thickness.
 - c. Second Base Coat: Tnemec Co. Inc.'s polyamide epoxy; not less than 2.5 mils dry film thickness. Tint similar to finish coat color per manufacturer's written recommendations.
 - d. Finish Coats: Tnemec's Series 1075 Endura-Shield, semi-gloss sheen or Tnemec's Series 1077 Endura-Lume as required; aliphatic acrylic polyurethane 2.5 mils dry film thickness.
 4. Shop Primed or painted (by others) Items; Semi-Gloss Acrylic finish:
 - a. Preparation: Lightly sand or etch existing finish as required for application of new finishes.
 - b. Base Coat: Tnemec Co. Inc.'s polyamide epoxy; not less than 2.5 mils dry film thickness. Tint similar to finish coat color per manufacturer's written recommendations.
 - c. Finish Coats: Tnemec's Series 1075 Endura-Shield, semi-gloss sheen or Tnemec's Series 1077 Endura-Lume as required; aliphatic acrylic polyurethane 2.5 mils dry film thickness.
 5. Shop Galvanized Items:
 - a. Galvanizing repair provided in Section 050500 – Metal Fabrications.
 - b. Base Coat: Tnemec Co. Inc.'s polyamide epoxy; not less than 2.5 mils dry film thickness. Tint similar to finish coat color per manufacturer's written recommendations.

- c. Finish Coats: Tnemec's Series 1075 Endura-Shield, semi-gloss sheen or Tnemec's Series 1077 Endura-Lume as required; aliphatic acrylic polyurethane 2.5 mils dry film thickness.
 7. Ferrous Metal Mechanical and Electrical Piping, Conduits, Ductwork, Supports, Hangers, Machinery and Similar Items; Industrial Enamel:
 - a. 1st Coat: Ferrous Metal Primer.
 - b. 2nd Coat: Industrial Maintenance Enamel.
 - c. 3rd Coat: Industrial Maintenance Enamel.
- F. Interior Aluminum and Copper:
 1. Refer to Section 076200 – Flashing and Sheet Metal for shop and field-applied paint finishes specified in those Sections.
 2. Mechanical and Electrical Items:
 - a. Pretreatment: Metal Pretreatment.
 - b. 1st Coat: Aluminum Primer. Provide additional general purpose sealer coat when recommended by paint manufacturer.
 - c. 2nd Coat: Acrylic Paint, Semi-Gloss.
 - d. 3rd Coat: Acrylic Paint, Semi-Gloss.
- G. Interior Wood:
 1. General: Transparent Finishes are specified and provided in Section 064123 Interior Architectural Woodwork
 2. 1st Coat: Latex Enamel Undercoater.
 3. 2nd Coat: Acrylic Paint; Eggshell, Semi-Gloss or Gloss as scheduled on Drawings or selected by Architect.
 4. 3rd Coat: Acrylic Paint; Eggshell, Semi-Gloss or Gloss as scheduled on Drawings or selected by Architect.
- H. Interior Mechanical Insulation; Finish Varies:
 1. Provide finish materials recommended in writing by the mechanical insulation manufacturer for their products in exterior locations. Adapt the following as required.
 - a. 1st Coat: General Purpose PVA Sealer, or as recommended by the insulation manufacturer.
 - b. 2nd Coat: Match adjacent finish system.
- I. Interior Tar Coated Pipe; Gloss Enamel:
 1. 1st Coat: Aluminum Paint.
 2. 2nd Coat: Industrial Maintenance Enamel.
- J. Miscellaneous Interior Painting Systems:
 1. Ductwork at Grilles and Diffusers:
 - a. Apply interior surfaces of ductwork partially visible through grilles and diffusers.
 - b. 1st Coat: Galvanized Metal Primer.
 - c. 2nd Coat: Acrylic Paint, Matte Black.
 - d. 3rd Coat: Acrylic Paint, Matte Black.
 2. Exposed Insulated Pipes and Ductwork:

- a. 1st Coat: 1 coat General Purpose PVA sealer. Omit sealer where glass fabric jackets are used.
 - b. 2nd Coat: Acrylic Paint, match adjacent finish.
 - c. 3rd Coat: Acrylic Paint, match adjacent finish.
3. Exposed Non-Insulated Pipes and Ductwork: Including conduit.
- a. Cast-Iron Pipe:
 - 1) Pre-treatment: Conform with the requirements of Section 050500 – Metal Fabrications.
 - 2) 1st Coat: Ferrous Metal Primer.
 - 3) 2nd Coat: Acrylic Paint, match adjacent finish.
 - 4) 3rd Coat: Acrylic Paint, match adjacent finish.
 - b. Other Pipes, Conduit, and Ductwork:
 - 1) Pre-treatment: Conform with the requirements of Section 050500 – Metal Fabrications.
 - 2) 1st Coat: As specified for ferrous and non-ferrous metals as applicable.
 - 3) 2nd Coat: Acrylic Paint, match adjacent finish.
 - 4) 3rd Coat: Acrylic Paint, match adjacent finish.
- K. Miscellaneous Interior Painting Systems:
1. Factory Finished Equipment: Satisfactorily refinish surfaces damaged before, during, or after installation as directed; use 128 semi-gloss enamel.
 2. Plywood Equipment Backing:
 - a. General: Telephone, Data and Electric Closets.
 - b. 1st Coat: Latex Enamel Undercoater.
 - c. 2nd Coat: Acrylic Paint; match adjacent finish.
 - d. 3rd Coat: Acrylic Paint; match adjacent finish.
- L. Pipe Identification:
1. General: Per ANSI A13.1; buried pipe, electrical conduit, and pipe in concealed spaces such as furred spaces and shafts not included.
 2. Color Scheme: ANSI Z53.1 in combination with legend and flow markers; continuous total length coverage. Safety colors as specified under applicable Mechanical Section.
 3. Legend: Stencil letters of colors, type, and sizes per ANSI A13.1. Tags for identification of pipes less than 3/4-inch overall outside diameter, including valves and fittings; provided under applicable mechanical Section.
 4. Flow Markers: Provide each type with appropriate size arrows to indicate flow direction in pipe; same color as legend.
 5. Visibility: Locate legend and flowmarkers for easy visibility from operating floor; space not over 20 feet with at least one per room.
- 3.8 CLEANING:
- A. Comply with provisions of Section 017900 – Cleaning.
 - B. Remove paint spots, oil, and stains from adjacent surfaces upon completion of Work; leave Work clean.

Sherwin Williams Contractor Job Tracking Form

To be included in Contractor Bid Package

Instructions for Contractor:

- Please complete this form with as much information as available
- If you have an assigned Sherwin Williams Sales Representative or a Home store that services, your account please contact them directly with this form
- If you do not have a Sherwin Williams assigned account manager, please email this form to Michael.J.Koncilja@Sherwin.com
- This form must be forwarded to Sherwin Williams prior to the start of any Capital Expenditure Project
- A job account must be assigned for every project

Instructions for Sherwin Williams Employees:

- Upon receiving this form please open a job account for the paint contractor
- The job account must read as follows: Intermountain Healthcare/Name of City/ Project Name
- A job account is strictly required for all IHC related projects
- Upon opening an IHC job account, an email containing the 9 digit job account number is to be sent to Michael.J.Koncilja@Sherwin.com for tracking purposes
- A request for this project to be linked to Parent #5540 will be communicated
- All Purchases associated with said project are to be made on this job account only

Project Tracking Form

Name of Contractor: _____

Sherwin Williams Account number (Existing): _____

IHC Job Account number (To be assigned): _____

Name and Address of IHC related

Project: _____

Name/Store of Sherwin Williams

Contact: _____

Estimated Materials Needed: _____

Estimated Project Start Date: _____

Additional Comments/Needs of Contractor: (I.E renderings needed,
drawdowns required, Special environmental
restrictions.) _____

SECTION 102600 – WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included: Provide and install wall protection, wall corner guards and other finish protection products, complete, as shown on Drawings and as specified, including:

1. Surface-Mounted Corner Guards and Partition End Guards.

- B. Work Specified Elsewhere:

1. Section 081113 – Hollow Metal Doors and Frames.
2. Section 084113 – Aluminum Entrances and Storefronts.
3. Section 081416 – Flush Wood Doors.
4. Section 079200 – Joint Sealants.
5. Section 087100 – Door Hardware
6. Section 092216 – Non-Structural Metal Framing.

1.2 SUBMITTALS

- A. Comply with provisions of Section 013300 – Submittal Procedures.
- B. Product Data: Manufacturer's catalog cuts, standard color charts, and data sheets; including installation details and instructions, for each item specified.
- C. Samples:
1. Partition End and Corner Guards: 12-inch-long piece of each type specified, including color.
 2. Wall protection and Door Protection: 12-inch-square piece of each specified type, including corner and specified color.

1.3 PRODUCT HANDLING

- A. Delivery and Storage: Deliver and store items and related fasteners in manufacturer's original packaging, identified with manufacturer's name and type of product, and size. Store materials indoors, protected from moisture and other sources of damage.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Manufacturer: InPro Corporation, Construction Specialties, Inc., Pawling Corporation OR Korogard
 - a. Basis-of-Design: InPro Corporation, wall protection systems
- B. Fire Hazard Classification: Flame spread of 25 or less when tested per ASTM E84.

2.2 STAINLESS STEEL CORNER GUARDS

- A. Surface-Mounted, Metal Corner Guards: Fabricated from 1-piece, formed or extruded metal with formed edges; with 90- or 135-degree turn to match wall condition.
 - 1. Material: Stainless steel, Type 304.
 - a. Thickness: Minimum 0.0625 inch (1.6 mm).
 - b. Finish: Directional satin, No. 4.
 - 2. Wing Size: Nominal 2 x 2 x 48 inches (50.8 x 50.8 x 1219 mm) (size to be field verified to match adjacent existing)..
 - 3. Corner Radius: 1/8 inch (3 mm).
 - 4. Mounting: Adhere to wall with adhesive as recommended by the corner guard manufacturer.
 - 5. Location: Install corner guards at all outside corners at new and existing conditions of remodeled area.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: After application of wall base and finish painting of walls is complete, examine areas and conditions under which items are to be installed. If unsatisfactory conditions exist, do not proceed with the Work until such conditions have been corrected.

3.2 PREPARATION

- A. Cleaning: Prior to application, clean side of units that will be in contact with wall surface.

3.3 INSTALLATION

- A. General: Install units per manufacturer's instructions and as specified. Install wall and corner guards, crash rails and handrails plumb and true and securely fastened to backing plates or substrates.

3.4 ADJUSTING AND CLEANING

- A. Cleaning: Prior to time of final acceptance, strip units of protective coverings, and clean in accordance with manufacturer's instructions.
- B. Defective Materials: Remove and replace any defective, misaligned, or damaged units, at no additional cost to Owner.

END OF SECTION

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SECTION 102800– TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Work included: Provide and install toilet accessories as shown on Drawings and as specified, including:
 - 1. Single-accommodation toilet room accessories.
- B. Work Specified Elsewhere:
 - 1. Section 088000 –Glazing.
 - 2. Section 092216 – Non-Structural Metal Framing.
 - 3. Division 23 – Mechanical (Pipe Protection under Lavatories).

1.2 SUBMITTALS

- A. Comply with provisions of Section 013300 – Submittal Procedures
- B. Manufacturer's literature describing products.
- C. Shop Drawings: Show methods of backing, installation, and fastening.

1.3 QUALITY ASSURANCE

- A. Installed grab bars shall withstand 300 pounds downward pull.
- B. Design, quality, capacity, function, and finish shall conform with manufacturer's descriptions corresponding to catalog numbers cited unless otherwise noted.
- C. Provide the same keying for all locks of all accessory units specified.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Comply with requirements of Section 016000 – Product Requirements.
- B. Deliver materials and products in original containers with seals unbroken and labels intact until time of use. Label shall identify accessory, catalog number and finish.
- C. Store delivered products in clean, safe, dry area.

1.5 PROJECT CONDITIONS

- A. Comply with requirements of Section 013100 – Project Management and

Coordination.

- B. Coordinate as required with work of other sections to ensure proper backing.
- C. Sequencing, Scheduling: Do not install accessories until after completion of finish painting.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. General: Bobrick Washroom Equipment, Inc., no substitutions permitted unless otherwise specified. Accessory items specified by Bobrick catalog numbers.

2.2 PRODUCTS:

A. Grab Bars:

Provide heavy duty 18-gauge, type 304 stainless steel grab bars complying with the following:

1. Products: Bobrick; B-5806, 18", 24", 36" & 42" grab bars as indicated on drawings.
2. Mounting: Concealed with manufacturer's standard flanges and anchors.
3. Gripping Surfaces: Smooth, satin finish.
4. Outside Diameter: 1-1/4 inches for heavy-duty applications.

B. Mirror Unit:

Provide mirror unit complying with the following:

1. Products: Bobrick; B-165, 24" x 36" without shelf.
2. Stainless-Steel, Channel-Framed Mirror: Fabricate frame from stainless-steel channels in manufacturer's standard satin or bright finish with square corners mitered to hairline joints and mechanically interlocked.

C. Robe Hooks:

1. Model B-6717; single robe hook; surface-mounted; Type 304, stainless steel with satin finish.

D. Toilet Seat Cover Dispenser:

1. Model B-221 Surface-Mounted Toilet Seat Cover Dispenser; dispenses 250 single or half-fold seat covers; Type 304 stainless steel satin finish; fill from bottom through concealed opening.

E. Sanitary Napkin Disposal:

1. Model B-270; Contura series, surface mounted sanitary napkin dispenser

with full-length piano hinge and hinged bottom with tumbler lock; type 304 stainless steel with satin finish.

F. Mop and Broom Holder:

1. Model B-223x36; anti-slip mop holders with spring-loaded rubber cam on steel retainers; surface-mounted; Type 304 satin finish stainless steel; 36 inches long.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine area to receive toilet or bath accessories and certify that:
 1. Backing not included in work of this section is correct.
 2. Surfaces are dry, clean, free from foreign matter, and otherwise proper for installation.
 3. Toilet compartments or dressing rooms, to receive accessories have been properly installed and correctly prepared.
- B. Do not begin work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install accessories in accordance with approved manufacturer's recommendations.
- B. Attach accessories securely to substantial backing, with concealed fastenings unless otherwise noted; insure true alignment.
- C. Adjust as required for correct operation.

3.3 CLEANING AND ADJUSTMENTS

- A. Comply with requirements of Section 017900 – Cleaning.
- B. Adjust units as necessary to assure smooth, quiet operation without catching, binding or malfunctioning.

END OF SECTION

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SECTION 105123 - PLASTIC-LAMINATE-CLAD LOCKERS

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 plastic-laminate-clad wood lockers.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of locker.
- B. Shop Drawings: For plastic-laminate-clad wood lockers.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Show details full size.
 - 3. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 - 4. Show locations and sizes of cutouts and holes for items installed in lockers.
 - 5. Show locker fillers, trim, base, sloping tops, and accessories.
 - 6. Show locker identification system and numbering sequence.
- C. Samples for Initial Selection: For each type of the following:
 - 1. High-pressure decorative laminates.
 - 2. Thermoset decorative overlay panels.
 - 3. Carpet.
- D. Samples for Verification: For the following products:
 - 1. Plastic-laminate-clad panels, not less than 8 by 10 inches (200 by 250 mm), for each type, color, pattern, and surface finish, with separate samples of unfaced panel product used for core.
 - 2. Thermoset decorative-overlay-surfaced panels, not less than 8 by 10 inches (200 by 250 mm), for each type, color, pattern, and surface finish.
 - 3. Corner pieces of locker front frame joints between stiles and rail, as well as exposed end pieces, not less than 18 inches wide by 18 inches high by 6 inches deep (457 mm wide by 450 mm high by 152 mm deep).
 - 4. Exposed cabinet hardware and accessories, one unit for each type and finish.

5. Carpet, not less than 8 by 10 inches (200 by 250 mm), for each type, color, and pattern.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

1.6 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. Locker doors, complete with specified door hardware. Furnish no fewer than 2 doors of each type and color installed.
 2. Units of the following locker hardware items equal to 10 percent of amount installed for each type and finish installed, but no fewer than 2 units:
 - a. Hinges.
 - b. Pulls.
 - c. Shelf rests.
 - d. Cylinder and drawer locks.
 - e. Blank identification plates and holders.
 - f. Hooks.

1.7 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 1. Build mockup of typical locker, including door panel with specified door hardware as shown on Drawings.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver lockers until painting and similar operations that could damage lockers have been completed in installation areas. If lockers must be stored in

other-than-installation areas, store only in areas where environmental conditions are the same as those in final installation location and comply with requirements specified in "Field Conditions" Article.

- B. Deliver master and control keys to Owner by registered mail or overnight package service.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install lockers until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity between 25 and 55 percent during the remainder of the construction period.
- B. Field Measurements: Where lockers are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings.
 - 1. Locate concealed framing, blocking, and reinforcements that support lockers by field measurements before being enclosed, and indicate measurements on Shop Drawings.
- C. Established Dimensions: Where lockers are indicated to fit to other construction, establish dimensions for areas where lockers are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.10 COORDINATION

- A. Coordinate sizes and locations of concealed wood support bases.
 - 1. Requirements are specified in Section 061000 "Rough Carpentry."
- B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that lockers can be supported and installed as indicated.
- C. Hardware Coordination: Distribute copies of approved hardware schedule specified in Section 087100 "Door Hardware" to fabricator of lockers; coordinate Shop Drawings and fabrication with hardware requirements.

1.11 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of lockers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures.
 - b. Faulty operation of locks or hardware.
 - c. Deterioration of wood, finishes, and other materials beyond normal use.

2. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: For lockers indicated to be accessible, comply with applicable provisions in ICC A117.1.

2.2 PLASTIC-LAMINATE-CLAD WOOD LOCKERS

- A. Manufacturers:

1. Ideal Lockers
2. Legacy Lockers
3. Salsbury Industries
4. Summit Lockers
5. Approved Equals

- B. Construction Style: Manufacturer's standard.

1. Reveal Dimension: 1/2 inch (13 mm).

- C. Final Assembly: Manufacturer's standard factory assembly.

- D. Locker Body: Fabricated from particleboard-core panels covered on both sides with thermoset decorative overlay.

1. Side Panels: Manufacturer's standard 3/4 or 5/8 inch (19 or 16 mm) thick.
2. Back Panel: Manufacturer's standard 1/2 or 3/8 inch (13 or 9.5 mm) thick.
3. Top Panel: Manufacturer's standard 3/4 or 5/8 inch (19 or 16 mm) thick.
4. Bottom Panel: Manufacturer's standard 3/4 or 5/8 inch (19 or 16 mm) thick.
5. Exposed Panel Edges: Thermoset decorative overlay to match panel.

- E. Plastic-Laminate-Clad Wood Doors: High-pressure decorative laminate, Grade VGS, over both sides of particleboard core.

1. Thickness: Manufacturer's standard 3/4 or 5/8 inch (19 or 16 mm) thick.
2. Panel Edges: High-pressure decorative laminate, Grade VGS, to match panels.

- F. End Panels: Match style, material, construction, and finish of plastic-laminate-clad wood doors.

- G. Shelves: Fabricated from particleboard-core panels covered on both sides with thermoset decorative overlay; fixed unless otherwise indicated.

1. Thickness: 3/4 inch (19 mm).
2. Exposed Edges: High-pressure decorative laminate, Grade VGS, to match panels.

- H. Drawer Faces: Match style, material, construction, and finish of plastic-laminate-clad wood doors. Attach drawer faces to subfronts with mounting screws from drawer interior.
- I. Drawer Subfronts, Sides, and Backs: Fabricated from particleboard-core panels covered on both sides with thermoset decorative overlay.
 - 1. Thickness: 1/2 inch (13 mm).
 - 2. Exposed Edges: High-pressure decorative laminate, Grade VGS, to match panels] [1/4-inch- (6-mm-) thick, solid wood.
- J. Drawer Bottoms: 1/4-inch- (6-mm-) thick, thermoset decorative overlay over particleboard core.
- K. Corners and Filler Panels: 3/4-inch- (19-mm-) thick panels. Match style, material, construction, and finish of plastic-laminate-clad wood doors.
- L. Continuous Finish Base: Plastic-laminate-clad, 3/4-inch- (19-mm-) thick panel that matches door faces; fabricated in lengths as long as practical to enclose base and base ends of lockers.
- M. Continuously Sloping Tops: Plastic-laminate-clad, 3/4-inch- (19-mm-) thick panel that matches door faces for installation over lockers with separate flat tops. Fabricate tops in lengths as long as practical, without visible fasteners at splice locations. Provide fasteners, supports, and closures, as follows:
 - 1. Closures: Vertical-end type.
 - 2. Sloping-top corner fillers, mitered.
- N. Plastic-Laminate Colors, Patterns, and Finishes:
 - 1. As indicated by manufacturer's designations.
 - 2. Match Architect's samples.
 - 3. As selected by Architect from plastic-laminate manufacturer's full range of colors and patterns.

2.3 MATERIALS

- A. Composite Wood: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
 - 1. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10.
 - 2. Medium-Density Fiberboard: ANSI A208.2, Grade 130.
 - 3. Particleboard: ANSI A208.1, Grade M-2.
 - 4. Softwood Plywood: DOC PS 1, medium-density overlay.
- B. High-Pressure Decorative Laminate: NEMA LD 3, grades as follows:

1. Horizontal Surfaces: Grade HGS.
 2. Post-formed Surfaces: Grade HGP.
 3. Vertical Surfaces: Grade HGS.
- C. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.
- D. Anchors: Material, type, size, and finish as required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- E. Wood Support Base: 2-by-4-inch nominal-size (51-by-102-mm, actual-size) lumber treated with manufacturer's standard preservative-treatment, pressure process.

2.4 HARDWARE (coord. all hardware requirements with owner prior to purchasing)

- A. Cam Padlock Hasp: Surface mounted, steel; finished to match other locker hardware.
- B. Frameless Hinges (European Type): Fully concealed, self-closing, nickel-plated steel, with not less than 125 degrees of opening.
1. Provide two hinges for doors 36 inches (910 mm) high and less.
- C. Wire Pulls: Back mounted; 4 inches (102 mm) long.
- D. Shelf Rests: BHMA A156.9, B04013.
- E. Hooks: Manufacturer's standard, ball-pointed aluminum or steel; finished to match other locker hardware. Attach hooks with at least two fasteners.
1. Provide one double-prong ceiling hook and two single-prong wall hooks for each compartment of double-tier lockers.
- F. Exposed Hardware Finish: Satin chrome unless otherwise indicated that complies with BHMA A156.18 for BHMA finish.

2.5 FABRICATION

- A. Fabricate each locker with shelves, an individual door and frame, an individual top, a bottom, and a back, and with common intermediate uprights separating compartments.
1. Fabricate lockers to dimensions, profiles, and details indicated.
 2. Ease edges of corners of solid-wood members to 1/16-inch (1.5-mm) radius.
- B. Fabricate lockers square, rigid, without warp, and with finished faces flat and free of dents, scratches, and chips. Accurately factory machine components for attachments. Make joints tight and true.

1. Fabricate lockers using manufacturer's standard construction, with joints made with dowels, dados, or rabbets. Dado side panels to receive shelving except where indicated to be adjustable.
- C. Accessible Lockers: Fabricate as follows:
1. Locate bottom shelf no lower than 15 inches (381 mm) above the floor.
 2. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches (1219 mm) above the floor.
- D. Venting: Fabricate lockers with space between doors and locker assembly of not less than 1/4 inch (6 mm), with painted metal security screen attached to each shelf between doors.
- E. Number Identification Plates: Inlay number plates flush in each locker door, near top, centered.
- F. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
1. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that the parts fit as intended, and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.
 2. Use only manufacturer's nuts, bolts, screws, and other devices for assembly.
- G. Shop cut openings, to maximum extent possible, to receive hardware, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
- H. Attach PVC edging to panels by thermally fusing edging to panels after panel fabrication.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and floors or support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Verify that furring is attached to concrete and masonry walls that are to receive lockers.

- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Condition lockers to average prevailing humidity conditions in installation areas before installation.
- B. Before installing lockers, examine factory-fabricated work for completeness and complete work as required, including removal of packing.

3.3 INSTALLATION

- A. Install wood support base with 1/2-inch- (13-mm-) thick, plywood top.
- B. Install lockers level, plumb, and true; use concealed shims.
- C. Connect groups of lockers together with manufacturer's standard fasteners, through predrilled holes, with no exposed fasteners on face frames. Fit lockers accurately together to form flush, tight, hairline joints.
- D. Install lockers without distortion so doors fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings, providing unencumbered operation. Complete installation of hardware and accessory items as indicated.
 - 1. Installation Tolerance: No more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line. Shim as required with concealed shims.
- E. Locker Anchorage: Fasten lockers through wood locker base, at ends, and not more than 36 inches (910 mm) o.c. with No. 8 brass-finished, flush-head wood screws sized for 1-inch (25-mm) penetration into wood base.
- F. Scribe and cut corner and filler panels to fit adjoining work using fasteners concealed where practical. Repair damaged finish at cuts.
- G. Attach sloping-top units to lockers, with end panels covering exposed ends.
- H. Install number identification plates after lockers are in place.
 - 1. Attach number identification plate on each locker door, near top, centered, with at least two screws with finish matching the plate.
 - 2. Attach name identification plate holder on each locker door, centered, with at least two screws, with finish matching the name identification plate holder.
 - 3. Insert name identification plate into matching nameplate holder on each door.
- I. Provide protective mat at each shoe shelf.

3.4 ADJUSTING

- A. Clean, lubricate, and adjust hardware. Adjust doors to operate easily without binding. Verify that integral locking devices operate properly.

3.5 PROTECTION

- A. Protect lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.
- B. Touch up marred finishes or replace lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION

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SECTION 11 70 00 - HOSPITAL EQUIPMENT - GENERAL REQUIREMENTS

PART 1 – GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Hospital Equipment - General Requirements, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Dimensions, voltages, electrical power requirements, and utility connections are based on items specified.
- B. Contractor is responsible for costs for dimensional adjustments and for providing or arranging for additional electrical or utility services or equipment required as a result of using approved substitute products.
- C. If necessary to vary from arrangement indicated, make such variations only after approval of Architect and at no additional expense to Owner.
- D. Field verify dimensions involving work. Measure recesses and openings and provide trim pieces, fillers, closures in sizes required.
- E. Equipment may be inspected by Owner at manufacturer's plant prior to shipment.
- F. Equipment found not in accordance with specifications and approved drawings may be rejected.
- G. Replace rejected equipment at no cost to Owner.
- H. Electric operated equipment, heated equipment, or both:
 - 1. Comply with latest version of National Electrical Manufacturer's Association (NEMA), National Electric Code (NEC) and Underwriters' Laboratories, (UL).
- I. Installer qualifications: Manufacturer, or approved in writing by manufacturer.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Submit drawings to indicate arrangement and location of equipment.

2. Complete equipment list including manufacturer, model number, power and utility requirements, room name and number where located.
- B. Product Data:
1. Manufacturers standard literature describing specified equipment.
 2. Installer qualifications.
- C. Contract Closeout Information:
1. Warranty.
 2. Operation and Maintenance data.
 - a. See Section 01 78 23.
 3. Contract closeout information not required for Owner furnished equipment.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Contractor Installed - Contractor furnished new equipment:
1. Contractor store equipment to prevent damage to materials or structure in dry, weathertight, ventilated spaces.
 2. Deliver to site in manufacturer's original labeled containers.
 3. Protect exposed surfaces and edges until work is completed.
 4. Repair or remove and replace damaged or rejected work.
- B. Contractor Installed - Owner furnished new equipment:
1. Owner to receive and store new equipment. Contractor to obtain such equipment from Owner's storage location, deliver to site and install.
 2. Deliver to site in manufacturer's original labeled containers.
 3. Protect exposed surfaces and edges until work is completed.
 4. Contractor to provide fasteners, supports, or other miscellaneous items necessary for complete installation, not provided by equipment manufacturer.
 5. Owner to provide Contractor with rough-in and installation Drawings of purchased equipment.
 6. Delivery place and time to be determined by Owner but not necessarily during normal working hours.
- C. Contractor Installed - Owner furnished existing equipment:
1. Contractor disconnect, remove, store and install such equipment in same manner as new equipment. Replace fasteners or supports as required.
 2. Inspect equipment at existing location if rough-in and installation drawings are unavailable.
- D. Contractor and Owner mutually inspect existing equipment prior to removal, upon delivery to new location, and after installation to verify physical appearance and working condition.

1.5 WARRANTY

- A. Manufacturer's standard warranty against equipment failure, including cost of shipping, repair, replacement and legal discard of waste materials.
- B. Equipment furnished by Owner for installation by Contractor, shall be excluded from Contractor's one year warranty.

PART 2 - PRODUCTS

1.6 ACCEPTABLE MANUFACTURERS

- A. Hospital equipment: Manufacturers indicated in equipment schedules are used as basis of design.
- B. Other manufacturers desiring approval comply with Section 00 26 00.

1.7 EQUIPMENT

- A. Provide equipment of each specialty type, as designated by Sections referenced, by one manufacturer, insofar as is possible, and except as otherwise indicated.

1.8 EQUIPMENT SCHEDULE

- A. Hospital program equipment: Reference Schedule 1.
- B. Intermountain Medical Group program equipment: Reference Schedule 2.

PART 3 - EXECUTION

1.9 INSPECTION

- A. Examine substrates and conditions under which work is to be performed.
- B. Insure that adequate Wall Backing has been installed.
 - 1. Metal Wall Backing: Specified in Section 09 22 16.
 - 2. Coordinate and direct installation of backing required for wall-mounted equipment.
- C. Correct unsatisfactory conditions.
- D. Start of work constitutes acceptance of responsibility for performance.

1.10 INSTALLATION

- A. Install per manufacturer's printed instructions, drawings, or both.
- B. Except for final connection, installation of each item shall be complete in every respect.
 - 1. Provide controls, regulating devices and other accessories necessary for proper operation and maintenance of equipment including, but not necessarily limited to, pressure reducing valves, strainers, steam traps, control valves, relief valves, etc.
 - 2. Include these accessories whether or not they are specifically indicated.
- C. Where an item of equipment is furnished without a cord and plug, electrical wiring from equipment shall be brought to an equipment junction box to make a final connection between item and junction box with flexible connection.
- D. Provide stands, supports, sleeves, collars, escutcheons, ferrules, brackets, braces or other miscellaneous items required for a complete installation.
- E. Repair damage done to premises as a result of installation.
- F. Repair or replace damaged, stained or rejected work.
- G. Test and adjust items of equipment for satisfactory operation.
- H. Remove debris left by this installation.

1.11 OWNER INSTRUCTION

- A. Perform instruction of Owner personnel

END OF SECTION

SECTION 211000 - WATER-BASED FIRE-SUPPRESSION SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following fire-suppression piping inside the building:

1. Wet-pipe sprinkler systems.
2. Description: remodel of existing wet-pipe sprinkler system. Maintain existing design

B. Related Sections include the following:

1. Division 22 Section "Facility Water Distribution Piping" for piping outside the building. Section.

C. All black steel sprinkler pipe shall have a wall thickness less than or equal to schedule 40 and greater than schedule 10.

1. Exception: Pipe with a nominal pipe size of 6 inches and greater may be schedule 10.

D. Summary Table:

Item	Summary
Underground service entrance piping	(Ductile Iron, restrained as required, with thrust blocks, transitioned with bolted flange.)
Interior pipe type	Mains: Schedule 40 Branchlines: Threadable thinwall or schedule 40
Sprinkler Finish	Flat Plate Concealed, except uprights and storage
Extended Coverage	Not Allowed
Center of Tile	Required, Center thirds are acceptable for rectangular tiles
Flexible Sprinkler Drops	Designers preference
Calculations	Not required, use reduced flow data
Alarm Device	Existing to remain.
FDC	Existing to remain.
Special Items	
Seismic	

1.3 DEFINITIONS

- A. CPVC: Chlorinated polyvinyl chloride plastic.
- B. CR: Chlorosulfonated polyethylene synthetic rubber.
- C. High-Pressure Piping System: Fire-suppression piping system designed to operate at working pressure higher than standard 175 psig.
- D. PE: Polyethylene plastic.
- E. Underground Service-Entrance Piping: Underground service piping below the building.

1.4 SYSTEM DESCRIPTIONS

- A. Semi-Automatic Wet-Type, Class III Standpipe System: Includes NPS 1-1/2 hose stations and NPS 2-1/2 hose connections. Has open water-supply valve and is capable of supplying water demand for fire sprinklers only. Piping is wet, but water must be pumped in to standpipes to satisfy demand.
- B. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

1.5 PERFORMANCE REQUIREMENTS

- A. Standard Piping System Component Working Pressure: Listed for at least 175 psig.
- B. Design sprinkler piping according to the following and obtain approval from engineer, prior to submitting to other authorities having jurisdiction:
 - 1. Design sprinkler system with the following 10% reduced flow data:
 - Maintain existing sprinkler system design.
 - 2. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
 - 3. Sprinkler Occupancy Hazard Classifications:
 - a. Building Service Areas: Ordinary Hazard, Group 1.
 - b. General Storage Areas: Ordinary Hazard, Group 1.
 - c. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
 - d. Office and Public Areas: Light Hazard.
 - e. Patient area: light hazard.
 - 4. Minimum Density for Automatic-Sprinkler Piping Design:
 - a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. area.
 - b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. area.

- c. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over 1500-sq. ft. area.
 - d. Extra-Hazard, Group 1 Occupancy: 0.30 gpm over 2500-sq. ft. area.
 - e. Extra-Hazard, Group 2 Occupancy: 0.40 gpm over 2500-sq. ft. area.
 - f. Special Occupancy Hazard: As determined by authorities having jurisdiction.
5. Minimum Density for Deluge-Sprinkler Piping Design:
- a. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over entire area.
 - b. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over entire area.
 - c. Extra-Hazard, Group 1 Occupancy: 0.30 gpm over entire area.
 - d. Extra-Hazard, Group 2 Occupancy: 0.40 gpm over entire area.
 - e. Special Occupancy Hazard: As determined by authorities having jurisdiction.
6. Maximum Protection Area per Sprinkler: Per UL listing, maintaining existing sprinkler design.
7. Total Combined Hose-Stream Demand Requirement: According to NFPA 13, unless otherwise indicated:
8. Sprinklers are to be installed throughout the premises, as required by NFPA 13.
- C. Seismic Performance: Fire-suppression piping shall be capable of withstanding the effects of earthquake motions determined according to NFPA 13.

1.6 SUBMITTALS

- A. Product Data: For the following:
1. Piping materials, including dielectric fittings, flexible connections, and sprinkler specialty fittings.
 2. Pipe hangers and supports, including seismic restraints.
 3. Valves, including listed fire-protection valves, unlisted general-duty valves, and specialty valves and trim.
 4. Sprinklers, escutcheons, and guards. Include sprinkler flow characteristics, mounting, finish, and other pertinent data.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Seismic Calculations.
- D. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations, if applicable. Drawings are to be approved by Engineer prior to submission to State Fire Marshal.
- E. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping".
- F. Welding certificates.
- G. Field quality-control test reports.

- H. Operation and Maintenance Data: For standpipe and sprinkler specialties to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications:

- 1. An experienced installer who has designed and installed fire-suppression piping similar to that indicated for this Project and obtained design approval and inspection approval from authorities having jurisdiction. The Engineer requires evidence to support the ability of the contractor to perform work in the scope and volume as specified. A contractor, who cannot show such experience, may be found not suitable to perform the work.

- B. Installer's responsibilities include designing, fabricating, and installing fire-suppression systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

- 1. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer or NICET Level III technician.

- C. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

- D. NFPA Standards: Fire-suppression-system equipment, specialties, accessories, installation, and testing shall comply with the following:

- 1. NFPA 13, "Installation of Sprinkler Systems."

- E. International Conference of Building Code Officials codes and standards complying with the following:

- 1. IBC-2015, "International Building Code."
- 2. IFC-2015, "International Fire Code."

1.8 COORDINATION

- A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

1.9 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

- 1. Sprinkler Cabinets: Finished, wall-mounting, steel cabinet with hinged cover, with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include

separate cabinet with sprinklers and wrench for each type of sprinkler on Project.

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 STEEL PIPE AND FITTINGS

A. Threaded-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, hot-dip galvanized where indicated and with factory- or field-formed threaded ends.

1. Cast-Iron Threaded Flanges: ASME B16.1.
2. Malleable-Iron Threaded Fittings: ASME B16.3.
3. Gray-Iron Threaded Fittings: ASME B16.4.
4. Steel Threaded Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, seamless steel pipe hot-dip galvanized where indicated. Include ends matching joining method.
5. Steel Threaded Couplings: ASTM A 865 hot-dip galvanized-steel pipe where indicated.

B. Plain-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795 hot-dip galvanized-steel pipe where indicated.

1. Locking-Lug Fittings: UL 213, ductile-iron body with retainer lugs that require one-quarter turn to secure pipe in fitting not allowed.

C. Plain-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795 hot-dip galvanized-steel pipe where indicated.

1. Steel Welding Fittings: ASTM A 234/A 234M, and ASME B16.9 or ASME B16.11.
2. Steel Flanges and Flanged Fittings: ASME B16.5.

D. Grooved-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, hot-dip galvanized where indicated and with factory- or field-formed, roll-grooved ends.

1. Grooved-Joint Piping Systems:

a. Manufacturers:

- 1) Anvil International, Inc.
- 2) Central Sprinkler Corp.

- 3) Victaulic Co. of America.
 - 4) Ward Manufacturing.
- b. Grooved-End Fittings: UL-listed, ASTM A 536, ductile-iron casting with OD matching steel-pipe OD.
 - c. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe OD. Include ductile-iron housing with keys matching steel-pipe and fitting grooves, prelubricated rubber gasket listed for use with housing, and steel bolts and nuts.
- E. Threaded-End, Threadable, Thinwall Steel Pipe: ASTM A 135 or ASTM A 795, with wall thickness less than Schedule 40 and greater than Schedule 10, and with factory- or field-formed threaded ends.
1. Cast-Iron Threaded Flanges: ASME B16.1.
 2. Malleable-Iron Threaded Fittings: ASME B16.3.
 3. Gray-Iron Threaded Fittings: ASME B16.4.
 4. Steel Threaded Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, seamless steel pipe.
 5. Steel Threaded Couplings: ASTM A 865.
- F. Plain-End, Threadable, Thinwall Steel Pipe: ASTM A 135 or ASTM A 795, with wall thickness less than Schedule 40 and greater than Schedule 10.
1. Locking-Lug Fittings: UL 213, ductile-iron body with retainer lugs that require one-quarter turn to secure pipe in fitting not allowed.
- G. Plain-End, Threadable, Thinwall Steel Pipe: ASTM A 135 or ASTM A 795, with wall thickness less than Schedule 40 and greater than Schedule 10.
1. Steel Welding Fittings: ASTM A 234/A 234M, and ASME B16.9 or ASME B16.11.
 2. Steel Flanges and Flanged Fittings: ASME B16.5.
- H. Grooved-End, Threadable, Thinwall Steel Pipe: ASTM A 135 or ASTM A 795, with wall thickness less than Schedule 40 and greater than Schedule 10, and with factory- or field-formed, roll-grooved ends.
1. Grooved-Joint Piping Systems:
 - a. Manufacturers:
 - 1) Anvil International, Inc.
 - 2) Central Sprinkler Corp.
 - 3) Victaulic Co. of America.
 - 4) Ward Manufacturing.
 - b. Grooved-End Fittings: UL-listed, ASTM A 536, ductile-iron casting with OD matching steel-pipe OD.
 - c. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe OD. Include ductile-iron housing with keys matching steel-pipe and fitting

grooves, prelubricated rubber gasket listed for use with housing, and steel bolts and nuts.

- I. Plain-End, Schedule 10 Steel Pipe: ASTM A 135 or ASTM A 795, Schedule 10 is not allowed.
- J. Plain-End, Nonstandard OD, Thinwall Steel Pipe: ASTM A 135 or ASTM A 795, with wall thickness less than Schedule 10 is not allowed.
- K. Plain-End, Hybrid Steel Pipe: ASTM A 135 or ASTM A 795, lightwall, with wall thickness less than Schedule 10 and greater than Schedule 5 is not allowed.
- L. Grooved-End, Hybrid Steel Pipe: ASTM A 135 or ASTM A 795, lightwall, with wall thickness less than Schedule 10 and greater than Schedule 5; with factory- or field-formed, roll-grooved ends are not allowed.
- M. Schedule 5 Steel Pipe: ASTM A 135 or ASTM A 795, lightwall, with plain ends is not allowed.

2.3 CPVC TUBE AND FITTINGS

- 1. Is Not Allowed

2.4 FLEXIBLE SPRINKLER DROPS

- A. Flexible connectors shall be FM approved with exterior wire braid and have materials suitable for system fluid. Include 175-psig minimum working-pressure rating and ends according to the following:
 - 1. NPS 1: Threaded.
- B. Manufacturers:
 - 1. Flex-Head
 - 2. Victaulic
- C. Stainless-Steel-Hose/Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include steel nipples or flanges, welded to hose.
- D. Stainless-Steel-Hose/Stainless-Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include stainless-steel nipples or flanges, welded to hose.

2.5 SPRINKLER SPECIALTY FITTINGS

- A. Sprinkler specialty fittings shall be FMG approved with 175-psig minimum working-pressure rating, and made of materials compatible with piping. Sprinkler specialty fittings shall have 250-psig minimum working-pressure rating if fittings are components of high-pressure piping systems.

- B. Sprinkler Drain and Alarm Test Fittings: Cast- or ductile-iron body, with threaded or locking-lug inlet and outlet, test valve, and orifice and sight glass.
 - 1. Manufactures:
 - a. Central Sprinkler Corp.
 - b. Fire-End and Croker Corp.
 - c. Viking Corp.
 - d. Victaulic Co. of America.

- C. Drop-Nipple Fittings: UL 1474, adjustable with threaded inlet and outlet, and seals.

2.6 LISTED FIRE-PROTECTION VALVES

- A. Ball Valves: Comply with UL 1091, except with ball instead of disc.
 - 1. NPS 1-1/2 and Smaller: Bronze body with threaded ends.
 - 2. NPS 2 and NPS 2-1/2: Bronze body with threaded ends or ductile-iron body with grooved ends.
 - 3. NPS 3: Ductile-iron body with grooved ends.
 - 4. Manufacturers:
 - a. NIBCO.
 - b. Victaulic Co. of America.

- B. Butterfly Valves: UL 1091.
 - 1. NPS 2 and Smaller: Bronze body with threaded ends.
 - a. Manufacturers:
 - 1) Global Safety Products, Inc.
 - 2) Milwaukee Valve Company.

- C. Indicating Valves: UL 1091, with integral indicating device and ends matching connecting piping.
 - 1. Indicator: Electrical, 115-V ac, prewired, single-circuit, supervisory switch and Visual.
 - 2. NPS 2 and Smaller: Ball or butterfly valve with bronze body and threaded ends.
 - a. Manufacturers:
 - 1) Milwaukee Valve Company.
 - 2) NIBCO.
 - 3) Victaulic Co. of America.

 - 3. NPS 2-1/2 and Larger: Butterfly valve with cast- or ductile-iron body; wafer type or with flanged or grooved ends.
 - a. Manufacturers:

- 1) Central Sprinkler Corp.
- 2) Grinnell Fire Protection.
- 3) McWane, Inc.; Kennedy Valve Div.
- 4) Milwaukee Valve Company.
- 5) NIBCO.
- 6) Victaulic Co. of America.

2.7 UNLISTED GENERAL-DUTY VALVES

- A. Ball Valves NPS 2 and Smaller: MSS SP-110, 2-piece copper-alloy body with chrome-plated brass ball, 600-psig minimum CWP rating, blowout-proof stem, and threaded ends.
- B. Check Valves NPS 2 and Smaller: MSS SP-80, Type 4, Class 125 minimum, swing type with bronze body, nonmetallic disc, and threaded ends.
- C. Gate Valves NPS 2 and Smaller: MSS SP-80, Type 2, Class 125 minimum, with bronze body, solid wedge, and threaded ends.
- D. Globe Valves NPS 2 and Smaller: MSS SP-80, Type 2, Class 125 minimum, with bronze body, nonmetallic disc, and threaded ends.

2.8 SPECIALTY VALVES

- A. Sprinkler System Control Valves: FMG approved, cast- or ductile-iron body with flanged or grooved ends, and 175-psig minimum pressure rating. Control valves shall have 250-psig minimum pressure rating if valves are components of high-pressure piping system.
 1. Manufacturers:
 - a. Globe Fire Sprinkler Corporation.
 - b. Reliable Automatic Sprinkler Co., Inc.
 - c. Victaulic Co. of America.
 - d. Viking Corp.
- B. Automatic Drain Valves: UL 1726, NPS 3/4, ball-check device with threaded ends.
 1. Manufacturers:
 - a. Grinnell Fire Protection.

2.9 SPRINKLERS

- A. Sprinklers shall be UL listed or FMG approved, with 175-psig minimum pressure rating. Sprinklers shall have 250-psig minimum 300-psig pressure rating if sprinklers are components of high-pressure piping system.
- B. Manufacturers:

1. Globe Fire Sprinkler Corporation.
 2. Reliable Automatic Sprinkler Co., Inc.
 3. Victaulic Co. of America.
 4. Viking Corp.
 5. Tyco Fire
- C. Automatic Sprinklers: With heat-responsive element complying with the following:
1. UL 199, for nonresidential applications.
 2. UL 1626, for residential applications.
- D. Sprinkler Types and Categories: Nominal 1/2-inch orifice for "Ordinary" temperature classification rating, unless otherwise indicated or required by application.
- E. Sprinkler types, features, and options as follows:
1. Concealed ceiling sprinklers, including cover plate.
 2. Extended-coverage sprinklers, not allowed unless approved in writing prior to bidding.
 3. Flow-control sprinklers, with automatic open and shutoff feature.
 4. Flush ceiling sprinklers, including escutcheon, not allowed.
 5. Institution sprinklers, made with a small, breakaway projection.
 6. Pendent sprinklers.
 7. Pendent, dry-type sprinklers.
 8. Quick-response sprinklers.
 9. Recessed sprinklers, including escutcheon.
 10. Sidewall sprinklers.
 11. Sidewall, dry-type sprinklers.
 12. Upright sprinklers.
- F. Sprinkler Finishes: Chrome plated, bronze, and painted. Finishes as approved by FM Global.
- G. Special Coatings: Wax, lead, and corrosion-resistant paint.
- H. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
1. Ceiling Mounting: Flat plate concealed, white.
 2. Sidewall Mounting: Semi-Recessed, white.
- I. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler.
- 2.10 ALARM DEVICES
- a. Existing to remain.
 - B. Valve Supervisory Switch: UL 753, electrical, single-pole, double-throw switch with normally closed contacts. Include design that signals controlled valve is in other than fully open position.

1. Manufacturers:
 - a. McWane, Inc.; Kennedy Valve Div.
 - b. Potter Electric Signal Company.
 - c. System Sensor.

2.11 PRESSURE GAGES

A. Manufacturers:

1. Brecco Corporation.
2. Dresser Equipment Group; Instrument Div.
3. Marsh Bellofram.
4. WIKA Instrument Corporation.

B. Description: UL 393, 3-1/2- to 4-1/2-inch- diameter, dial pressure gage with range of 0 to 250 psig minimum.

1. Water System Piping: Include caption "WATER" or "AIR/WATER" on dial face.
2. Air System Piping: Include retard feature and caption "AIR" or "AIR/WATER" on dial face.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PIPING APPLICATIONS

- A. Shop weld pipe joints where welded piping is indicated.
- B. Do not use welded joints for galvanized-steel pipe.
- C. Flanges, flanged fittings, unions, nipples, and transition and special fittings with finish and pressure ratings same as or higher than system's pressure rating may be used in aboveground applications, unless otherwise indicated.
- D. Sprinkler Main Piping: Use the following:
 1. NPS 6 and Smaller: Standard-weight steel pipe with threaded ends, or grooved ends. No plain ends allowed.
 2. Outlets shall be welded.
 - a. Victaulic Brand Mechanical tee fittings may be used in lieu of welded outlets.
- E. Branch line piping: Use the following:

1. NPS 2 and Smaller: Threadable steel pipe with threaded ends; cast- or malleable-iron threaded fittings; and threaded joints.
 - a. Victaulic Brand Mechanical tee fittings may be used

3.3 VALVE APPLICATIONS

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 1. Fire-Protection-Service Valves: UL listed and FM approved for applications where required by NFPA 13 and NFPA 14.
 2. General-Duty Valves: For applications where UL-listed and FM-approved valves are not required by NFPA 13 and NFPA 14.
 - a. Shutoff Duty: Use gate, ball, or butterfly valves.
 - b. Throttling Duty: Use globe, ball, or butterfly valves.

3.4 JOINT CONSTRUCTION

- A. Refer to Division 23 Section "Common Work Result for HVAC" for basic piping joint construction.
- B. Ductile-Iron-Piping, Grooved Joints: Use ductile-iron pipe with radius-cut-grooved ends; ductile-iron, grooved-end fittings; and ductile-iron, keyed couplings. Assemble joints with couplings, gaskets, lubricant, and bolts according to coupling manufacturer's written instructions.
- C. Steel-Piping, Grooved Joints: Use Schedule 40 steel pipe with cut or roll-grooved ends and Schedule 30 or thinner steel pipe with roll-grooved ends; steel, grooved-end fittings; and steel, keyed couplings. Assemble joints with couplings, gaskets, lubricant, and bolts according to coupling manufacturer's written instructions. Use gaskets listed for dry-pipe service for dry piping.

3.5 PIPING INSTALLATION

- A. Refer to Division 23 Section "Common Work Result for HVAC" for basic piping installation.
- B. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
- C. Install mechanical sleeve seal at pipe penetrations in basement and foundation walls. Refer to Division 23 Section "Common Work Result for HVAC."

- D. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- E. Install unions adjacent to each valve in pipes NPS 2 and smaller. Unions are not required on flanged devices or in piping installations using grooved joints.
- F. Install flanges or flange adapters on valves, apparatus, and equipment having NPS 2-1/2 and larger connections.
- G. Install "Inspector's Test Connections" in sprinkler piping, complete with shutoff valve, sized and located according to NFPA 13.
- H. Install sprinkler piping with drains for complete system drainage.
- I. Install sprinkler zone control valves, check valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
- J. Hangers and Supports: Comply with NFPA 13 for hanger materials. Install according to NFPA 13 for sprinkler piping.
 - 1. No powder driven studs allowed.
 - 2. Wrap-around braces are to be provided at end of branch lines.
- K. Earthquake Protection: Install piping according to NFPA 13-9.3 requirements, to protect from earthquake damage. Seismic Bracing shall be designed to withstand vertical forces and movement.
- L. Install piping with grooved joints according to manufacturer's written instructions. Construct rigid piping joints, unless otherwise indicated, or required by NFPA 13 for flexibility in seismic zones.
- M. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.
- N. When a fire pipe crosses a seismic expansion joint it shall have a Metraflex fire loop installed at the joint in accordance with NFPA 13 chapter 9.

3.6 SPECIALTY SPRINKLER FITTING INSTALLATION

- A. Install specialty sprinkler fittings according to manufacturer's written instructions.

3.7 VALVE INSTALLATION

- A. Refer to Division 23 Section "Valves" for installing general-duty valves. Install fire-protection specialty valves, trim, fittings, controls, and specialties according to NFPA 13 and NFPA 14, manufacturer's written instructions, and authorities having jurisdiction.

- B. Valves: Install fire-protection-service valves supervised-open, located to control sources of water supply except from fire department connections. Provide permanent identification signs indicating portion of system controlled by each valve.

3.8 SPRINKLER APPLICATIONS

- A. General: All sprinklers are to be quick response type. Sprinkler heads shall be of the latest design closed spray type for 155°F unless specified otherwise or required by code. Extended coverage heads shall not be used. Orifices larger than 1/2" may be used as required by density and spacing demands. Use sprinklers according to the following applications:

1. Rooms without Ceilings: Upright and/or pendent sprinklers. Provide mechanical guards on all heads at or below 7'-0" height above the floor or where damage from room occupant use may occur.
2. Rooms with Ceilings: Concealed sprinklers.
3. Wall Mounting: Sidewall sprinklers with recessed escutcheon.
4. Institutional sprinklers shall be installed in areas of detention, correctional or mental health care facilities.
5. Spaces Subject to Freezing: Upright; pendent, dry-type; and sidewall, dry-type sprinklers.
6. Provide freeze proof type automatic sprinkler heads serving unconditioned spaces, areas subject to freezing and in other areas requiring their use.
7. Heads located within the air streams of unit heaters or other heat-emitting equipment shall be selected for proper temperature rating.
8. Sprinkler Finishes: Use sprinklers with the following finishes:
 - a. Upright, Pendent, and Sidewall Sprinklers: Chrome in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view.
 - b. Concealed Sprinklers: Rough brass, with White cover plate to match ceiling color.

- B. Sprinklers: Use the following:

1. All sprinklers shall be listed, quick response type.
2. Finish ceiling spaces shall have flat plate concealed type escutcheon cover plate.

3.9 SPRINKLER INSTALLATION

- A. Every effort shall be required to ensure that the heads form a symmetrical pattern in the ceiling with the ceiling grid, lights, diffusers and grilles. Offsets shall be made in piping to accommodate ductwork in the ceiling. Heads should be symmetrical and all piping run parallel or perpendicular to building lines.

1. In no case shall sprinkler heads be installed closer than approved distances from ceiling obstructions and HVAC ductwork.
2. Sprinkler heads shall not conflict with tile grids.
3. Sprinkler heads shall be located near center of corridors.

- B. Where layout of sprinkler heads is shown on reflected ceiling plans the locations shall be followed unless approval is obtained from the Architect or such locations shown do not meet the requirements of NFPA-13. In either case, approval of the Architect shall be obtained in writing before sprinkler head locations are changed. If the installation of additional heads is needed to conform to NFPA 13 requirements in areas where heads are shown on reflected ceiling plans, they shall be included in the contract price.
- C. Install sprinklers in patterns indicated.
- D. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing. Use dry-type sprinklers with water supply from heated space.
- E. Future finish shelled and tenant finish; Shell spaces shall be piped to accommodate future.
- F. Concealed type sprinkler shall be installed in the following areas:
 - 1. Throughout building

3.10 CONNECTIONS

- A. Connect water-supply piping and standpipes and sprinklers where indicated.
- B. Connect piping to specialty valves, hose valves, specialties, fire department connections, and accessories.
- C. Electrical Connections: Power wiring is specified in Division 28.
- D. Connect alarm devices to fire alarm.

3.11 LABELING AND IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13 and in Division 23 Section "Common Work Result for HVAC."

3.12 FIELD QUALITY CONTROL

- A. Flush, test, and inspect sprinkler piping according to NFPA 13, "System Acceptance" Chapter.
- B. Replace piping system components that do not pass test procedures and retest to demonstrate compliance. Repeat procedure until satisfactory results are obtained.
- C. When making a mechanical tee connection the coupon shall be attached at the mechanical tee.
- D. Report test results promptly and in writing to Architect and authorities having jurisdiction.

3.13 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Remove and replace sprinklers having paint other than factory finish.

3.14 PROTECTION

- A. Protect sprinklers from damage until Substantial Completion.

3.15 COMMISSIONING

- A. Verify that specialty valves, trim, fittings, controls, and accessories are installed and operate correctly.
- B. Verify that specified tests of piping are complete and that "Material Test Certificates" are complete.
- C. Verify that damaged sprinklers and sprinklers with paint or coating not specified are replaced with new, correct type.
- D. Verify that sprinklers are correct types, have correct finishes and temperature ratings, and have guards as required for each application.
- E. Fill wet-pipe sprinkler piping with water.
- F. Coordinate with fire alarm tests. Operate as required.

3.16 DEMONSTRATION & TESTS

- A. Demonstrate equipment, specialties, and accessories. Review operating and maintenance information.
- B. All tests will be conducted as required by the local authority having jurisdiction, and in no case less than those required by NFPA standards. As a minimum, piping in the sprinkler system shall be tested at a water pressure at 200 psi for a period of not less two hours, or at 50 psi in excess of the normal pressure when the normal pressure is above 150 psi. Bracing shall be in place, and air shall be removed from the system through the hydrants and drain valves before the test pressure is applied. No apparent leaks will be permitted on interior or underground piping.
- C. The local jurisdiction having authority and the State Fire Marshal's office (where required) shall be notified at least three working days in advance of all tests and flushing. This includes any flushing of underground, hydrostatic testing, or flow testing that may be required.
- D. This contractor shall make all the required tests to the sprinkler system as required by code. He shall be responsible to assure that the Contractor Test Certificates for the overhead, backflow and underground work are completed and delivered to the owner's insurance underwriter to assure proper insurance credit.

- E. All tests requiring the witnessing by local authorities will be the responsibility of this contractor. If tests are not run or do not have the proper witness, then they will be run later and all damage caused by the system, or caused in uncovering the system for such test, will be borne by this contractor.

3.17 WARRANTY

- A. This contractor shall warranty the sprinkler system and all its components for one year from the date of acceptance by the owner. Any costs incurred to extend any warranties of materials to assure this time frame shall be borne by this contractor.
- B. Provide Operation and Maintenance Manuals with correct as-builts test certificates and warranties included. A minimum 6 sets to be provided in red 3-ring binders. Include a current adopted version of NFPA 25 softbound copy left with owner.
- C. Electronic copy of AutoCAD as-built drawings shall also be provided on CD, with each O&M Manual.

3.18 FIELD QUALITY CONTROL

- A. Flush, test and inspect sprinkler piping according to NFPA 13, "System Acceptance" Chapter.
- B. Replace piping system components that do not pass test procedures and retest to demonstrate compliance. Repeat procedure until satisfactory results are obtained.
- C. Report test results promptly and in writing to Architect and authorities having jurisdiction.

END OF SECTION

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SECTION 220500 - COMMON WORK RESULTS FOR PLUMBING

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. Piping materials and installation instructions common to most piping systems.
 2. Transition fittings.
 3. Dielectric fittings.
 4. Mechanical sleeve seals.
 5. Sleeves.
 6. Escutcheons.
 7. Equipment installation requirements common to equipment sections.
 8. Painting and finishing.
 9. Supports and anchorages.
 10. Link Seal
 11. Lead Free requirements.

1.3 LEAD FREE REQUIREMENTS

- A. For all projects within the United States, and when water is anticipated for human consumption, all pipes, pipe fittings, plumbing fittings and fixtures shall comply with PUBLIC LAW 111-380 "Reduction of Lead in Drinking Water Act" 124 STAT. 4131, 42-USC 1201, January 4th, 2011.

1.4 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, and crawlspaces.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms, accessible pipe shafts, accessible plumbing chases and accessible tunnels.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for rubber materials:
 - 1. EPDM: Ethylene-propylene-diene terpolymer rubber.
 - 2. NBR: Acrylonitrile-butadiene rubber.
- G. Lead Free:
 - 1. Not containing more than 0.2 percent lead when used with respect to solder and flux.
 - 2. Not more than a weighted average of 0.25 percent lead when used with respect to the wetted surfaces of pipes, pipe fittings, plumbing fittings and fixtures.
 - 3. Calculation: The weighted average lead content of a pipe, pipe fitting, plumbing fitting or fixture shall be calculated by using the formula prescribed in the law named in LEAD FREE REQUIREMENTS above.

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Transition fittings.
 - 2. Dielectric fittings.
 - 3. Mechanical sleeve seals.
 - 4. Escutcheons.
- B. Welding certificates.

1.6 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. 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.

1.7 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.

1.8 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 set sleeves in poured-in-place concrete and other structural components as they are constructed.
- 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 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 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.

2.3 JOINING MATERIALS

- A. Refer to individual Division 22 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.
 - 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

- D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- F. 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.

2.4 TRANSITION FITTINGS

- A. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

- 1. Manufacturers:

- a. Cascade Waterworks Mfg. Co.
- b. Fernco, Inc.
- c. Mission Rubber Company.
- d. Plastic Oddities, Inc.

2.5 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

- 1. Manufacturers:

- a. Capitol Manufacturing Co.
- b. Central Plastics Company.
- c. Eclipse, Inc.
- d. Epco Sales, Inc.
- e. Hart Industries, International, Inc.
- f. Watts Industries, Inc.; Water Products Div.
- g. Zurn Industries, Inc.; Wilkins Div.

- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

- 1. Manufacturers:

- a. Capitol Manufacturing Co.
- b. Central Plastics Company.
- c. Epco Sales, Inc.

- d. Watts Industries, Inc.; Water Products Div.
- E. 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. Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Central Plastics Company.
 - d. Pipeline Seal and Insulator, Inc.
 2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.
- F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
 1. Manufacturers:
 - a. Calpico, Inc.
 - b. Lochinvar Corp.
- G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.
 1. Manufacturers:
 - a. Perfection Corp.
 - b. Precision Plumbing Products, Inc.
 - c. Sioux Chief Manufacturing Co., Inc.
 - d. Victaulic Co. of America.

2.6 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 1. Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - 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.
 3. Pressure Plates: Stainless steel. Include two for each sealing element.

4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.7 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 1. Underdeck Clamp: Clamping ring with set screws.
- E. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.8 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Floor-Plate Type: Cast-iron floor plate.
- D. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.9 LINK SEAL

- A. Link-Seal® Modular Seal Pressure Plates
 1. Link-Seal® modular seal pressure plates shall be molded of glass reinforced Nylon Polymer with the following properties:
 - a. Izod Impact - Notched = 2.05ft-lb/in. per ASTM D-256
 - Flexural Strength @ Yield = 30,750 psi per ASTM D-790
 - Flexural Modulus = 1,124,000 psi per ASTM D-790
 - Elongation Break = 11.07% per ASTM D-638
 - Specific Gravity = 1.38 per ASTM D-792
 2. Models LS200-275-300-315 shall incorporate the most current Link-Seal® Modular Seal design modifications and shall include an integrally molded compression assist boss on the top (bolt entry side) of the pressure plate, which permits

increased compressive loading of the rubber sealing element. Models 315-325-340-360-400-410-425-475-500-525-575-600 shall incorporate an integral recess known as a "Hex Nut Interlock" designed to accommodate commercially available fasteners to insure proper thread engagement for the class and service of metal hardware. All pressure plates shall have a permanent identification of the manufacturer's name molded into it.

3. For fire and Hi-Temp service, pressure plates shall be steel with 2-part Zinc Dichromate Coating.
4. Link-Seal® Modular Seal Hardware: All fasteners shall be sized according to latest Link-Seal® modular seal technical data. Bolts, flange hex nuts shall be: 316 Stainless Steel per ASTM F593-95, with a 85,000 psi average tensile strength.

2.10 LEAD FREE PRODUCTS:

- A. For all products to be purchased whenever water is anticipated for human consumption, all pipes, pipe fittings, plumbing fittings and fixtures shall comply with the LEAD FREE REQUIREMENTS in PART 1 above.

PART 3 - EXECUTION

3.1 PLUMBING DEMOLITION

- A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure 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.
 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.

3.2 SEISMIC REQUIREMENTS

- A. Comply with SEI/ASCE 7 and with requirements for seismic seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

3.3 LEAD FREE REQUIREMENTS

- A. Installations where water is anticipated for human consumption, all pipes, pipe fittings, plumbing fittings and fixtures shall be Lead Free as given in PART 1 above.

3.4 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.
- 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 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.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - 1. New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
 - c. Insulated Piping: One-piece, stamped-steel type with spring clips.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.

- e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
 - f. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
2. Existing Piping: Use the following:
- a. Chrome-Plated Piping: Split-casting, cast-brass type with chrome-plated finish.
 - b. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
 - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and spring clips.
 - d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
 - e. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and set screw.
 - f. Bare Piping in Equipment Rooms: Split-casting, cast-brass type.
 - g. Bare Piping in Equipment Rooms: Split-plate, stamped-steel type with set screw or spring clips.
 - h. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.
- M. Sleeves are not required for core-drilled holes.
- N. Permanent sleeves are not required for holes formed by removable PE sleeves.
- O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
- P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
- 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. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
 - 3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
 - b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
 - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
- 1) Seal space outside of sleeve fittings with grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
- Q. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
- R. Verify final equipment locations for roughing-in.
- S. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.5 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. Bevel plain ends of steel pipe.
- 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. 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.

3.6 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. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
 - 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.7 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. 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. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.8 PAINTING

- A. Painting of plumbing systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.9 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.

END OF SECTION

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SECTION 220517 - SLEEVES AND SLEEVE SEALS 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. Sleeves.
 - 2. Sleeve-seal systems.
 - 3. Grout.

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 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, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.2 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. Link-Seal
4. Metraflex Company (The).
5. Pipeline Seal and Insulator, Inc.
6. Proco Products, Inc.

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**.
3. Connecting Bolts and Nuts: **Carbon steel, with corrosion-resistant coating**, of length required to secure pressure plates to sealing elements.

2.3 GROUT

- A. Standard: ASTM C 1107, 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.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- 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.
 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, and concrete walls as new slabs and walls are constructed.
 1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
 2. 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.

3. 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 Division 07 Section "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 Division 07 Section "Penetration Firestopping."

3.2 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.

3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
1. 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.
 2. Interior Partitions:
 - a. Piping Smaller Than **NPS 6: Galvanized-steel-pipe sleeves.**
 - b. Piping **NPS 6** and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION

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SECTION 220518 - ESCUTCHEONS 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. Escutcheons.

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

- A. One-Piece, Cast-Brass Type: With **polished, chrome-plated** finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.
- C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to 2 inch (50mm), tube, and insulation of insulated piping and with OD that completely covers opening.
 - 1. Escutcheons for New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type with polished, chrome-plated finish.

- b. Chrome-Plated Piping: One-piece, **cast-brass** type with polished, chrome-plated finish.
- c. Insulated Piping: One-piece, **stamped-steel type with chrome-plated finish.**
- d. Bare Piping **2 inch** and Smaller at Wall and Floor Penetrations in Finished Spaces: **One-piece, cast-brass** type with polished, chrome-plated finish.
- e. Bare Piping Larger than **2 inch** at Wall and Floor Penetrations in Finished Spaces: **One-piece, stamped-steel type with polished, chrome-plated finish.**
- f. Bare Piping **2 inch** and Smaller at Ceiling Penetrations in Finished Spaces: **One-piece, cast-brass** type with polished, chrome-plated finish.

3.2 FIELD QUALITY CONTROL

- A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION

SECTION 220523 - GENERAL-DUTY VALVES 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. Bronze angle valves.
2. Bronze ball valves.
3. Iron, single-flange butterfly valves.
4. Bronze lift check valves.
5. Bronze swing check valves.
6. Iron swing check valves.
7. Bronze globe valves.
8. Iron globe 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.
3. Division 33 water distribution piping Sections for general-duty and specialty valves for site construction piping.

1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer 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.
- G. SWP: Steam working pressure.

1.4 SUBMITTALS

- A. Product Data: For each type of valve indicated.

1.5 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 B31.1 for power piping valves.
 - 3. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, grooves, and weld ends.
 - 3. Set angle and globe valves closed to prevent rattling.
 - 4. Set ball and plug valves open to minimize exposure of functional surfaces.
 - 5. Set butterfly valves closed or slightly open.
 - 6. 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.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valve Actuator Types:

1. Gear Actuator: For quarter-turn valves NPS 8 and larger.
2. Handwheel: For valves other than quarter-turn types.
3. Handlever: For quarter-turn valves NPS 6 and smaller except plug valves.
4. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 5 plug valves, for each size square plug-valve head.

E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:

1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
2. Butterfly Valves: With extended neck.

F. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Solder Joint: With sockets according to ASME B16.18.
3. Threaded: With threads according to ASME B1.20.1.

G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE ANGLE VALVES

A. Class 125, Bronze Angle Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hammond Valve.
 - b. Milwaukee Valve Company.
2. Description:
 - a. Standard: MSS SP-80, Type 1.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - d. Ends: Threaded.
 - e. Stem and Disc: Bronze.
 - f. Packing: Asbestos free.
 - g. Handwheel: Malleable iron, bronze, or aluminum.

2.3 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. American Valve, Inc.
 - b. Conbraco Industries, Inc.; Apollo Valves.

- c. Crane Co.; Crane Valve Group; Crane Valves.
- d. Hammond Valve.
- e. Lance Valves; a division of Advanced Thermal Systems, Inc.
- f. Milwaukee Valve Company.
- g. NIBCO INC.
- h. Red-White Valve Corporation.
- i. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

- a. Standard: MSS SP-110.
- b. SWP Rating: 150 psig.
- c. CWP Rating: 600 psig.
- d. Body Design: Two piece.
- e. Body Material: Bronze.
- f. Ends: Threaded.
- g. Seats: PTFE or TFE.
- h. Stem: Bronze.
- i. Ball: Chrome-plated brass.
- j. Port: Full.

B. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Conbraco Industries, Inc.; Apollo Valves.
- b. Crane Co.; Crane Valve Group; Crane Valves.
- c. Hammond Valve.
- d. Lance Valves; a division of Advanced Thermal Systems, Inc.
- e. Milwaukee Valve Company.
- f. NIBCO INC.
- g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

- a. Standard: MSS SP-110.
- b. SWP Rating: 150 psig.
- c. CWP Rating: 600 psig.
- d. Body Design: Two piece.
- e. Body Material: Bronze.
- f. Ends: Threaded.
- g. Seats: PTFE or TFE.
- h. Stem: Stainless steel.
- i. Ball: Stainless steel, vented.
- j. Port: Full.

C. Three-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Conbraco Industries, Inc.; Apollo Valves.
- b. DynaQuip Controls.
- c. Hammond Valve.
- d. Milwaukee Valve Company.
- e. NIBCO INC.
- f. Red-White Valve Corporation.

2. Description:

- a. Standard: MSS SP-110.
- b. SWP Rating: 150 psig.
- c. CWP Rating: 600 psig.
- d. Body Design: Three piece.
- e. Body Material: Bronze.
- f. Ends: Threaded.
- g. Seats: PTFE or TFE.
- h. Stem: Bronze.
- i. Ball: Chrome-plated brass.
- j. Port: Full.

D. Three-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Conbraco Industries, Inc.; Apollo Valves.
- b. Hammond Valve.
- c. Milwaukee Valve Company.
- d. NIBCO INC.

2. Description:

- a. Standard: MSS SP-110.
- b. SWP Rating: 150 psig.
- c. CWP Rating: 600 psig.
- d. Body Design: Three piece.
- e. Body Material: Bronze.
- f. Ends: Threaded.
- g. Seats: PTFE or TFE.
- h. Stem: Stainless steel.
- i. Ball: Stainless steel, vented.
- j. Port: Full.

2.4 IRON, SINGLE-FLANGE BUTTERFLY VALVES

A. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Aluminum-Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.

- b. Conbraco Industries, Inc.; Apollo Valves.
- c. Cooper Cameron Valves; a division of Cooper Cameron Corporation.
- d. Crane Co.; Crane Valve Group; Jenkins Valves.
- e. Crane Co.; Crane Valve Group; Stockham Division.
- f. DeZurik Water Controls.
- g. Flo Fab Inc.
- h. Hammond Valve.
- i. Kitz Corporation.
- j. Milwaukee Valve Company.
- k. NIBCO INC.
- l. Norrisal; a Dover Corporation company.
- m. Red-White Valve Corporation.
- n. Spence Strainers International; a division of CIRCOR International, Inc.
- o. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

- a. Standard: MSS SP-67, Type I.
- b. CWP Rating: 200 psig.
- c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
- d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
- e. Seat: EPDM.
- f. Stem: One- or two-piece stainless steel.
- g. Disc: Aluminum bronze.

B. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Ductile-Iron Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
- b. American Valve, Inc.
- c. Conbraco Industries, Inc.; Apollo Valves.
- d. Cooper Cameron Valves; a division of Cooper Cameron Corporation.
- e. Crane Co.; Crane Valve Group; Center Line.
- f. Crane Co.; Crane Valve Group; Stockham Division.
- g. DeZurik Water Controls.
- h. Flo Fab Inc.
- i. Hammond Valve.
- j. Kitz Corporation.
- k. Milwaukee Valve Company.
- l. Mueller Steam Specialty; a division of SPX Corporation.
- m. NIBCO INC.
- n. Norrisal; a Dover Corporation company.
- o. Spence Strainers International; a division of CIRCOR International, Inc.
- p. Sure Flow Equipment Inc.
- q. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

- a. Standard: MSS SP-67, Type I.

- b. CWP Rating: 200 psig.
- c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
- d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
- e. Seat: EPDM.
- f. Stem: One- or two-piece stainless steel.
- g. Disc: Nickel-plated or -coated ductile iron.

C. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Stainless-Steel Disc:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the:
 - a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
 - b. American Valve, Inc.
 - c. Conbraco Industries, Inc.; Apollo Valves.
 - d. Cooper Cameron Valves; a division of Cooper Cameron Corporation.
 - e. Crane Co.; Crane Valve Group; Jenkins Valves.
 - f. Crane Co.; Crane Valve Group; Stockham Division.
 - g. DeZurik Water Controls.
 - h. Flo Fab Inc.
 - i. Hammond Valve.
 - j. Kitz Corporation.
 - k. Milwaukee Valve Company.
 - l. Mueller Steam Specialty; a division of SPX Corporation.
 - m. NIBCO INC.
 - n. Norrised; a Dover Corporation company.
 - o. Red-White Valve Corporation.
 - p. Spence Strainers International; a division of CIRCOR International, Inc.
 - q. Sure Flow Equipment Inc.
 - r. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

- a. Standard: MSS SP-67, Type I.
- b. CWP Rating: 200 psig.
- c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
- d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
- e. Seat: EPDM.
- f. Stem: One- or two-piece stainless steel.
- g. Disc: Stainless steel.

2.5 BRONZE LIFT CHECK VALVES

A. Class 125, Lift Check Valves with Bronze Disc:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.

- b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
2. Description:
- a. Standard: MSS SP-80, Type 1.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Vertical flow.
 - d. Body Material: ASTM B 61 or ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: Bronze.

2.6 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. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Crane Co.; Crane Valve Group; Jenkins Valves.
 - d. Crane Co.; Crane Valve Group; Stockham Division.
 - e. Hammond Valve.
 - f. Kitz Corporation.
 - g. Milwaukee Valve Company.
 - h. NIBCO INC.
 - i. Powell Valves.
 - j. Red-White Valve Corporation.
 - k. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - l. Zy-Tech Global Industries, Inc.

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 150, 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. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Crane Co.; Crane Valve Group; Jenkins Valves.
 - d. Crane Co.; Crane Valve Group; Stockham Division.
 - e. Kitz Corporation.
 - f. Milwaukee Valve Company.

- g. NIBCO INC.
- h. Red-White Valve Corporation.
- i. Zy-Tech Global Industries, Inc.

2. Description:

- a. Standard: MSS SP-80, Type 3.
- b. CWP Rating: 300 psig.
- c. Body Design: Horizontal flow.
- d. Body Material: ASTM B 62, bronze.
- e. Ends: Threaded.
- f. Disc: Bronze.

2.7 IRON SWING CHECK VALVES

A. Class 125, Iron Swing Check Valves with Metal Seats:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. Hammond Valve.
 - e. Kitz Corporation.
 - f. Milwaukee Valve Company.
 - g. NIBCO INC.
 - h. Powell Valves.
 - i. Red-White Valve Corporation.
 - j. Sure Flow Equipment Inc.
 - k. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - l. Zy-Tech Global Industries, Inc.

2. Description:

- a. Standard: MSS SP-71, Type I.
- b. CWP Rating: 200 psig.
- c. Body Design: Clear or full waterway.
- d. Body Material: ASTM A 126, gray iron with bolted bonnet.
- e. Ends: Flanged.
- f. Trim: Bronze.
- g. Gasket: Asbestos free.

B. Class 250, Iron Swing Check Valves with Metal Seats:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. Hammond Valve.

- e. Milwaukee Valve Company.
- f. NIBCO INC.
- g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

- a. Standard: MSS SP-71, Type I.
- b. CWP Rating: 500 psig.
- c. Body Design: Clear or full waterway.
- d. Body Material: ASTM A 126, gray iron with bolted bonnet.
- e. Ends: Flanged.
- f. Trim: Bronze.
- g. Gasket: Asbestos free.

2.8 BRONZE GLOBE VALVES

A. Class 125, Bronze Globe Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Crane Co.; Crane Valve Group; Crane Valves.
- b. Crane Co.; Crane Valve Group; Stockham Division.
- c. Hammond Valve.
- d. Kitz Corporation.
- e. Milwaukee Valve Company.
- f. NIBCO INC.
- g. Powell Valves.
- h. Red-White Valve Corporation.
- i. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- j. Zy-Tech Global Industries, Inc.

2. Description:

- a. Standard: MSS SP-80, Type 1.
- b. CWP Rating: 200 psig.
- c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
- d. Ends: Threaded or solder joint.
- e. Stem and Disc: Bronze.
- f. Packing: Asbestos free.
- g. Handwheel: Malleable iron, bronze, or aluminum.

2.9 IRON GLOBE VALVES

A. Class 125, Iron Globe Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Crane Co.; Crane Valve Group; Crane Valves.
- b. Crane Co.; Crane Valve Group; Jenkins Valves.

- c. Crane Co.; Crane Valve Group; Stockham Division.
- d. Hammond Valve.
- e. Kitz Corporation.
- f. Milwaukee Valve Company.
- g. NIBCO INC.
- h. Powell Valves.
- i. Red-White Valve Corporation.
- j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- k. Zy-Tech Global Industries, Inc.

2. Description:

- a. Standard: MSS SP-85, Type I.
- b. CWP Rating: 200 psig.
- c. Body Material: ASTM A 126, gray iron with bolted bonnet.
- d. Ends: Flanged.
- e. Trim: Bronze.
- f. Packing and Gasket: Asbestos free.

B. Class 250, Iron Globe Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Crane Co.; Crane Valve Group; Crane Valves.
- b. Crane Co.; Crane Valve Group; Jenkins Valves.
- c. Crane Co.; Crane Valve Group; Stockham Division.
- d. Hammond Valve.
- e. Milwaukee Valve Company.
- f. NIBCO INC.
- g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

- a. Standard: MSS SP-85, Type I.
- b. CWP Rating: 500 psig.
- c. Body Material: ASTM A 126, gray iron with bolted bonnet.
- d. Ends: Flanged.
- e. Trim: Bronze.
- f. Packing and Gasket: Asbestos free.

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. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- 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. Install check valves for proper direction of flow and as follows:
 - 1. Swing Check Valves: In horizontal position with hinge pin level.
 - 2. Lift Check Valves: With stem upright and plumb.

3.3 ADJUSTING

- A. Adjust or replace 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. Shutoff Service: Ball or butterfly valves.
 - 2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
 - 3. Throttling Service Globe, angle, ball or butterfly valves.
 - 4. Pump-Discharge Check Valves:
 - a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.
 - b. NPS 2-1/2 and Larger for Domestic Water: Iron swing check valves with lever and weight or check valves.
 - c. NPS 2-1/2 and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.
- B. 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.
- C. Select valves, except wafer types, with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
6. For Steel Piping, NPS 5 and Larger: Flanged ends.

3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Bronze Angle Valves: Class 125 or Class 150, bronze disc.
3. Ball Valves: One, Two or Three piece, full or, regular port, bronze with bronze or stainless-steel trim.
4. Bronze Swing Check Valves: Class 125 or Class 150, bronze disc.
5. Bronze Globe Valves: Class 125 or Class 150, bronze disc.

B. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Ball Valves: One, Two or Three piece, full or, regular port, bronze with bronze or stainless-steel trim.
3. Iron, Single-Flange Butterfly Valves: 200 CWP, EPDM seat, aluminum-bronze, ductile-iron or stainless-steel disc.
4. Iron Swing Check Valves: Class 125 or Class 250, metal seats.
5. Iron Globe Valves: Class 125 or Class 250.

END OF SECTION

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SECTION 220529 - 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 hangers and supports for plumbing system piping and equipment:
1. Steel pipe hangers and supports.
 2. Trapeze pipe hangers.
 3. Metal framing systems.
 4. Thermal-hanger shield inserts.
 5. Fastener systems.
 6. Pipe positioning systems.
- 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 21 Section "Water-Based Fire-Suppression Systems" for pipe hangers for fire-suppression piping.
 3. Division 22 Section "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.
 4. Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.3 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."

1.4 SEISMIC REQUIREMENTS

- A. Component Importance Factor. All plumbing components shall be assigned a component importance factor. The component importance factor, I_p , shall be taken as 1.5 if any of the following conditions apply:
1. The component is required to function for life-safety purposes after an earthquake.

2. The component contains hazardous materials.
 3. The component is in or attached to an Occupancy Category IV structure and it is needed for continued operation of the facility or its failure could impair the continued operation of the facility.
- B. All other components shall be assigned a component importance factor, I_p , equal to 1.0.

1.5 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- C. Seismic Performance: Plumbing equipment, hangers and supports shall withstand the effects of earthquake motions determined according to SEI/ASCE 7 and with the requirements specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
1. For components with a seismic importance factor of 1.0 the term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified."
 2. For components with a seismic importance factor of 1.5 the term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified and the system will be fully operational after the seismic event."

1.6 SUBMITTALS

- A. Product Data: For the following:
1. Steel pipe hangers and supports.
 2. Thermal-hanger shield inserts.
 3. Powder-actuated fastener systems.
 4. Pipe positioning systems.
 5. Mechanical Anchors: ICC-ES Evaluation Reports validating 'Cracked Concrete' testing per A.C. 193 must be provided for anchors resisting seismic loads and/or supporting life- safety systems including fire sprinkler systems.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:
1. Trapeze pipe hangers. Include Product Data for components.
 2. Metal framing systems. Include Product Data for components.
 3. Pipe stands. Include Product Data for components.
 4. Equipment supports.
- C. Welding certificates.

D. Delegated-Design Submittal:

1. Design calculations and detailed fabrication and assembly of pipe anchors and alignment guides, hangers and supports for multiple pipes, expansion joints and loops, and attachments of the same to the building structure.
2. Locations of pipe anchors and alignment guides and expansion joints and loops.
3. Locations of and details for penetrations, including sleeves and sleeve seals for exterior walls, floors, basement, and foundation walls.
4. Seismic calculations and detailed analysis: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices. Project specific design documentation and calculations shall be prepared and stamped by a registered professional engineer who is responsible for the seismic restraint design and who is licensed in the state where the project is being constructed (ASCE 7, 13.2.1.1).

1.7 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel.", AWS D1.4, "Structural Welding Code--Reinforcing Steel." and ASME Boiler and Pressure Vessel Code: Section IX.
- 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 D1.4, "Structural Welding Code--Reinforcing Steel."
 4. ASME Boiler and Pressure Vessel Code: Section IX.

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 STEEL PIPE HANGERS AND SUPPORTS

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.
- B. Manufacturers:

1. Anvil International.
2. AAA Technology & Specialties Co., Inc.
3. Bergen-Power Pipe Supports.
4. B-Line Systems, Inc.; a division of Cooper Industries.
5. Carpenter & Paterson, Inc.
6. Empire Industries, Inc.
7. ERICO/Michigan Hanger Co.
8. FNW/Ferguson Enterprises
9. Globe Pipe Hanger Products, Inc.
10. Grinnell Corp.
11. GS Metals Corp.
12. National Pipe Hanger Corporation.
13. PHD Manufacturing, Inc.
14. PHS Industries, Inc.
15. Piping Technology & Products, Inc.
16. Tolco Inc.
17. Simpson Strong-Tie Co.

C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Manufacturers:

1. Anvil International.
2. B-Line Systems, Inc.; a division of Cooper Industries.
3. ERICO/Michigan Hanger Co.; ERISTRUT Div.
4. FNW/Ferguson Enterprises
5. GS Metals Corp.
6. Hilti, Inc.
7. Power-Strut Div.; Tyco International, Ltd.
8. Thomas & Betts Corporation.
9. Tolco Inc.
10. Unistrut Corp.; Tyco International, Ltd.

C. Coatings: Manufacturer's standard finish unless bare metal surfaces are indicated.

- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.5 THERMAL-HANGER SHIELD INSERTS

- A. Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield.
- B. Manufacturers:
 - 1. Carpenter & Paterson, Inc.
 - 2. ERICO/Michigan Hanger Co.
 - 3. PHS Industries, Inc.
 - 4. Pipe Shields, Inc.
 - 5. Rilco Manufacturing Company, Inc.
 - 6. Value Engineered Products, Inc.
- C. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with vapor barrier.
- D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate.
- E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- G. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.6 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.
 - 1. Manufacturers:
 - a. Hilti, Inc.
 - b. MKT Fastening, LLC.
 - c. Powers Fasteners.
 - d. Simpson Strong-Tie Co.
 - B. Mechanical-Expansion Anchors and Concrete Screws: Insert-wedge-type 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. For anchors resisting seismic loads and/or supporting life- safety systems including fire sprinkler systems, Anchors shall have been tested for 'Cracked Concrete' per A.C. 193 per a valid ICC-ES Evaluation Report. Manufacturers with these anchors have been designated below with: '*'

1. Manufacturers:
 - a. B-Line Systems, Inc.; a division of Cooper Industries.
 - b. Empire Industries, Inc.
 - c. Hilti, Inc.
 - d. ITW Ramset/Red Head.
 - e. MKT Fastening, LLC.
 - f. Powers Fasteners.
 - g. Simpson Strong-Tie Co. *

2.7 PIPE STAND FABRICATION

A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod-roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

1. Manufacturers:
 - a. Anvil International.
 - b. ERICO/Michigan Hanger Co.
 - c. MIRO Industries.
 - d. Unipure

C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.

1. Manufacturers:
 - a. MIRO Industries.

D. High-Type, Single-Pipe Stand: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.

1. Manufacturers:
 - a. Anvil International.
 - b. ERICO/Michigan Hanger Co.
 - c. MIRO Industries.
 - d. Portable Pipe Hangers.

2. Base: Stainless steel.

3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.

4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.

1. Manufacturers:

- a. Anvil International.
 - b. Portable Pipe Hangers.
2. Bases: One or more plastic.
 3. Vertical Members: Two or more protective-coated-steel channels.
 4. Horizontal Member: Protective-coated-steel channel.
 5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.
- F. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe support made from structural-steel shape, continuous-thread rods, and rollers for mounting on permanent stationary roof curb.

2.8 PIPE POSITIONING SYSTEMS

- A. Description: IAPMO PS 42, system of metal brackets, clips, and straps for positioning piping in pipe spaces for plumbing fixtures for commercial applications.
- B. Manufacturers:
1. C & S Mfg. Corp.
 2. HOLDRITE Corp.; Hubbard Enterprises.
 3. Samco Stamping, Inc.

2.9 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.

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 padded hangers for piping that is subject to scratching.
- F. 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. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
 - 6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.
 - 7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
 - 8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
 - 9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.
 - 10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8.
 - 11. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3.
 - 12. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
 - 13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 - 14. 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.
 - 15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
 - 16. Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
 - 17. 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.
 - 18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20, from single rod if horizontal movement caused by expansion and contraction might occur.
 - 19. 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.
 - 20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24, if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.

21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30, if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- G. 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.
- 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 or Simpson Blue Banger Concrete insert with UL & FM approvals): 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.
 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.
- M. Comply with MFMA-102 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.
- O. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Comply with SEI/ASCE 7 and with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- C. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. 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 above for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- E. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- F. 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. Powder actuated fasteners shall not be used for seismic bracing attachments.
 - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions. For anchors resisting seismic loads and/or supporting life-safety systems including fire sprinkler systems, anchors shall have been tested for 'Cracked Concrete' per A.C. 193 and shall have a valid ICC-ES Evaluation Report
- G. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer to Division 22 Section "Plumbing Fixtures" for plumbing fixtures.
- H. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- I. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

- J. 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.
- K. Install lateral bracing with pipe hangers and supports to prevent swaying.
- L. 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. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- M. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- N. 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.
- O. 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.
 - 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.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
 - 5. Pipes NPS 8 and Larger: Include wood inserts.
 - 6. Insert Material: Length at least as long as protective shield.

7. 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 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.

3.4 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 .

3.5 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. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

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SECTION 220548 - VIBRATION AND SEISMIC CONTROLS 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 restraints and vibration isolation as defined in Section 230548 "Vibration Isolation and Seismic Controls for HVAC" for the following:

- 1. Plumbing Piping.
- 2. Plumbing Equipment.

PART 2 - PRODUCTS

2.1 (NOT USED)

PART 3 - EXECUTION

3.1 (NOT USED)

END OF SECTION

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SECTION 220553 - 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. Warning signs and labels.
3. Pipe labels.
4. Stencils.
5. Valve tags.
6. Warning tags.
7. Ceiling grid

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. 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 to include in maintenance manuals.

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.

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: White.
3. Background Color: Blue.
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.
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, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

C. 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, 1/16 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: Yellow.

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.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. 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 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, alkyd enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
 - 3. Identification Paint: Exterior, alkyd enamel in colors according to ASME A13.1 unless otherwise indicated.

2.5 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.

- 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. Valve-tag schedule shall be included in operation and maintenance data.

2.6 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: Brass grommet and wire.
 - 3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
 - 4. Color: Yellow background with black lettering.

2.7 CEILING GRID

- A. Provide valve identification for all plumbing and med gas valves located above the ceiling on the ceiling grid below the valve.

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. Piping Color-Coding: Painting of piping is specified in Division 09.
- 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 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 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- D. Pipe Label Color Schedule:
1. Low-Pressure, Compressed-Air Piping:
 - a. Background Color: Comply with ASME A13.1.
 - b. Letter Color: Comply with ASME A13.1.
 2. Medium-Pressure, Compressed-Air Piping:
 - a. Background Color: Comply with ASME A13.1.
 - b. Letter Color: Comply with ASME A13.1.
 3. Domestic Water Piping:
 - a. Background Color: Comply with ASME A13.1.
 - b. Letter Color: Comply with ASME A13.1.
 4. Sanitary Waste and Storm Drainage Piping:
 - a. Background Color: Comply with ASME A13.1.
 - b. Letter Color: Comply with ASME A13.1.

3.4 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. 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. Cold Water: 1-1/2 inches, round.
- b. Hot Water: 1-1/2 inches, round.
- c. Low-Pressure Compressed Air: 1-1/2 inches, round.
- d. High-Pressure Compressed Air: 1-1/2 inches, round.

2. Valve-Tag Color:

- a. Cold Water: Comply with ASME A13.1.
- b. Hot Water: Comply with ASME A13.1.
- c. Low-Pressure Compressed Air: Comply with ASME A13.1.
- d. High-Pressure Compressed Air: Comply with ASME A13.1.

3. Letter Color:

- a. Cold Water: Comply with ASME A13.1.
- b. Hot Water: Comply with ASME A13.1.
- c. Low-Pressure Compressed Air: Comply with ASME A13.1.
- d. High-Pressure Compressed Air: Comply with ASME A13.1.

3.5 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION

SECTION 220700 - PLUMBING INSULATION

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. Insulation Materials
2. Adhesives.
3. Lagging adhesives.
4. Sealants.
5. Factory-applied jackets.
6. Field-applied fabric-reinforcing mesh.
7. Field-applied jackets.
8. Tapes.
9. Securements.
10. Corner angles.

- B. Related Sections include the following:

1. Division 23 Section "HVAC Insulation."

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

- B. Shop Drawings:

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties, equipment connections, and access panels.
6. Detail application of field-applied jackets.

- C. Qualification Data: For qualified Installer.

- D. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation

materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

- E. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- 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.

1.5 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.

1.6 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. 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. 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. Mineral-Fiber, Preformed Pipe Insulation:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Fibrex Insulations Inc.; Coreplus 1200.
 - b. Johns Manville; Micro-Lok.
 - c. Knauf Insulation; 1000(Pipe Insulation.
 - d. Manson Insulation Inc.; Alley-K.
 - e. Owens Corning; Fiberglas Pipe Insulation.
 - 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. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 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 and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA Inc.; Aero seal.
 - b. Armacell LCC; 520 Adhesive.
 - c. Foster Products Corporation, H. B. Fuller Company; 85-75.
 - d. RBX Corporation; Rubatex Contact Adhesive.

- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-82.
 - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
 - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
 - d. Marathon Industries, Inc.; 225.
 - e. Mon-Eco Industries, Inc.; 22-25.
- 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. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-82.
 - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
 - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
 - d. Marathon Industries, Inc.; 225.
 - e. Mon-Eco Industries, Inc.; 22-25.
- E. PVC Jacket Adhesive: Compatible with PVC jacket.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Chemical Company (The); 739, Dow Silicone.
 - b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
 - c. P.I.C. Plastics, Inc.; Welding Adhesive.
 - d. Red Devil, Inc.; Celulon Ultra Clear.
 - e. Speedline Corporation; Speedline Vinyl Adhesive.

2.3 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. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-35.
 - b. Foster Products Corporation, H. B. Fuller Company; 30-90.
 - c. ITW TACC, Division of Illinois Tool Works; CB-50.
 - d. Marathon Industries, Inc.; 590.
 - e. Mon-Eco Industries, Inc.; 55-40.
 - f. Vimasco Corporation; 749.
 2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.

5. Color: White.
- C. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; Encacel.
 - b. Foster Products Corporation, H. B. Fuller Company; 60-95/60-96.
 - c. Marathon Industries, Inc.; 570.
 - d. Mon-Eco Industries, Inc.; 55-70.
 2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
 3. Service Temperature Range: Minus 50 to plus 220 deg F.
 4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
 5. Color: White.

2.4 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-52.
 - b. Foster Products Corporation, H. B. Fuller Company; 81-42.
 - c. Marathon Industries, Inc.; 130.
 - d. Mon-Eco Industries, Inc.; 11-30.
 - e. Vimasco Corporation; 136.
 2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over equipment and pipe insulation.
 3. Service Temperature Range: Minus 50 to plus 180 deg F.
 4. Color: White.

2.5 SEALANTS

- A. FSK and Metal Jacket Flashing Sealants:
1. Products: Subject to compliance with requirements, provide one of the following:
 - 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.

- B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-76.
 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: 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.
 3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
 4. PVDC Jacket for Indoor Applications: 4-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.
 - a. Products: Subject to compliance with requirements, provide the following:
 - 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.
 5. PVDC Jacket for Outdoor Applications: 6-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.
 - a. Products: Subject to compliance with requirements, provide the following:
 - 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.
 6. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.
 - a. Products: Subject to compliance with requirements, provide the following:
 - 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

2.7 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. PVC 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. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; Zeston.
 - b. P.I.C. Plastics, Inc.; FG Series.
 - c. Proto PVC Corporation; LoSmoke.
 - d. Speedline Corporation; SmokeSafe.
 - 2. Adhesive: As recommended by jacket material manufacturer.
 - 3. Color: White.
 - 4. 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, mechanical joints, and P-trap and supply covers for lavatories.
 - 5. Factory-fabricated tank heads and tank side panels.
- C. Metal Jacket:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; Metal Jacketing Systems.
 - b. PABCO Metals Corporation; Surefit.
 - c. RPR Products, Inc.; Insul-Mate.
 - 2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105 or 5005, Temper H-14.
 - a. Sheet and roll stock ready for shop or field sizing or Factory cut and rolled to size.
 - b. Finish and thickness are indicated in field-applied jacket schedules.
 - c. Moisture Barrier for Indoor Applications: 1-mil- thick, heat-bonded polyethylene and kraft paper.
 - d. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
 - e. Factory-Fabricated Fitting Covers:
 - 1) Same material, finish, and thickness as jacket.
 - 2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - 3) Tee covers.
 - 4) Flange and union covers.
 - 5) End caps.
 - 6) Beveled collars.

- 7) Valve covers.
- 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.8 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
 - b. Compac Corp.; 104 and 105.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
 - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
 2. Width: 3 inches.
 3. Thickness: 11.5 mils.
 4. Adhesion: 90 ounces force/inch in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch in width.
 7. 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. Products: Subject to compliance with requirements, provide one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
 - b. Compac Corp.; 110 and 111.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
 - d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.
 2. Width: 3 inches.
 3. Thickness: 6.5 mils.
 4. Adhesion: 90 ounces force/inch in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch in width.
 7. 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. Products: Subject to compliance with requirements, provide one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
 - b. Compac Corp.; 130.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
 - d. Venture Tape; 1506 CW NS.
 2. Width: 2 inches.
 3. Thickness: 6 mils.

4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
 - b. Compac Corp.; 120.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.
 - d. Venture Tape; 3520 CW.
2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

E. PVDC Tape: White vapor-retarder PVDC tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, provide the following:
 - a. Dow Chemical Company (The); Saran 540 Vapor Retarder Tape.
2. Width: 3 inches.
3. Film Thickness: 4 mils.
4. Adhesive Thickness: 1.5 mils.
5. Elongation at Break: 145 percent.
6. Tensile Strength: 55 lbf/inch in width.

2.9 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products; Bands.
 - b. PABCO Metals Corporation; Bands.
 - c. RPR Products, Inc.; Bands.
2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch wide with wing or closed seal.
3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing or closed seal.
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) AGM Industries, Inc.; CWP-1.
 - 2) GEMCO; CD.
 - 3) Midwest Fasteners, Inc.; CD.
 - 4) Nelson Stud Welding; TPA, TPC, and TPS.
2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) AGM Industries, Inc.; CWP-1.
 - 2) GEMCO; Cupped Head Weld Pin.
 - 3) Midwest Fasteners, Inc.; Cupped Head.
 - 4) Nelson Stud Welding; CHP.
3. 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. Products: Subject to compliance with requirements, provide one of the following:
 - 1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series T.
 - 2) GEMCO; Perforated Base.
 - 3) Midwest Fasteners, Inc.; Spindle.
 - b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - c. Spindle: Aluminum or Stainless steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
 - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
4. 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. Products: Subject to compliance with requirements, provide one of the following:

- 1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series TSA.
 - 2) GEMCO; Press and Peel.
 - 3) Midwest Fasteners, Inc.; Self Stick.
- b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - c. Spindle: Aluminum or Stainless steel], fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
 - d. Adhesive-backed base with a peel-off protective cover.
5. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, 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.
- a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) AGM Industries, Inc.; RC-150.
 - 2) GEMCO; R-150.
 - 3) Midwest Fasteners, Inc.; WA-150.
 - 4) Nelson Stud Welding; Speed Clips.
 - b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- D. Wire: 0.080-inch nickel-copper alloy or 0.062-inch soft-annealed, stainless steel.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. C & F Wire.
 - b. Childers Products.
 - c. PABCO Metals Corporation.
 - d. RPR Products, Inc.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
 1. Verify that systems and equipment to be insulated have been tested and are free of defects.
 2. Verify that surfaces to be insulated are clean and dry.
 3. 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.

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 and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system 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 4 inches o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
 4. Cover joints and seams with tape as recommended by insulation material manufacturer 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.
- 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. Manholes.
 5. Handholes.
 6. Cleanouts.

3.4 PENETRATIONS

- A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- B. 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" Firestopping and fire-resistive joint sealers.

C. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "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.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers,

- valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, 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.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
 5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 MINERAL-FIBER INSULATION INSTALLATION

- 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 but 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.

3.7 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 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 manufacturer's 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.

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. Where PVDC jackets are indicated, install as follows:

1. Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.
2. Wrap factory-presizes jackets around individual pipe insulation sections with one end overlapping the previously installed sheet. Install presized jacket with an approximate overlap at butt joint of 2 inches over the previous section. Adhere lap seal using adhesive or SSL, and then apply 1-1/4 circumferences of appropriate PVDC tape around overlapped butt joint.
3. Continuous jacket can be spiral wrapped around a length of pipe insulation. Apply adhesive or PVDC tape at overlapped spiral edge. When electing to use adhesives, refer to manufacturer's written instructions for application of adhesives along this spiral edge to maintain a permanent bond.
4. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches or less. The 33-1/2-inch-circumference limit allows for 2-inch- overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.
5. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

3.8 FINISHES

- A. Equipment and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.
 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

3.9 Insulation shall have a k value that meets the minimum requirements of the latest International Energy Conservation Code (IECC).

3.10 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. 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. Drainage piping located in crawl spaces.
 2. Underground piping.
 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.11 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. NPS 1-1/2 and Smaller: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch
2. NPS 2 and Larger: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inch thick.

B. Domestic Hot and Recirculated Hot Water:

1. NPS 1-1/2 and Smaller: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch.
2. NPS 2 and Larger: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 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. Piping, Concealed:
1. None.
- C. Piping, Exposed:
1. PVC: 20 mils thick.

END OF SECTION

SECTION 221116 - 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. Section Includes:
 - 1. Under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.
 - 2. Encasement for piping.

1.3 ACTION SUBMITTALS

- A. Product Data: For transition fittings and dielectric fittings.
- B. Delegated-Design Submittal:
 - 1. Design calculations and detailed fabrication and assembly of pipe anchors and alignment guides, hangers and supports for multiple pipes, expansion joints and loops, and attachments of the same to the building structure.
 - 2. Locations of pipe anchors and alignment guides and expansion joints and loops.
 - 3. Locations of and details for penetrations, including sleeves and sleeve seals for exterior walls, floors, basement, and foundation walls.

1.4 INFORMATIONAL SUBMITTALS

- A. System purging and disinfecting activities report.
- B. Field quality-control reports.

1.5 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 or owner no fewer than two days in advance of proposed interruption of water service.

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 and NSF 61. Plastic piping components shall be marked with "NSF-pw."
- C. All piping shall be American made and tested; no import pipe will be permitted.
- D. All exposed water supply piping in toilet rooms, custodial rooms and kitchens shall be chromium plated.
- E. All piping installed in or passing through a plenum must be plenum rated, fire wrapped, or installed in a metal conduit.

2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: **ASTM B 88, Type K** and **ASTM B 88, Type L** water tube, drawn temper.
- B. Soft Copper Tube: **ASTM B 88, Type K** and **ASTM B 88, Type L** water tube, annealed temper.
- C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
- D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- F. Copper Unions:
 - 1. MSS SP-123.
 - 2. Cast-copper-alloy, hexagonal-stock body.
 - 3. Ball-and-socket, metal-to-metal seating surfaces.
 - 4. Solder-joint or threaded ends.

2.3 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.
- E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 TRANSITION FITTINGS

- A. General Requirements:
 - 1. Same size as pipes to be joined.
 - 2. Pressure rating at least equal to pipes to be joined.
 - 3. End connections compatible with pipes to be joined.
- B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
- C. Sleeve-Type Transition Coupling: AWWA C219.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cascade Waterworks Manufacturing.
 - b. Dresser, Inc.; Piping Specialties Products.
 - c. Ford Meter Box Company, Inc. (The).
 - d. JCM Industries.
 - e. Romac Industries, Inc.
 - f. Smith-Blair, Inc.; a Sensus company.
 - g. Viking Johnson.

2.5 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 Nipples and Waterways:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Elster Perfection Corporation.
 - b. Grinnell Mechanical Products; Tyco Fire Products LP.
 - c. Matco-Norca.
 - d. Clearflow/Perfection Corp.
 - e. Precision Plumbing Products, Inc.
 - f. Victaulic Company.
 - 2. Standard: IAPMO PS 66 or ASTM F-1545-97.
 - 3. Electroplated steel nipple or waterway complying with ASTM F 1545 or ANSI/NSF-61 Compliant.
 - 4. Pressure Rating and Temperature: **300 psig at 225 deg F.**

5. End Connections: Male threaded or grooved.
6. Lining: Inert and noncorrosive, propylene or LTHS.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. 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.
- B. Polypropylene pipe in or passing through plenums must be fire wrapped or installed in a metal conduit.
- C. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- D. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
- E. Install underground **copper tube** in PE encasement according to ASTM A 674 or AWWA C105/A21.5.
- F. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Division 22 Section "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Division 22 Section "Domestic Water Piping Specialties."
- G. Install shutoff valve immediately upstream of each dielectric fitting.
- H. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Division 22 Section "Domestic Water Piping Specialties."
- I. Install domestic water piping level **with 0.25 percent slope downward toward drain** and plumb.
 1. Piping will be drained seasonally for freeze protection.
- J. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- K. Install seismic restraints on piping. Comply with SEI/ASCE 7 and with requirements for seismic-restraint devices in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

- L. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- M. 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.
- N. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- O. Install piping to permit valve servicing.
- P. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- Q. Install piping free of sags and bends.
- R. Install fittings for changes in direction and branch connections.
- S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."
- T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."
- U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."

3.3 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 pipes, tubes, and fittings before assembly.
- C. 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.
- D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Braze Joints" chapter.

- E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- F. 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.
- G. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.4 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
 - 1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
 - 2. Fittings for NPS 2 and Larger: Sleeve-type coupling.
- C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition **fittings**.

3.5 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 nipples/waterways**.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use **dielectric nipples/waterways**.

3.6 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint devices in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for pipe hanger, support products, and installation in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
 - 1. Vertical Piping: MSS Type 8 or 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
 - 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.

- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one 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.
 - 5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
 - 6. NPS 6: 10 feet with 5/8-inch rod.
 - 7. NPS 8: 10 feet with 3/4-inch rod.
- F. Install supports for vertical PP piping every 60 inches for NPS 1 and smaller, and every 72 inches for NPS 1-1/4 and larger.
- G. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

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.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
 - 1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
 - 2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
 - 3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code. Comply with requirements for connection sizes in Division 22 plumbing fixture Sections.
 - 4. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.8 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification materials and installation in Division 22 Section "Identification for Plumbing Piping and Equipment."
- B. Label pressure piping with system operating pressure.

3.9 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:

- 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 one day 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 authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
- c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
- d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

- 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 a 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 it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
- e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
- f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

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.
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 for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. 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 piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures 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. Repeat procedures if biological examination shows contamination.
 - e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Clean non-potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.

- b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.
- D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.12 PIPING SCHEDULE

- A. Some piping types and sizes mentioned in this section may not be used on this project.
- B. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- C. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- D. All exposed water supply piping in toilet rooms, custodial rooms and kitchens shall be chromium plated.
- E. Aboveground domestic water piping, **NPS 2 and smaller**, shall be one of the following:
 1. Hard copper tube, **ASTM B 88, Type L**; **cast-copper**, solder-joint fittings; and **soldered** joints.
- F. Aboveground domestic water piping, **NPS 2-1/2 to NPS 4**, shall be one of the following:
 1. Hard copper tube, **ASTM B 88, Type L**; **cast-copper**, solder-joint fittings; and **soldered** joints.

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 **ball** for piping NPS 3 and smaller. Use **butterfly** with flanged ends for piping NPS 4 and larger.
 2. Throttling Duty: Use **ball** valves for piping NPS 2 and smaller. Use **butterfly** valves with flanged ends for piping NPS 2-1/2 and larger.
 3. Drain Duty: Hose-end drain valves.
- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

END OF SECTION

SECTION 221119 - DOMESTIC WATER 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 domestic water piping specialties:
 - 1. Vacuum breakers.
 - 2. Backflow preventers.
 - 3. Water pressure-reducing valves.
 - 4. Temperature-actuated water mixing valves.
 - 5. Strainers.
 - 6. Water hammer arresters.
- B. Related Sections include the following:
 - 1. Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
 - 2. Division 22 Section "Emergency Plumbing Fixtures" for water tempering equipment.
 - 3. Division 22 Section "Drinking Fountains and Water Coolers" for water filters for water coolers.

1.3 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

1.5 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. NSF Compliance:
 - 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."

PART 2 - PRODUCTS

2.1 VACUUM BREAKERS

- A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ames Co.
 - b. Cash Acme.
 - c. Conbraco Industries, Inc.
 - d. FEBCO; SPX Valves & Controls.
 - e. Rain Bird Corporation.
 - f. Toro Company (The); Irrigation Div.
 - g. Watts Industries, Inc.; Water Products Div.
 - h. Zurn Plumbing Products Group; Wilkins Div.
 - 2. Standard: ASSE 1001.
 - 3. Size: NPS 1/4 to NPS 3, as required to match connected piping.
 - 4. Body: Bronze.
 - 5. Inlet and Outlet Connections: Threaded.
 - 6. Finish: Chrome plated.
- B. Hose-Connection Vacuum Breakers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Arrowhead Brass Products, Inc.
 - b. Cash Acme.
 - c. Conbraco Industries, Inc.
 - d. MIFAB, Inc.
 - e. Prier Products, Inc.
 - f. Watts Industries, Inc.; Water Products Div.
 - g. Woodford Manufacturing Company.
 - h. Zurn Plumbing Products Group; Light Commercial Operation.
 - i. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1011.
3. Body: Bronze, nonremovable, with manual drain.
4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
5. Finish: Chrome or nickel plated.

C. Pressure Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ames Co.
 - b. Conbraco Industries, Inc.
 - c. FEBCO; SPX Valves & Controls.
 - d. Flomatic Corporation.
 - e. Toro Company (The); Irrigation Div.
 - f. Watts Industries, Inc.; Water Products Div.
 - g. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1020.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
5. Accessories:
 - a. Valves: Ball type, on inlet and outlet.

D. Spill-Resistant Vacuum Breakers:

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.
2. Standard: ASSE 1056.
3. Operation: Continuous-pressure applications.
4. Accessories:
 - a. Valves: Ball type, on inlet and outlet.

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.
 - c. FEBCO; SPX Valves & Controls.
 - d. Flomatic Corporation.
 - e. Watts Industries, Inc.; Water Products Div.
 - f. 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 of NPS 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. Double-Check Backflow-Prevention Assemblies:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ames Co.
 - b. Conbraco Industries, Inc.
 - c. FEBCO; SPX Valves & Controls.
 - d. Flomatic Corporation.
 - e. Watts Industries, Inc.; Water Products Div.
 - f. Zurn Plumbing Products Group; Wilkins Div.
 2. Standard: ASSE 1015.
 3. Operation: Continuous-pressure applications, unless otherwise indicated.
 4. Pressure Loss: 5 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] <Insert type> for NPS 2-1/2 and larger.
 7. Accessories:
 - a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
- C. 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.
 5. Body: Stainless steel.

6. End Connections: Threaded.

D. Dual-Check-Valve Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cash Acme.
 - b. Conbraco Industries, Inc.
 - c. FEBCO; SPX Valves & Controls.
 - d. Flomatic Corporation.
 - e. Ford Meter Box Company, Inc. (The).
 - f. Honeywell Water Controls.
 - g. McDonald, A. Y. Mfg. Co.
 - h. Mueller Co.; Water Products Div.
 - i. Watts Industries, Inc.; Water Products Div.
 - j. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1024.
3. Operation: Continuous-pressure applications.
4. Body: Bronze with union inlet.

2.3 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. Armstrong International, Inc.
 - b. Lawler Manufacturing Company, Inc.
 - c. Leonard Valve Company.
 - d. Powers; a Watts Industries Co.
 - e. 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, 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: Chrome plated.
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. Cash Acme.
 - b. Conbraco Industries, Inc.
 - c. Honeywell Water Controls.
 - d. Lawler Manufacturing Company, Inc.
 - e. Leonard Valve Company.
 - f. Powers; a Watts Industries Co.
 - g. Watts Industries, Inc.; Water Products Div.
 - h. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1016, thermostatically controlled water tempering valve.
 3. Pressure Rating: 125 psig minimum, unless otherwise indicated.
 4. Body: Bronze body with corrosion-resistant interior components.
 5. Temperature Control: Adjustable.
 6. Inlets and Outlet: Threaded.
 7. Finish: Rough or chrome-plated bronze.

2.4 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum, unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating and for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations, unless otherwise indicated.
5. Perforation Size:
 - a. Strainers NPS 2 and Smaller: 0.020 inch.
 - b. Strainers NPS 2-1/2 to NPS 4: 0.045 inch.
 - c. Strainers NPS 5 and Larger: 0.10 inch.
6. Drain: Factory-installed, hose-end drain valve.

2.5 WATER HAMMER ARRESTERS

A. Water Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AMTROL, Inc.
 - b. Josam Company.
 - c. MIFAB, Inc.
 - d. PPP Inc.
 - e. Sioux Chief Manufacturing Company, Inc.
 - f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - g. Tyler Pipe; Wade Div.
 - h. Watts Drainage Products Inc.
 - i. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Metal bellows or Copper tube with piston.
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.
- C. Install water control valves with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.
- D. Install balancing valves in locations where they can easily be adjusted.
- E. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
 1. Install thermometers and water regulators if specified.
 2. Install cabinet-type units recessed in or surface mounted on wall as specified.
- F. Install Y-pattern strainers for water on supply side of each control valve, water pressure-reducing valve, solenoid valve, and pump.
- G. Install outlet boxes recessed in wall. Install 2-by-4-inch fire-retardant-treated-wood blocking wall reinforcement between studs. Fire-retardant-treated-wood blocking is specified in Division 06 Section "Rough Carpentry."
- H. Install water hammer arresters in water piping according to PDI-WH 201.
- I. Install drainage-type, trap-seal primer valves as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.
- J. Install trap-seal primer systems with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.
- B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
 - 1. Pressure vacuum breakers.
 - 2. Reduced-pressure-principle backflow preventers.
 - 3. Double-check backflow-prevention assemblies.
 - 4. Water pressure-reducing valves.
 - 5. Calibrated balancing valves.
 - 6. Primary, thermostatic, water mixing valves.
 - 7. Primary water tempering valves.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 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.
- B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.5 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow set points of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION

SECTION 221316 - 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. Section Includes:
 - 1. Pipe, tube, and fittings.
 - 2. Specialty pipe fittings.

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.**

1.4 ACTION SUBMITTALS

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

1.5 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.
- B. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste,

and vent piping; "NSF-sewer" for plastic sewer piping; "NSF-drain" for plastic drain piping, and "NSF-tubular" for plastic continuous waste piping.

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.

2.2 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: All cast-iron waste, vent and sewer pipe and fittings shall conform to the requirements of CISPI Standard 301 and ASTM A 888. All products shall be marked with the collective trademark of the Cast Soil Pipe Institute and shall be listed by NSF International or receive prior approval of the engineer. All cast-iron pipe and fittings shall be American made and tested. Non-compliant import cast-iron products will not be permitted. Any non-compliant cast-iron product installed by the contractor on this project will be replaced at the contractor's expense and shall include all repairs, patching, painting and other incidental work required to return the project to its pre-remediation state.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. AB&I Foundry
- b. Charlotte Pipe
- c. Tyler Pipe

- B. CISPI, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. ANACO.
- b. Ideal
- c. Mission Rubber Company; a division of MCP Industries, Inc.
- d. Tyler Pipe.

2. Standards: ASTM C 1277 and CISPI 310.
3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
4. Listing: Couplings shall be listed by NSF International. Each coupling shall be embossed with the NSF seal.

- C. Heavy-Duty, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Husky SD 4000.
 - b. Clamp-All Corp HI-TORQ 125.
2. Standards: ASTM C 1277 and ASTM C 1540.
 3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.3 PVC PIPE AND FITTINGS

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
- B. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- C. Adhesive Primer: ASTM F 656.
 1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. Solvent Cement: ASTM D 2564.
 1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EARTH MOVING

- A. Comply with requirements for excavating, trenching, and backfilling specified in Division 31 Section "Earth Moving."

3.2 PIPING INSTALLATION

- A. 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.
- 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. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Install seismic restraints on piping. Comply with SEI/ASCE 7 and with requirements for seismic-restraint devices specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- K. 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 two 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.
- L. 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.
- M. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:
 - 1. Building Sanitary Drain: **2 percent downward in direction of flow for piping.**
 - 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
 - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- N. 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."
 - 1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.
- O. Install underground **PVC** piping according to ASTM D 2321.
- P. Install engineered soil and waste drainage and vent piping systems as follows:
 - 1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.

Q. Plumbing Specialties:

1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping. Comply with requirements for cleanouts specified in Division 22 Section "Sanitary Waste Piping Specialties."
2. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Division 22 Section "Sanitary Waste Piping Specialties."
3. Install cleanout fitting with closure plug inside the building in sanitary force-main piping.

R. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

B. Plastic, Nonpressure-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 Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger and support devices and installation specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

1. Install **carbon-steel** pipe hangers for horizontal piping in noncorrosive environments.
2. Install **stainless-steel** pipe hangers for horizontal piping in corrosive environments.

3. Install **carbon-steel** pipe support clamps for vertical piping in noncorrosive environments.
 4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
 5. Vertical Piping: MSS Type 8 or Type 42, clamps.
 6. Install individual, straight, horizontal piping runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
 7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 8. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support horizontal piping and tubing within 12 inches of each **fitting and coupling or valve and coupling**.
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
- F. 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. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
 4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
 5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.
 6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- G. Install supports for vertical cast-iron soil piping every 15 feet.
- H. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.
- 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.
 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.
 4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
 5. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.
- D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
- E. Make fixture and equipment 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.

3.6 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.7 FIELD QUALITY CONTROL

- A. 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 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 drainage 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. 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 drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.

3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than **10-foot head of water**. From 15 minutes before inspection starts to completion of inspection, water level must not drop. 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. 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**. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. 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.

3.8 CLEANING AND PROTECTION

- 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.

3.9 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground, soil and waste piping **NPS 3** and smaller shall be the following:
 1. Hubless, cast-iron soil pipe and fittings **CISPI** hubless-piping couplings; and coupled joints.
- C. Aboveground, soil and waste piping **NPS 4** and larger shall be the following:
 1. Hubless, cast-iron soil pipe and fittings **heavy-duty** hubless-piping couplings; and coupled joints.
- D. Aboveground, vent piping **NPS 3** and smaller shall be the following:
 1. Hubless, cast-iron soil pipe and fittings **CISPI** hubless-piping couplings; and coupled joints.
- E. Aboveground, vent piping **NPS 4** and larger shall be the following:
 1. Hubless, cast-iron soil pipe and fittings **CISPI** hubless-piping couplings; and coupled joints.
 2. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

- F. Underground, soil, waste, and vent piping **NPS 3** and smaller shall be **any of** the following:
1. Hubless, cast-iron soil pipe and fittings **CISPI** hubless-piping couplings; and coupled joints.
 2. **Solid-wall** PVC pipe, PVC socket fittings, and solvent-cemented joints.
 3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 4. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- G. Underground, soil and waste piping **NPS 4** and larger shall be **any of** the following:
1. Hubless, cast-iron soil pipe and fittings **heavy-duty** hubless-piping couplings; and coupled joints.
 2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

END OF SECTION

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SECTION 221319 - 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. Through-penetration firestop assemblies.
 - 4. Miscellaneous sanitary drainage piping specialties.
 - 5. Flashing materials.
- B. Related Sections include the following:
 - 1. Division 22 Section "Storm Drainage Piping Specialties" for trench drains for storm water, channel drainage systems for storm water, roof drains, and catch basins.

1.3 SEISMIC REQUIREMENTS

- A. Component Importance Factor. All plumbing components shall be assigned a component importance factor. The component importance factor, I_p , shall be taken as 1.5 if any of the following conditions apply:
 - 1. The component is required to function for life-safety purposes after an earthquake.
 - 2. The component contains hazardous materials.
 - 3. The component is in or attached to an Occupancy Category IV structure and it is needed for continued operation of the facility or its failure could impair the continued operation of the facility.
- B. All other components shall be assigned a component importance factor, I_p , equal to 1.0.
- C. Seismic Performance: Plumbing equipment, hangers and supports shall withstand the effects of earthquake motions determined according to SEI/ASCE 7 and with the requirements specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

1.4 DEFINITIONS

- A. FRP: Fiberglass-reinforced plastic.

- B. HDPE: High-density polyethylene plastic.
- C. PE: Polyethylene plastic.
- D. PP: Polypropylene plastic.
- E. PVC: Polyvinyl chloride plastic.

1.5 SUBMITTALS

- A. Shop Drawings: Show fabrication and installation details for frost-resistant vent terminals.
 - 1. Wiring Diagrams: Power, signal, and control wiring.
- B. Manufacturer Seismic Qualification Certification: Submit certification that FOG disposal systems, grease interceptors, grease removal devices, oil interceptors, accessories, and components will withstand seismic forces defined in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment." Include the following:
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - a. For components with a seismic importance factor of 1.0 the term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
 - b. For components with a seismic importance factor of 1.5 the term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.
- 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. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

1.7 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Exposed Metal 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.
 - g. Sun Drainage Products
2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
3. Size: Same as connected drainage piping
4. Body Material: Hubless, cast-iron soil pipe test tee 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.
7. Closure: Stainless-steel plug with seal.

B. Metal Floor Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. Oatey.
 - 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.
 - h. Sun Drainage Products
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. Clamping Device: Required.
7. Outlet Connection: Inside call.
8. Closure: Brass plug with tapered threads.
9. Adjustable Housing Material: Cast iron with threads.
10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
11. Frame and Cover Shape: Round.
12. Top Loading Classification: Heavy Duty.
13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
14. Standard: ASME A112.3.1.
15. Size: Same as connected branch.
16. Housing: Stainless steel.
17. Closure: Stainless steel with seal.
18. Riser: Stainless-steel drainage pipe fitting to cleanout.

C. Cast-Iron Wall 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.
 - g. Sun Drainage Products
2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hub-and-spigot, cast-iron soil pipe T-branch 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.
7. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.
8. Wall Access: Round, stainless-steel wall-installation frame and cover.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: See Schedule at end of this Section:
 - 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.
 - g. Sun Drainage Products
3. Standard: ASME A112.6.3.
 4. Body Material: Gray iron.
 5. Seepage Flange: Required.
 6. Anchor Flange: Not required.
 7. Outlet: Bottom.
 8. Trap Material: Cast iron>.
 9. Trap Pattern: Deep-seal P-trap>.
 10. Trap Features: Trap-seal primer valve drain connection>.

2.3 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Firestop Assemblies:

1. 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:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ProSet Systems Inc.
3. Standard: UL 1479 assembly of sleeve and stack fitting with firestopping plug.
4. Size: Same as connected soil, waste, or vent stack.
5. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
6. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
7. Special Coating: Corrosion resistant on interior of fittings.

2.4 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.
 - a. NPS 2: 4-inch- minimum water seal.
 - b. NPS 2-1/2 and Larger: 5-inch- minimum water seal.

B. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.

2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

C. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 1 inch > above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

D. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

E. Vent Cap Filters:

1. Description: Activated carbon filter in housing for installation at vent terminal as manufactured by Sweet Filter.
2. Size: Same as connected stack vent or vent stack.

2.5 FLASHING MATERIALS

- A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:
1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.
 2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
 3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.
- B. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.
- C. Fasteners: Metal compatible with material and substrate being fastened.
- D. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- E. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- C. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 - 1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
 - 2. Locate at each change in direction of piping greater than 45 degrees.
 - 3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
 - 4. Locate at base of each vertical soil and waste stack.
- D. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- E. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- F. 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. Set with grates depressed according to the following drainage area radii:
 - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
 - b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
 - c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
 - 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.
- G. Assemble plastic channel drainage system components according to manufacturer's written instructions. Install on support devices so that top will be flush with adjacent surface.
 - 1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
 - 2. Size: Same as floor drain inlet.

- H. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- I. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- J. Install vent cap filters on each vent pipe passing through roof.
- K. 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.
- C. Grease Removal Devices: Connect controls, electrical power, factory-furnished accessories, and inlet, outlet, and vent piping to unit.
- 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."

3.3 FLASHING INSTALLATION

- A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
 - 1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
 - 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
 - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
 - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.

- E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07 Section "Sheet Metal Flashing and Trim."
- F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.
- G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
 - 1. Grease removal devices.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled grease removal devices and their installation, including piping and electrical connections, and to assist in testing.
- B. Tests and Inspections:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.6 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.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain grease removal devices. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION

SECTION 224000 - PLUMBING FIXTURES

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 conventional plumbing fixtures and related components:
 - 1. Faucets for lavatories and sinks.
 - 2. Flushometers.
 - 3. Toilet seats.
 - 4. Protective shielding guards.
 - 5. Fixture supports.
 - 6. Water closets.
 - 7. Lavatories.
 - 8. Owner-furnished fixtures.
 - 9. Lead Free fixtures.
- B. Related Sections include the following:
 - 1. Division 22 Section "Domestic Water Piping Specialties" for backflow preventers, floor drains, and specialty fixtures not included in this Section.
 - 2. Division 22 Section "Emergency Plumbing Fixtures."

1.3 LEAD FREE REQUIREMENTS

- A. For all projects within the United States, and when water is anticipated for human consumption, all pipes, pipe fittings, plumbing fittings and fixtures shall comply with PUBLIC LAW 111-380 "Reduction of Lead in Drinking Water Act" 124 STAT. 4131, 42-USC 1201, January 4th, 2011.

1.4 DEFINITIONS

- A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- B. Cast Polymer: Cast-filled-polymer-plastic material. This material includes cultured-marble and solid-surface materials.
- C. Cultured Marble: Cast-filled-polymer-plastic material with surface coating.
- D. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads

and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

- E. FRP: Fiberglass-reinforced plastic.
- F. PMMA: Polymethyl methacrylate (acrylic) plastic.
- G. PVC: Polyvinyl chloride plastic.
- H. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.
- I. Lead Free:
 - 1. Not containing more than 0.2 percent lead when used with respect to solder and flux.
 - 2. Not more than a weighted average of 0.25 percent lead when used with respect to the wetted surfaces of pipes, pipe fittings, plumbing fittings and fixtures.
 - 3. Calculation: The weighted average lead content of a pipe, pipe fitting, plumbing fitting or fixture shall be calculated by using the formula prescribed in the law named in LEAD FREE REQUIREMENTS above.

1.5 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.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Operation and Maintenance Data: For plumbing fixtures to include in emergency, operation, and maintenance manuals.
- D. Warranty: Special warranty specified in this Section.

1.6 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. 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. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.

- D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- E. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- F. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- G. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
 2. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
 3. Slip-Resistant Bathing Surfaces: ASTM F 462.
 4. Solid-Surface-Material Lavatories and Sinks: ANSI/ICPA SS-1.
 5. Stainless-Steel Residential Sinks: ASME A112.19.3.
 6. Vitreous-China Fixtures: ASME A112.19.2M.
 7. Water-Closet, Flushometer Tank Trim: ASSE 1037.
- H. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:
1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
 2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
 3. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
 4. Faucets: ASME A112.18.1.
 5. Hose-Connection Vacuum Breakers: ASSE 1011.
 6. Hose-Coupling Threads: ASME B1.20.7.
 7. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
 8. NSF Potable-Water Materials: NSF 61.
 9. Pipe Threads: ASME B1.20.1.
 10. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
 11. Supply Fittings: ASME A112.18.1.
 12. Brass Waste Fittings: ASME A112.18.2.
 13. NSF61 Appendage G-AB 1953. Lead free potable drinking faucets.
- I. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:
1. Atmospheric Vacuum Breakers: ASSE 1001.
 2. Brass and Copper Supplies: ASME A112.18.1.
 3. Dishwasher Air-Gap Fittings: ASSE 1021.
 4. Manual-Operation Flushometers: ASSE 1037.
 5. Plastic Tubular Fittings: ASTM F 409.
 6. Brass Waste Fittings: ASME A112.18.2.
 7. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.
 8. NSF61 Appendage G-AB 1953. Lead free potable drinking faucets.
- J. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Flexible Water Connectors: ASME A112.18.6.
2. Floor Drains: ASME A112.6.3.
3. Grab Bars: ASTM F 446.
4. Hose-Coupling Threads: ASME B1.20.7.
5. Off-Floor Fixture Supports: ASME A112.6.1M.
6. Pipe Threads: ASME B1.20.1.
7. Plastic Toilet Seats: ANSI Z124.5.
8. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.1 LEAD FREE PRODUCTS:

- A. For all products purchased that where water is anticipated for human consumption, all pipes, pipe fittings, plumbing fittings and fixtures shall comply with the LEAD FREE REQUIREMENTS in PART 1 above.

2.2 LAVATORY FAUCETS

A. Lavatory Faucets:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Chicago Faucets.
 - b. T & S Brass and Bronze Works, Inc.
 - c. Moen, Inc.

2.3 SINK FAUCETS

A. Sink Faucets:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Chicago Faucets.
 - b. T & S Brass and Bronze Works, Inc.
 - c. Moen, Inc.

2.4 FLUSHOMETERS

A. Flushometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Sloan Valve Company.
 - b. Zurn Plumbing Products Group; Commercial Brass Operation.

- c. Moen, Inc.

2.5 TOILET SEATS

A. Toilet Seats:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bemis Manufacturing Company.
 - b. Centoco Manufacturing Corp.
 - c. Church Seats.
 - d. Olsonite Corp.
 - e. Sperzel.
2. Description: Toilet seat for water-closet-type fixture.
 - a. Material: Molded, solid plastic with antimicrobial agent.
 - b. Configuration: Open front without cover.
 - c. Size: Elongated.
 - d. Hinge Type: CK, check.
 - e. Class: Heavy-duty commercial.
 - f. Color: White.

2.6 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Engineered Brass Co.
 - b. Insul-Tect Products Co.; a Subsidiary of MVG Molded Products.
 - c. McGuire Manufacturing Co., Inc.
 - d. Plumberex Specialty Products Inc.
 - e. TCI Products.
 - f. TRUEBRO, Inc.
 - g. Zurn Plumbing Products Group; Tubular Brass Plumbing Products Operation.
2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements. Product shall also meet the ASTM E 84 25/450 smoke and flame rating.

B. Protective Shielding Piping Enclosures:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. TRUEBRO, Inc.

2. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

2.7 FIXTURE SUPPORTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Josam Company.
 2. MIFAB Manufacturing Inc.
 3. Smith, Jay R. Mfg. Co.
 4. Tyler Pipe; Wade Div.
 5. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
 6. Zurn Plumbing Products Group; Specification Drainage Operation.
- B. Lavatory Supports:
 1. Description: Type II, lavatory carrier with concealed arms and tie rod for wall-mounting, lavatory-type fixture. Include steel uprights with feet.
 2. Accessible-Fixture Support: Include rectangular steel uprights.

2.8 WATER CLOSETS

- A. Water Closets:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard Companies, Inc.
 - b. Crane Plumbing, L.L.C./Fiat Products.
 - c. Eljer.
 - d. Kohler Co.

2.9 LAVATORIES

- A. Lavatories:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard Companies, Inc.
 - b. Briggs Plumbing Products, Inc.
 - c. Crane Plumbing, L.L.C./Fiat Products.
 - d. Eljer.
 - e. Kohler Co.

2.10 COMMERCIAL SINKS

A. Commercial Sinks:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Elkay Manufacturing Co.
 - b. Just Manufacturing Company.

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. Installations where water is anticipated for human consumption, all pipes, pipe fittings, plumbing fittings and fixtures shall be Lead Free as given in PART 1 above.
- B. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- C. 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.
- D. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.
- E. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
- F. Install wall-mounting fixtures with tubular waste piping attached to supports.
- G. Install counter-mounting fixtures in and attached to casework.
- H. Install fixtures level and plumb according to roughing-in drawings.

- I. 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, gate, or globe valves if supply stops are not specified with fixture. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- J. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- K. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
- L. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.
- M. Install toilet seats on water closets.
- N. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- O. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.
- P. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- Q. Install traps on fixture outlets.
 - 1. Exception: Omit trap on fixtures with integral traps.
 - 2. Exception: Omit trap on indirect wastes, unless otherwise indicated.
- R. 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."
- S. Set bathtubs and service basins in leveling bed of cement grout. Grout is specified in Division 22 Section "Common Work Results for Plumbing."
- T. 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."
- U. All plumbing fixtures are to be mounted at the height specified on the Architectural drawings.

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.
- 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. 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.
- E. Install fresh batteries in sensor-operated mechanisms.

3.5 ADJUSTING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.
- C. Replace washers and seals of leaking and dripping faucets and stops.
- D. Install fresh batteries in sensor-operated mechanisms.

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.

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.

END OF SECTION

SECTION 23 0100 - MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL CONDITIONS

- A. The General Conditions of the Contract, with the amendments, supplements, forms and requirements in Division 1, and herewith made a part of this Division.
- B. All sections of Division 21, 22, & 23 shall comply with the Mechanical General Requirements. The standards established in this section as to quality of materials and equipment, the type and quality of workmanship, mode of operations, safety rules, code requirements, etc., shall apply to all sections of this Division as though they were repeated in each Division.
- C. Mechanical equipment that is pre-purchased if any will be assigned to the Mechanical Contractor. By assignment to the Mechanical Contractor, the Mechanical Contractor shall accept and installed the equipment and provide all warranties and guarantees as if the Mechanical Contractor had purchased the equipment.
- D. Construction Indoor-Air Quality Management
 - 1. Comply with SMACNA's "SMACNA IAQ Guideline for Occupied Buildings under Construction."
 - a. If Owner authorizes use of permanent heating, cooling, and ventilating systems during construction period as specified in Division 01 Section "Temporary Facilities and Controls," install filter media having a MERV 8 according to ASHRAE 52.2 at each return-air inlet for the air-handling system used during construction.
 - b. Replace all air filters immediately prior to occupancy.

2.

1.2 SCOPE OF WORK

- A. The project described herein is the CASSIA REGIONAL MEDICAL CENTER PHARMACY REMODEL (USP 797). This work shall include all labor, materials, equipment, fixtures, and devices for the entire mechanical work and a complete operating and tested installation as required for this project.
- B. This Division will schedule the boiler inspection and pay for all costs associated with certifying the boiler with the state.

1.3 CODES & ORDINANCES

- A. All work shall be executed in accordance with all underwriters, public utilities, local and state rules and regulations applicable to the trade affected. Should any change in the plans and Specifications be required to comply with these regulations, the Contractor shall notify the Architect before the time of submitting his bid. After entering into contract, the Contractor will be held to complete all work necessary to meet these requirements without

extra expense to the Owner. Where work required by drawings or specifications is above the standard required, it shall be done as shown or specified.

- B. Applicable codes:
1. Utah Boiler and Pressure Vessel Rules and Regulations-2019 Edition
 2. International Building code- 2018 Edition
 3. International Mechanical Code- 2018 Edition
 4. International Plumbing Code- 2018 Edition
 5. International Fire Code- 2018 Edition
 6. International Energy Code- 2018 Edition
 7. International Fuel Gas Code- 2018 Edition
 8. National Electrical Code- 2017 Edition

1.4 INDUSTRY STANDARDS

- A. All work shall comply with the following standards.
1. Associated Air Balance council (AABC)
 2. Air Conditioning and Refrigeration Institute (ARI)
 3. Air Diffusion council (ADC)
 4. Air Movement and Control Association (AMCA)
 5. American Gas Association (AGA)
 6. American National Standards Institute (ANSI)
 7. American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE)
 8. American Society of Mechanical Engineers (ASME)
 9. American Society of Testing Materials (ASTM)
 10. American Water Works Association (AWWA)
 11. Cooling Tower Institute (CTI)
 12. ETL Testing Laboratories (ETL)
 13. Institute of Electrical and Electronic Engineers (IEEE)
 14. Hydronics Institute (HI)
 15. Manufacturers Standardization Society of the Valve and Fitting Industry (MSS)
 16. National Fire Protection Association (NFPA)
 17. National Electrical Code (NEC)
 18. National Electrical Manufacturers Association (NEMA)
 19. National Electrical Safety code (NESC)
 20. Utah safety Standard (OSHA), Utah State Industrial Council.
 21. Sheet Metal and Air Conditioning Contractor's National Association (SMACNA)
 22. Underwriters Laboratories (UL)
 23. Tubular Exchanger Manufacturers Association, Inc. (TEMA)
 24. Heat Exchanger Institute (HEI)
 25. Hydraulic Institute (HI)
 26. Thermal Insulation Manufacturer=s Association (TIMA)
 27. Scientific Apparatus Makers Association (SAMA)
- B. Compliance Verification:
1. All items required by code or specified to conform to the ASME code shall be stamped with the ASME seal.
 2. Form U-1, the manufacturer=s data report for pressure vessels, is to be included in the Operation and Maintenance Manuals. National Board Register (NBR) numbers shall be provided where required by code.

3. Manufactured equipment which is represented by a UL classification and/or listing, shall bear the UL or equivalent ETL label.

1.5 UTILITIES & FEES

- A. All fees for permits required by this work will be paid by this division. The contractor shall obtain the necessary permits to perform this work. Unless noted otherwise, all systems furnished and or installed by this Contractor, shall be complete with all utilities, components, commodities and accessories required for a fully functioning system. This Contractor shall furnish smoke generators when required for testing, furnish glycol for glycol piping systems, full load of salt to fill brine tank for water softening system, furnish cleaners and water treatment additives.

1.6 SUBMITTALS AND SHOP DRAWINGS

- A. General: As soon as possible after the contract is awarded, but in no case more than 45 calendar days thereafter, the Contractor shall submit to the Architect manufacturer's data on products and materials to be used in the installation of mechanical systems for this project. The review of the submitted data will require a minimum of **14 days**. The first day starts after the day they are received in the engineer's office to which the project is being constructed from. If the Contractors schedule requires return of submitted literature in less than the allotted time, the Contractor shall accelerate his submittal delivery date. The Contractor shall resubmit all items requiring re-review within **14 days** of returned submittals. Refer to each specification section for items requiring submittal review. **If the re-submittal is returned a 2nd time for correction the Contractor will provide the specific equipment that is specified on the drawings and/or the specifications.** Written approval of the Owner's Representative shall be obtained before installing any such equipment or materials for the project.
- B. Review by the Owner's Representative is for general conformance of the submitted equipment to the project specification. **In no way** does such review relieve this Contractor of his obligation to furnish equipment and materials that comply in detail to the specification **nor does it relieve** the Contractor of his obligation to determine actual field dimensions and conditions that may affect his work. **Regardless of any items overlooked** by the submittal review, the requirements of the contract drawings and specifications **must be followed** and are not waived or superseded **in any way** by the review.
- C. By description, catalog number, and manufacturer's names, standards of quality have been established by the Architect and the Engineer for certain manufactured equipment items and specialties that are to be furnished by this Division. Alternate products and equipment may be proposed for use only if specifically named in the specifications or if given written prior approval in published addenda. Design equipment is the equipment listed on the drawings or if not listed on the drawings is the equipment first named in the specifications.
- D. If the Engineer is required to do additional design work to incorporate changes caused by submitting equipment or products, different than the design equipment specified, as defined above, the contractor shall reimburse the engineer for additional time and expenses at the engineer's current, recognized, hourly rates.

- E. Submittal Format: At the contractor's discretion, project submittals may be in either of the formats described in the following paragraphs, but mixing the two formats is not acceptable.
1. Hardcopy Submittal Format: **Six (6)** copies of the descriptive literature covering products and materials to be used in the installation of mechanical systems for this project will be provided for review. The submittals shall be prepared in an orderly manner, contained in a 3-ring loose-leaf binder with index and identification tab for each item or group of items and for each specification section. All items shall be submitted at one time except automatic temperature control drawings and seismic restraint drawings which may be submitted separately within **120 days** of the contract award date. Partial submittals will not be reviewed until the complete submittal is received.
 - a. Submitted literature shall bear the Contractor's stamp, indicating that he has checked all equipment being submitted; that each item will fit into the available space with the accesses shown on the drawings; and, further, that each item conforms to the capacity and quality standards given in the contract documents.
 - b. Submitted literature shall clearly indicate performance, quality, and utility requirements; shall show dimension and size of connection points; and shall include derating factors that were applied for each item of equipment to provide capacity at job site elevation. Temperature control submittals shall include piping and wiring diagrams, sequence of operation and equipment. Equipment must fit into the available space with allowance for operation, maintenance, etc. Factory piped and wired equipment shall include shop drawings for all internal wiring and piping furnished with the unit.
 - c. Submitted literature shall clearly show all required field install wiring, piping, and accessory installations required by the Contractor to provide a complete operating system.
 2. Electronic Submittal Format: Identify and incorporate information in each electronic submittal file as follows:
 - a. All items shall be submitted at one time except automatic temperature control drawings and seismic restraint drawings which may be submitted separately within **120 days** of the contract award date. Partial submittals will not be reviewed until the complete submittal is received.
 - b. Submitted electronic file shall bear the Contractor's stamp, indicating that he has checked all equipment being submitted; that each item will fit into the available space with the accesses shown on the drawings; and, further, that each item conforms to the capacity and quality standards given in the contract documents.
 - c. Submitted electronic file shall clearly indicate performance, quality, and utility requirements; shall show dimension and size of connection points; and shall include derating factors that were applied for each item of equipment to provide capacity at job site elevation. Temperature control submittals shall include piping and wiring diagrams, sequence of operation and equipment. Equipment must fit into the available space with allowance for operation, maintenance, etc. Factory piped and wired equipment shall include shop drawings for all internal wiring and piping furnished with the unit.
 - d. Submitted electronic file shall clearly show all required field install wiring, piping, and accessory installations required by the Contractor to provide a complete operating system.

- e. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
- f. Name file with submittal number or other unique identifier, including revision identifier.
- g. Electronic file shall be completely electronically searchable or it will be rejected.**
- h. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by:
 - 1) Architect.**
- i. Transmittal Form for Electronic Submittals:
 - 1) Use one of the following options acceptable to the Owner;
 - a) Software-generated form from electronic project management software.**
 - b) Electronic form.**
 - 2) The Electronic Submittal shall contain the following information:
 - a) Project name.
 - b) Date.
 - c) Name and address of Architect.
 - d) Name of Construction Manager.
 - e) Name of Contractor.
 - f) Name of firm or entity that prepared submittal.
 - g) Names of subcontractor, manufacturer, and supplier.
 - h) Category and type of submittal.
 - i) Submittal purpose and description.
 - j) Specification Section number and title.
 - k) Specification paragraph number or drawing designation and generic name for each of multiple items.
 - l) Drawing number and detail references, as appropriate.
 - m) Location(s) where product is to be installed, as appropriate.
 - n) Related physical samples submitted directly.
 - o) Indication of full or partial submittal.
 - p) Transmittal number[, numbered consecutively].
 - q) Submittal and transmittal distribution record.
 - r) Other necessary identification.
 - s) Remarks.
- j. Metadata: Include the following information as keywords in the electronic submittal file metadata:
 - 1) Project name.
 - 2) Number and title of appropriate Specification Section.
 - 3) Manufacturer name.
 - 4) Product name.

1.7 DRAWINGS AND MEASUREMENTS

- A. Construction Drawings: The contract document drawings show the general design, arrangements, and extent of the system. In certain cases, the drawings may include

details that show more nearly exact locations and arrangements; however, the locations, as shown diagrammatically, are to be regarded as general.

- B. It shall be the work of this Section to make such slight alterations as may be necessary to make adjustable parts fit to fixed parts, leaving all complete and in proper shape when done. All dimensions given on the drawings shall be verified as related to this work and with the Architect's office before work is started.
- C. This Section shall carefully study building sections, space, clearances, etc., and then provide offsets in piping or ductwork as required to accommodate the building structure without additional cost to the Owner. In any case and at any time during the construction process, a change in location required by obstacles or the installation of other trades not shown on the mechanical plans shall be made without charge.
- D. The drawings shall not be scaled for roughing in measurements nor shall they be used as shop drawings. Where drawings are required for these purposes or where drawings must be made from field measurements, the Contractor shall take the necessary measurements and prepare the drawings. Shop drawings of the various subcontractors shall be coordinated to eliminate all interferences and to provide sufficient space for the installation of all equipment, piping, ductwork, etc.
- E. The drawings and specifications have been prepared to supplement each other and they shall be interpreted as an integral unit with items shown on one and not the other being furnished and installed as though shown and called out on both.
- F. Coordination Drawings: The contractor shall provide coordination drawings for mechanical rooms, fan rooms, equipment rooms, and congested areas to eliminate conflicts with equipment, piping, or work of other trades. The drawings shall be a minimum scale of 1/4 inch= 1 foot and of such detail as may be required by the Engineer to fully illustrate the work. These drawings shall include all piping, conduit, valves, equipment, and ductwork.
- G. Sheet-metal shop drawings will be required for all ductwork in the entire building. These drawings will show all ductwork in the entire building and shall be coordinated with architectural, structural and electrical portions of the project. The contractor shall specifically obtain copies of the structural shop drawings and shall coordinate the ductwork shop drawings with approved structural members. These drawings shall be submitted to the engineer for review prior to any fabrication. The contractor is responsible for all modifications necessary to accommodate duct installation within the structural, architectural and electrical restrictions. These drawings, once reviewed by the engineer, will be made available to all mechanical, electrical, and fire sprinkler subcontractors to coordinate installation of their work.

1.8 CONTRACTOR'S USE OF BUILDING EQUIPMENT

- A. The Contractor may use equipment such as electric motors, fans, heat exchangers, filters, etc., with the written permission of the Owner. As each piece of equipment is used (such as electric motors and fans), maintenance procedures approved by the manufacturer are to be followed. A careful record is to be kept of the length of the time the equipment is used, maintenance procedures followed, and any difficulty encountered. The record is to be submitted to the Owner upon acceptance. All fan belts and filter media (such as bearings) shall be carefully inspected just prior to acceptance. Any excessive wear noted

shall require replacement. New filter media shall be installed in air handlers at the time systems are turned over to the owner.

1.9 EXISTING CONDITIONS

- A. The Contractor shall carefully examine all existing conditions that might affect the mechanical system and shall compare these conditions with all drawings and specifications for work included under this contract. He shall, at such time, ascertain and check all conditions that may affect his work. No allowance shall subsequently be made in his behalf for an extra expense incurred as a result of his failure or neglect to make such examination. This Contractor shall include in his bid proposal all necessary allowances to repair or replace any item that will remain or will be removed, and any item that will be damaged or destroyed by new construction.
- B. The Contractor shall remove all abandoned piping, etc., required by new construction and cap or plug openings. No capping, etc., shall be exposed in occupied areas. All openings of items removed shall be sealed to match adjacent surfaces.
- C. The Contractor shall verify the exact location of all existing services, utilities, piping, etc., and make connections to existing systems as required or as shown on the drawings. The exact location of each utility line, together with size and elevation, shall be established before any on-site lines are installed. Should elevation or size of existing main utility lines make connections to them impossible as shown on drawings, then notification of such shall immediately be given to the Owners Representative for a decision.

1.10 EQUIPMENT CAPACITIES

- A. Capacities shown for equipment in the specifications and on the drawings are the minimum acceptable. No equipment shall be considered as an alternate that has capacities or performance less than that of design equipment.
- B. All equipment shall give the specified capacity and performance at the job-site elevation. Manufacturers' standard ratings shall be adjusted accordingly. All capacities and performances listed on drawings or in specifications are for job-site conditions.

1.11 SEISMIC REQUIREMENTS FOR EQUIPMENT

- A. All equipment shall be furnished structurally adequate to withstand seismic forces as outlined in the International Building Code. Refer to section Mechanical Vibration Controls and Seismic Restraints. Equipment bases shall be designed for direct attachment of seismic snubbers and/or seismic anchors.

1.12 COOPERATION WITH OTHER TRADES

- A. The Contractor shall refer to other drawings and parts of this specification that cover work of other trades that is carried on in conjunction with the mechanical work such that all work can proceed without interference resulting from lack of coordination.

- B. The Contractor shall properly size and locate all openings, chases, sleeves, equipment bases, and accesses. He shall provide accurate wiring diagrams to the Electrical Contractor for all equipment furnished under this Division.
- C. The ceiling cavity must be carefully reviewed and coordinated with all trades. In the event of conflict, the installation of the mechanical equipment and piping shall be in the following order: plumbing, waste, and soil lines; supply, return, and exhaust ductwork; water piping; medical gases; fire protection piping; and pneumatic control piping.
- D. The mechanical Contractor shall insure that the installation of all piping, ducts and equipment is in compliance with Articles 110-16 and 384-4 of the National Electrical Code relative to proper clearances in front of and over all electrical panels and equipment. No piping or ductwork will be allowed to run over electrical panel.

1.13 RESPONSIBILITY OF CONTRACTOR

- A. The Contractor is responsible for the installation of a satisfactory piece of work in accordance with the true intent of the drawings and specifications. He shall provide, as a part of his work and without expense, all incidental items required even though these items are not particularly specified or indicated. The installation shall be made so that its several component parts will function together as a workable system and shall be left with all equipment properly adjusted and in working order. The Contractor shall familiarize the Owner's Representative with maintenance and lubrication instructions as prepared by the Contractor and shall explain and fully instruct him relative to operating, servicing, and maintenance of them.
- B. If a conflict arises between the drawings and the specifications the most stringent procedure/action shall be followed. A clarification to the engineer will help to determine the course of action to be taken. If a conflict arises between specification sections the engineer will determine which course of action is to be followed.

1.14 PIPE AND DUCT OPENINGS AND EQUIPMENT RECESSES

- A. Pipe and duct chases, openings, and equipment recesses shall be provided by others only if shown on architectural or structural drawings. All openings for the mechanical work, except where plans and specifications indicate otherwise, shall be provided as work of this Division. Include openings information with coordination drawings.
- B. Whether chases, recesses, and openings are provided as work of this Division or by others, this Contractor shall supervise their construction and be responsible for the correct size and location even though detailed and dimensioned on the drawings. This Contractor shall pay for all necessary cutting, repairing, and finishing if any are left out or incorrectly made. All necessary openings thru existing walls, ceilings, floors, roofs, etc. shall be provided by this Contractor unless indicated otherwise by the drawing and/or specifications.

1.15 UNFIT OR DAMAGED WORK

- A. Any part of this installation that fails, is unfit, or becomes damaged during construction, shall be replaced or otherwise made good. The cost of such remedy shall be the responsibility of this Division.

1.16 WORKMANSHIP

- A. Workmanship shall be the best quality of its kind for the respective industries, trades, crafts, and practices, and shall be acceptable in every respect to the Owner's representative. Nothing contained herein shall relieve the Contractor from making good and perfect work in all details in construction.

1.17 SAFETY REGULATION

- A. The Contractor shall comply with all local, Federal, and OSHA safety requirements in performance with this work. (See General Conditions). This Contractor shall be required to provide equipment, supervision, construction, procedures, and all other necessary items to assure safety to life and property.

1.18 ELECTRICAL SERVICES

- A. All equipment control wiring and all automatic temperature control wiring including all necessary contacts, relays, and interlocks, whether low or line voltage, except power wiring, shall be furnished and installed as work of this Division unless shown to be furnished by Division 26. All such wiring shall be in conduit as required by electrical codes. Wiring in the mechanical rooms, fans rooms and inaccessible ceilings and walls shall be installed in conduit as well. Installation of any and all wiring done under Division 21, 22 and 23 shall be in accordance with the requirements of Division 26, Electrical.
- B. All equipment that requires an electrical connection shall be furnished so that it will operate properly and deliver full capacity on the electrical service available.
- C. Refer to the electrical control equipment and wiring shown on the diagrams. Any changes or additions required by specific equipment furnished shall be the complete responsibility of the Contractor furnishing the equipment.
- D. The Mechanical Contractor must coordinate with the Electrical Contractor to insure that all required components of control work are included and fully understood. No additional cost shall accrue to the Owner as a result of lack of such coordination.

1.19 WORK, MATERIALS, AND QUALITY OF EQUIPMENT

- A. Unless otherwise specified, all materials shall be new and of the best quality of their respective kinds and all labor shall be done in a most thorough and workmanlike manner.
- B. Products or equipment of any of the manufacturers cited herein or any of the products approved by the Addenda may be used. However, where lists of products are cited herein, the one first listed in the design equipment used in drawings and schedules to establish size, quality, function, and capacity standards. If other than design equipment is used, it shall be carefully checked for access to equipment, electrical and control requirements, valving, and piping. Should changes or additions occur in piping, valving, electrical work, etc., or if the work of other Contractors would be revised by the alternate equipment, the cost of all changes shall be borne as work of this Division.

- C. The Execution portions of the specifications specify what products and materials may be used. Any products listed in the Product section of the specification that are not listed in the Execution portion of the specification may not be used without written approval by the Engineer.
- D. The access to equipment shown on the drawings is the minimum acceptable space requirements. No equipment that reduces or restricts accessibility to this or any other equipment will be considered.
- E. All major items of equipment are specified in the equipment schedules on the drawings or in these specifications and shall be furnished complete with all accessories normally supplied with the catalog item listed and all other accessories necessary for a complete and satisfactory installation.
- F. All welders shall be certified in accordance with Section IX of the ASME Boiler and Pressure Vessel Code, latest Edition.

1.20 PROTECTION AGAINST WEATHER AND STORING OF MATERIALS

- A. All equipment and materials shall be properly stored and protected against moisture, dust, and wind. Coverings or other protection shall be used on all items that may be damaged or rusted or may have performance impaired by adverse weather or moisture conditions. Damage or defect developing before acceptance of the work shall be made good at the Contractor's expense.
- B. All open duct and pipe openings shall be adequately covered at all times.

1.21 INSTALLATION CHECK

- A. An experienced, competent, and authorized representative of the manufacturer or supplier of each item of equipment indicated in the equipment schedule and the seismic supplier shall visit the site of the work and inspect, check, adjust if necessary, and approve the equipment installation. In each case, the equipment supplier's representative shall be present when the equipment is placed in operation. The equipment supplier's representative shall revisit the job site as often as necessary until all trouble is corrected and the equipment installation and operation is satisfactory to the Engineer.
- B. Each equipment supplier's representative shall furnish to the Owner, through the Engineer, a written report certifying that the equipment (1) has been properly installed and lubricated; (2) is in accurate alignment; (3) is free from any undue stress imposed by connecting piping or anchor bolts; and, (4) has been operated under full load conditions and that it operated satisfactorily.
- C. All costs for this work shall be included in the prices quoted by equipment suppliers.

1.22 EQUIPMENT LUBRICATION

- A. The Contractor shall properly lubricate all pieces of equipment before turning the building over to the Owner. A linen tag shall be attached to each piece of equipment, showing

the date of lubrication and the lubricant used. No equipment shall be started until it is properly lubricated.

- B. Necessary time shall be spent with the Owner's Representative to thoroughly familiarize him with all necessary lubrications and maintenance that will be required of him.
- C. Detergent oil as used for automotive purposes shall not be used for this work.

1.23 CUTTING AND PATCHING

- A. No cutting or drilling in structural members shall be done without written approval of the Architect. The work shall be carefully laid out in advance, and cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, or other surfaces necessary for the mechanical work shall be carefully done. Any damage to building, piping, or equipment shall be repaired by professional plasterers, masons, concrete workers, etc., and all such work shall be paid for as work of this Division.
- B. When concrete, grading, etc., is disturbed, it shall be restored to original condition as described in the applicable Division of this Specification.

1.24 EXCAVATION AND BACKFILLING

- A. All necessary excavations and backfilling for the Mechanical phase of this project shall be provided as work of this Division. Trenches for all underground pipelines shall be excavated to the required depths. The bottom of trenches shall be compacted hard and graded to obtain required fall. Backfill shall be placed in horizontal layers, not exceeding 12 inches in thickness, and properly moistened. Each layer shall be compacted, by suitable equipment, to a density of not less than 95 percent as determined by ASTM D-1557. After pipelines have been tested, inspected, and approved, the trench shall be backfilled with selected material. Excess earth shall be hauled from the job site. Fill materials approved by the Architect shall be provided as work of this Division.
- B. No trenches shall be cut near or under any footings without consultation first with the Architect's office. Any trenches or excavations more than 30 inches deep shall be tapered, shored, covered, or otherwise made absolutely safe so that no vehicle or persons can be injured by falling into such excavations, or in any way be harmed by cave-ins, shifting earth, rolling rocks, or by drowning. This protection shall be extended to all persons approaching excavation related to this work whether or not such persons are authorized to be in the vicinity of the construction.

1.25 ACCESS

- A. Provide access doors in walls, ceilings and floors by this division unless otherwise noted. For access to mechanical equipment such as valves, dampers, VAV boxes, fans, controls, etc. Refer to Division 8 for door specifications. All access doors shall be 24" x 24" unless otherwise indicated or required. Coordinate location of doors with the Architect prior to installation. . If doors are not specified in Division 8, provide the following: Doors in ceilings and wall shall be equal to JR Smith No. 4760 bonderized and painted. Doors in tile walls shall be equal to JR Smith No. 4730 chrome plated. Doors in floors shall be equal to JR Smith No. 4910

- B. Valves: Valve must be installed in locations where access is readily available. If access is compromised, as judged by the Mechanical Engineer, these valves shall be relocated where directed at the Contractors expense.
- C. Equipment: Equipment must be installed in locations and orientations so that access to all components requiring service or maintenance will not be compromised. If access is compromised, as judged by the Mechanical Engineer, the contractor shall modify the installation as directed by the Engineer at the Contractors expense.
- D. It is the responsibility of this division to install terminal boxes, valves and all other equipment and devices so they can be accessed. If any equipment or devices are installed so they cannot be accessed on a ladder a catwalk and ladder system shall be installed above the ceiling to access and service this equipment.

1.26 CLEANING AND PAINTING

- A. Cleaning: After all tests and adjustments have been made and all systems pronounced satisfactory for permanent operation, this Contractor shall clean all exposed piping, ductwork, insulated members, fixture, and equipment installed under this Section and leave them ready for painting. He shall refinish any damaged finish and leave everything in proper working order. The Contractor shall remove all stains or grease marks on walls, floors, glass, hardware, fixtures, or elsewhere, caused by his workman or for which he is responsible. He shall remove all stickers on plumbing fixtures, do all required patching up and repair all work of others damaged by this division of the work, and leave the premises in a clean and orderly condition.
- B. Painting: Painting of exposed pipe, insulated pipe, ducts, or equipment is work of Division 9, Painting.
- C. Mechanical Contractor: All equipment which is to be furnished in factory prefinished conditions by the mechanical Contractor shall be left without mark, scratch, or impairment to finish upon completion of job. Any necessary refinishing to match original shall be done. Do not paint over nameplates, serial numbers, or other identifying marks.
- D. Removal of Debris, Etc: Upon completion of this division of the work, remove all surplus material and rubbish resulting from this work, and leave the premises in a clean and orderly condition.

1.27 CONTRACT COMPLETION

- A. Incomplete and Unacceptable Work: If additional site visits or design work is required by the Engineer or Architect because of the use of incomplete or unacceptable work by the Contractor, then the Contractor shall reimburse the Engineer and Architect for all additional time and expenses involved.
- B. Maintenance Instructions: The Contractor shall furnish the Owner complete printed and illustrated operating and maintenance instructions covering all units of mechanical equipment, together with parts lists.
- C. Instructions To Owner's Representatives: In addition to any detailed instructions called for, the mechanical Contractor must provide, without expense to the Owner, competent

instructors to train the Owner's representatives who will be in charge of the apparatus and equipment, in the care, adjustment, and operation of all parts on the heating, air conditioning, ventilating, plumbing, fire protection, and automatic temperature control equipment. Instruction dates shall be scheduled at time of final inspection. A written report specifying times, dates, and name of personnel instructed shall be forwarded to the Architect. A minimum of four 8-hour instruction periods shall be provided. The instruction periods will be broken down to shorter periods when requested by the Owner. The total instruction hours shall not be reduced. The ATC Contractor shall provide 4 hours of instructions. The remaining hours shall be divided between the mechanical and sheet metal Contractor.

- D. Guarantee: By the acceptance of any contract award for the work herein described or shown on the drawings, the Contractor assumes the full responsibility imposed by the guarantee as set forth herein and in the General Conditions, and should protect himself through proper guarantees from equipment and special equipment Contractors and from subcontractors as their interests may appear.
- E. The guarantee so assumed by the Contractor and as work of this Section is as follows:
1. That the entire mechanical system, including plumbing, heating, and air-conditioning system shall be quiet in operation.
 2. That the circulation of water shall be complete and even.
 3. That all pipes, conduit, and connections shall be perfectly free from foreign matter and pockets and that all other obstructions to the free passage of air, water, liquid, sewage, and vent shall be removed.
 4. That he shall make promptly and free of charge, upon notice from the Owner, any necessary repairs due to defective workmanship or materials that may occur during a period of one year from date of Substantial Completion.
 5. That all specialties, mechanical, and patent devices incorporated in these systems shall be adjusted in a manner that each shall develop its maximum efficiency in the operation of the system; i.e., diffusers shall deliver the designed amount of air shown on drawings, thermostats shall operate to the specified limits, etc.
 6. All equipment and the complete mechanical, ductwork, piping and plumbing systems shall be guaranteed for a period of one year from the date of the Architect's Certificate of Substantial Completion, this includes all mechanical, ductwork, piping and plumbing equipment and products and is not limited to boiler, chillers, coils, fans, filters etc. Any equipment supplier not willing to comply with this guarantee period shall not submit a bid price for this project. The Contractor shall be responsible for a 100-percent guarantee for the system and all items of equipment for this period. If the contractor needs to provide temporary heating or cooling to the building and or needs to insure systems are installed properly and or to meet the project schedule the guaranteed of all systems and equipment shall be as indicated above, on year from the date of the Architect's Certificate of Substantial Completion.
 7. All filters used during construction shall be replaced just before equipment is turned over to the Owner, and all required equipment and parts shall be oiled. Any worn parts shall also be replaced.
 8. If any systems or equipment is used for temporary heating or cooling the systems shall be protected so they remain clean. I.e. if the ductwork systems are used temporary filters and a filter holder (not duct-taped to ducts or grilles) shall be installed to insure the systems and the equipment remain clean.

1.28 TEST RUN

- A. The Mechanical Contractor shall operate the mechanical system for a minimum of 30 days to prove the operation of the system.

1.29 EQUIPMENT STARTUP AND CHECKOUT:

- A. Each major piece of equipment shall be started and checked out by an authorized representative of the equipment manufacturer. A certificate indicating the equipment is operating to the satisfaction of the manufacturer shall be provided and shall be included in the commissioning report.
- B. This contractor shall coordinate commissioning procedures and activities with the commissioning agent.

1.30 DEMOLITION

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
- B. Proceed with demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
- C. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
- D. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
- E. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
- F. Maintain adequate ventilation when using cutting torches.
- G. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
- H. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
- I. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
- J. Dispose of demolished items and materials promptly.

- K. Return elements of construction and surfaces that are to remain to condition existing before selective demolition operations began.
- L. Existing Facilities: Comply with building manager's requirements for using and protecting elevators, stairs, walkways, loading docks, building entries, and other building facilities during selective demolition operations.
- M. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals, using power-driven saw, then remove concrete between saw cuts.
- N. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.
- O. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.
- P. Air-Conditioning Equipment: Remove equipment without releasing refrigerants.

END OF SECTION

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SECTION 230150 – TEMPORARY USE OF EQUIPMENT AND SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes requirements for temporary use of equipment and systems and any other items that are used during the construction of the project.

1.2 EQUIPMENT OR SYSTEMS NEEDED TO OPERATE BEFORE CONTRACT COMPLETION

- A. If the contractor needs to provide temporary heating or cooling to the building and or needs to insure systems are installed properly for start up and or to meet the project schedule the guaranteed of all systems and equipment shall be for one year from the date of the Architect's Certificate of Substantial Completion.

All equipment and the complete mechanical, ductwork, piping and plumbing systems shall be guaranteed for a period of one year from the date of the Architect's Certificate of Substantial Completion, this includes all mechanical, ductwork, piping and plumbing equipment and products and is not limited to boiler, chillers, coils, fans, filters etc. Any contractor or equipment supplier who is not willing to comply with this guarantee period shall not submit a bid price for this project. The Contractor shall be responsible for a 100-percent guarantee for the systems and all items of equipment for this period.

All filters used during construction shall be replaced just before equipment is turned over to the Owner, and all required equipment and parts shall be oiled. Any worn parts shall also be replaced.

If any systems or equipment is used for temporary heating or cooling the systems shall be protected so they remain clean. I.e. if the ductwork systems are used temporary filters and a filter holder (not duct-taped to ducts or grilles) shall be installed to insure the systems and the equipment remain clean. All return air openings shall be protected with a metal filter frame and filters.

1.3 TEMPORARY EQUIPMENT OR SYSTEM SUBMITTALS

- A. If it is determined by the project or contractor that equipment or systems are needed to operate to provide heating, cooling or other needed services this division shall submit a document indicating what measures will be taken to insure the safe and proper operation of the equipment, systems and personal associated with the operation, this document shall be submitted to the engineer for approval. This plan shall show connections of equipment, utility hookups (if required) staging areas etc.

1.4 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
- C. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.
- D. SMACNA: The latest standard from SSMACNA shall apply.

1.5 PROJECT CONDITIONS

- A. Temporary Use of equipment or systems: Engage installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use until the facility has been accepted by the owner regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters and cooling units if required with individual space thermostatic control.
 - 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 - 2. Heating Units: Listed and labeled for type of fuel being consumed, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
 - 3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filters with MERV of **8** at each return air opening in system and remove at end of construction. These filters are to be installed in a filter housing frame and are not to be duct taped. Clean HVAC system as required in Division 01 Section "Closeout Procedures."

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Locate equipment where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify equipment and systems as required by progress of the Work.
 - 1. Locate equipment to limit site disturbance as specified in Division 01 Section "Summary."

3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
 - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.
- C. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- D. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

3.3 OPERATION, TERMINATION, AND REMOVAL

- A. Maintenance: Maintain equipment and systems in good operating condition until removal.
 - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar equipment and systems on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- B. Termination and Removal: Remove each temporary facility or equipment when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
 - 1. Materials equipment that constitute temporary equipment are property of Contractor.
 - 2. At Substantial Completion, repair, renovate, and clean permanent equipment and systems used during construction period. Comply with final cleaning requirements specified in Division 01 Section "Closeout Procedures."

3.4 EQUIPMENT STARTUP AND CHECKOUT:

- A. Each major piece of equipment shall be started and checked out by an authorized representative of the equipment manufacturer at substantial completion. A certificate indicating the equipment is operating to the satisfaction of the manufacturer shall be provided and shall be included in the commissioning report.

END OF SECTION

SECTION 230500 - COMMON WORK RESULTS FOR HVAC

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. Piping materials and installation instructions common to most piping systems.
 - 2. Transition fittings.
 - 3. Dielectric fittings.
 - 4. Escutcheons.
 - 5. Equipment installation requirements common to equipment sections.
 - 6. Painting and finishing.
 - 7. Supports and anchorages.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, and crawlspaces.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces, mechanical equipment rooms, accessible pipe shafts, accessible plumbing chases, and accessible tunnels.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for plastic materials:
 - 1. CPVC: Chlorinated polyvinyl chloride plastic.
 - 2. PVC: Polyvinyl chloride plastic.
- G. The following are industry abbreviations for rubber materials:
 - 1. EPDM: Ethylene-propylene-diene terpolymer rubber.

2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

- A. Product Data: For the following:
 1. Transition fittings.
 2. Dielectric fittings.
 3. Mechanical sleeve seals.
 4. Escutcheons.
- B. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. 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.
- C. 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.

1.6 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.

1.7 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 set sleeves in poured-in-place concrete and other structural components as they are constructed.

- C. 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."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

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.

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.
 - 2. AWWA C110, rubber, flat face, **1/8 inch** thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, 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 TRANSITION FITTINGS

- A. Plastic-to-Metal Transition Fittings: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
 - 1. Manufacturers:
 - a. Eslon Thermoplastics.
- B. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
 - 1. Manufacturers:
 - a. Thompson Plastics, Inc.

2.5 DIELECTRIC FITTINGS

- A. General: Assembly or fitting with insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.
- B. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld-neck end types and matching piping system materials.
- C. 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**.
- 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 Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
 - 1. Provide separate companion flanges and steel bolts and nuts for **150-** or **300-psig** minimum working pressure as 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; plain, threaded, or grooved ends; and **300-psig** minimum working pressure at **225 deg F**.
 - 1. Manufacturers:
 - a. Capitol Manufacturing Co.

- b. Central Plastics Company.
- c. Watts Industries, Inc.; Water Products Div

2.6 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
 - 1. Finish: Polished chrome-plated and rough brass.
- D. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.
- E. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw or spring clips, and chrome-plated finish.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 23 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.
- 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 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.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - 1. New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
 - c. Insulated Piping: One-piece, stamped-steel type with spring clips.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
 - f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-casting, cast-brass type with polished chrome-plated finish.
 - g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge and set screw.
- M. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
- N. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
- O. Verify final equipment locations for roughing-in.
- P. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 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.

- 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.

3.3 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. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
 - 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. 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. Extend grease fittings to accessible locations.

- D. Install equipment to allow right of way for piping installed at required slope.

3.5 PAINTING

- A. Painting of HVAC systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 5 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.
- C. Field Welding: Comply with AWS D1.1.

END OF SECTION

SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC 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 or shipped separately by equipment manufacturer for field installation.

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.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with requirements in this Section except when the requirements in equipment schedules, other specification sections, drawing notes or in other contract documents are more stringent.
- 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.

- C. Motors **3/4 HP** and larger: Polyphase.
- D. Motors smaller than **3/4 HP**: Single phase.
- E. All motors shall have ASTM Grade 5 hardware that is Yellow Zinc-dichromate plated.

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Rotor: Random-wound, squirrel cage.
- E. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- F. Temperature Rise: Match insulation rating.
- G. Insulation: **Class F**.
- H. 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.
- I. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. 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. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
 - 5. Shaft Grounding Ring: Microfiber type.
 - a. Provide grounded discharge path for VFD induced voltage in the shaft to prevent arcing in the motor bearings.

- C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 Electronically Commutated Motor (ECM)

1. Motor enclosures: Open type
2. Motor to be a DC electronic commutation type motor (ECM).
 - a. AC induction type motors are not acceptable.
3. Permanently lubricated motor with heavy duty ball bearing
4. Internal motor circuitry to convert AC power supplied to the fan to DC power to operate the motor.
5. Speed controllable to 20% of full speed (80% turndown).
 - a. Potentiometer dial mounted at the motor speed controller
 - b. 0-10 VDC signal.
6. 85% efficient at all speeds minimum.
7. Motors smaller than 2.0 hp.

2.6 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.
- B. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- C. Motors **1/20 HP** and Smaller: Shaded-pole type.
- D. 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, unless otherwise indicated.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

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SECTION 230519 - METERS AND GAGES FOR HVAC

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. Liquid-in-glass thermometers.
 - 2. Thermowells.
 - 3. Gage attachments.
 - 4. Test plugs.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of meter and gage, from manufacturer.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 LIQUID-IN-GLASS THERMOMETERS

- A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Palmer Wahl Instrumentation Group.
 - b. Trerice, H. O. Co.

- c. Weiss Instruments, Inc.
 - d. Weksler.
2. Standard: ASME B40.200.
 3. **Case:** Die Cast aluminum or brass; nominal size unless otherwise indicated.
 4. Case Form: **Adjustable angle** type unless otherwise indicated, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.
 5. **Tube:** Glass with magnifying lens and **blue** organic liquid.
 6. Tube Background: Satin faced, nonreflective aluminum with permanently etched scale markings graduated in **deg F**.
 7. Window: **Glass**.
 8. **Stem:** Copper-plated steel, aluminum, stainless steel, or brass designed for thermowell installation. Stem shall be of length to match thermowell insertion length.
 - a. **Design for** Thermowell Installation: Bare stem.
 9. Connector: **1-1/4 inches**, with ASME B1.1 screw threads.
 10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.2 THERMOWELLS

A. Thermowells:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AMETEK, Inc.; U.S. Gauge Div.
 - b. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
 - c. Ernst Gage Co.
 - d. Marsh Bellofram.
 - e. Miljoco Corp.
 - f. NANMAC Corporation.
 - g. Noshok, Inc.
 - h. Palmer - Wahl Instruments Inc.
 - i. REO TEMP Instrument Corporation.
 - j. Tel-Tru Manufacturing Company.
 - k. Trerice, H. O. Co.
 - l. Weiss Instruments, Inc.
 - m. Weksler
 - n. WIKA Instrument Corporation.
 - o. Winters Instruments.
2. Manufacturers: Same as manufacturer of thermometer being used.
3. Standard: ASME B40.200.
4. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
5. **Material for Use with Copper Tubing: Brass.**
6. **Material for Use with Steel Piping: Brass.**

7. Type: Stepped shank unless straight or tapered shank is indicated.
8. External Threads: **NPS 1/2, NPS 3/4, NPS 1 or NPS 1-1/4** ASME B1.20.1 pipe threads.
9. Internal Threads: **1/2, 3/4, and 1 inch** with ASME B1.1 screw threads.
10. Bore: Diameter required to match thermometer bulb or stem.
11. Insertion Length: Length required to match thermometer bulb or stem.
12. Lagging Extension: Include on thermowells for insulated piping and tubing.
13. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

- B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.3 GAGE ATTACHMENTS

- A. Snubbers: ASME B40.100, brass; with ASME B1.20.1 pipe threads. Include extension for use on insulated piping. **NPS 1/4 or NPS 1/2**.
1. **Surge-dampening device: porous-metal**-type.
- B. Siphons:
1. **Loop-shaped section: Brass** pipe with pipe threads. **NPS 1/4 or NPS 1/2**.
- C. Valves:
1. **Needle: Brass**, with **NPS 1/4 or NPS 1/2** ASME B1.20.1 pipe threads.

2.4 TEST PLUGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Flow Design, Inc.
 2. MG Piping Products Co.
 3. National Meter, Inc.
 4. Peterson Equipment Co., Inc.
 5. Sisco Manufacturing Company, Inc.
 6. Trerice, H. O. Co.
 7. Twin City Hose.
 8. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
 9. Welsler.
- B. Description: Test-station fitting made for insertion into piping tee fitting.
- C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.
- D. Thread Size: or , ASME B1.20.1 pipe thread.
- E. Minimum Pressure and Temperature Rating:
- F. Core Inserts: Self-sealing synthetic rubber;
1. EPDM (Nordel) for air, water or glycol operation between **30 and 275 deg F**.

2. CR (Neoprene) for air, water, glycol, oil, or gas operation between **-30 to 200 deg F**.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. **Install thermowells:** with socket extending **one-third of pipe diameter** and in vertical position in piping tees.
- 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. Fill thermowells with heat-transfer medium.
- E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions to most readable position.
- F. Install needle-valve and snubber in piping for each pressure gage for fluids. Exception: Steam.
- G. Install test plugs in piping tees.

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.

3.4 THERMOMETER SCHEDULE

- A. Thermometers at inlet and outlet of each hydronic zone shall be **one of** the following:
 1. **Test plug:** With EPDM self-sealing rubber inserts.
- B. Thermometers at inlet and outlet of each hydronic coil at fan coils, cabinet heaters, unit heaters and reheat coils and as shown on details shall be the following:
 1. **Industrial**-style, liquid-in-glass type.
 2. Test plug with **EPDM** self-sealing rubber inserts.
- C. Thermometer stems shall be of length to match thermowell insertion length.

3.5 THERMOMETER SCALE-RANGE SCHEDULE

- A. Scale Range for Chilled-Water Piping: **0 to 100 deg F** .
- B. Scale Range for Heating, Hot-Water Piping: **30 to 240 deg F** .

END OF SECTION

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SECTION 230523 - GENERAL-DUTY VALVES FOR HVAC 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. Bronze ball valves.
- 2. Iron, single-flange butterfly valves.
- 3. Bronze lift check valves.
- 4. Bronze swing check valves.
- 5. Iron swing check valves.
- 8. Bronze globe valves.
- 9. Iron globe valves.
- 10. Lubricated plug valves.

B. Related Sections:

- 1. Section 230553 "Identification for HVAC Piping and Equipment" for valve tags and schedules.

1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer 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.
- G. SWP: Steam working pressure.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of valve indicated. Body material, valve design, pressure and temperature classification, end connection details, seating materials, trim material and arrangement, dimensions and required clearances, and installation instructions. Include list indicating valve and its application.
- B. Maintenance data for valves to be included in the operation and maintenance data specified in Division 1. Include detailed manufacturer's instructions on adjusting, servicing, disassembling, and repairing.

1.5 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve as listed in SUMMARY from a single source and from a single manufacturer.
- B. Compliance:
 - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 2. ASME B31.1 for power piping valves.
 - 3. ASME B31.9 for building services piping valves.
 - 4. MSS Compliance: Comply with the various MSS Standard Practice documents referenced.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, and weld ends.
 - 3. **Set** angle, and globe valves closed to prevent rattling.
 - 4. Set ball and plug valves open to minimize exposure of functional surfaces.
 - 5. Set butterfly valves closed or slightly open.
 - 6. 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.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to HVAC valve schedule articles for applications of valves.
 - B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
 - C. Valve Sizes: Same as upstream piping unless otherwise indicated.
 - D. Valve Actuator Types:
 - 1. Gear Actuator: For quarter-turn valves NPS 8 and larger.
 - 2. Handwheel: For valves other than quarter-turn types.
 - 3. Handlever: For quarter-turn valves NPS 6 and smaller[**except plug valves**].
 - 4. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every **[5]** **[10]** **<Insert number>** plug valves, for each size square plug-valve head.
 - 5. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.
 - E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
 - 2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
 - 3. Butterfly Valves: With extended neck.
 - F. Valve-End Connections:
 - 1. Flanged: With flanges according to ASME B16.1 for iron valves.
 - 2. Solder Joint: With sockets according to ASME B16.18.
 - a. **Caution:** Where soldered end connections are used, use solder having a melting point below 840 deg. For, globe, and check valves: below 421 deg. F for ball valves.
 - 3. Threaded: With threads according to ASME B1.20.1.
 - G. Valve Bypass and Drain Connections: MSS SP-45.
-
- 2.2 MANUFACTURERS
 - A. Subject to compliance with requirements, provide products by one of the following:
 - 1. APCO Willamette Valve and Primer Corp.
 - 2. Babbitt Steam Specialty Company.
 - 3. Bray Controls.
 - 4. Center Line.
 - 5. Cla-Val Company.
 - 6. Conbraco Industries Inc.

7. Crane Co.; Crane Valve Group.
8. Fisher Valve by Emerson.
9. Flo Fab Inc.
10. Flow-Tek Inc.
11. Grinnell Corporation.
12. Hammond Valve.
13. Jamesbury; a subsidiary of Metso Automation.
14. Jomar International LTD.
15. Keystone Valve USA, Inc.
16. Kitz Corp.
17. Metraflex Company.
18. Milwaukee Valve Company.
19. Mueller Steam Specialty.
20. NIBCO Inc.
21. Red-White Valve Corp.
22. Spence Strainers International.
23. Stockham Valves and Fittings, Inc.
24. Tyco Fire/Shurjoint Piping Products.
25. Tyco/Pentair LTD.
26. Val-Matic Valve & Mfg. Corp.
27. Victaulic Company.
28. Watts Regulator Company.

2.4 BRONZE BALL VALVES

C. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Bronze.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Bronze.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full.

2.5 IRON, SINGLE-FLANGE BUTTERFLY VALVES

A. 150 CWP, Iron, Single-Flange (Lug) Butterfly Valves:

1. Description:
 - a. Standard: MSS SP-67, Type I.
 - b. CWP Rating: 150 psig.

- c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - e. Seat: EPDM.
 - f. Stem: One- or two-piece stainless steel.
 - g. **Disc: Nylon 11 coated ductile iron.**
- B. 175 CWP, Iron, Single-Flange (Lug) Butterfly Valves:
- 1. Description:
 - a. Standard: MSS SP-67, Type I.
 - b. CWP Rating: 175 psig.
 - c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - e. Seat: EPDM.
 - f. Stem: One- or two-piece stainless steel.
 - g. **Disc: Nylon 11 coated ductile iron.**
- C. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and **Nylon 11 coated ductile Iron** Disc:
- 1. Description:
 - a. Standard: MSS SP-67, Type I.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - e. Seat: EPDM.
 - f. Stem: One- or two-piece stainless steel.
 - g. **Disc: Nylon 11 coated ductile iron.**
- D. 250 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and **Nylon 11 coated ductile Iron** Disc:
- 1. Description:
 - a. Standard: MSS SP-67, Type I.
 - b. CWP Rating: 250 psig.
 - c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - e. Seat: EPDM.
 - f. Stem: One- or two-piece stainless steel.
 - g. **Disc: Nylon 11 coated ductile iron.**

2.6 BRONZE LIFT CHECK VALVES

A. Class 125, Lift Check Valve:

- 1. Description:

- a. Standard: MSS SP-80.
- b. CWP Rating: 200 psig.
- c. Body Design: Vertical flow.
- d. Body Material: ASTM B 61, ASTM B 62, bronze.
- e. **Ends: Threaded.**
- f. **Disc: Bronze, Type 1.**

2.7 BRONZE SWING CHECK VALVES

A. Class 150, Bronze Swing Check Valves with Bronze Disc:

1. Description:

- a. Standard: MSS SP-80, Type 3.
- b. CWP Rating: 300 psig.
- c. Body Design: Horizontal flow.
- d. Body Material: ASTM B 62, bronze.
- e. Ends: Threaded.
- f. Disc: Bronze.

2.8 IRON SWING CHECK VALVES

A. Class 125, Iron Swing Check Valves with Metal Seats:

1. Description:

- a. Standard: MSS SP-71, Type I.
- b. **NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.**
- c. Body Design: Clear or full waterway.
- d. Body Material: ASTM A 126, gray iron with bolted bonnet.
- e. Ends: Flanged.
- f. Trim: Bronze.
- g. Gasket: Asbestos free.

2.9 BRONZE GLOBE VALVES

A. Class 150, Bronze Globe Valves with Nonmetallic Disc:

1. Description:

- a. Standard: MSS SP-80, Type 2.
- b. CWP Rating: 300 psig.
- c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
- d. **Ends: Threaded.**
- e. Stem: Bronze.
- f. Disc: PTFE or TFE.
- g. Packing: Teflon impregnated, asbestos free.
- h. **Handwheel: Malleable iron.**

2.10 IRON GLOBE VALVES

A. Class 125, Iron Globe Valves:

1. Description:

- a. Standard: MSS SP-85, Type I.
- b. CWP Rating: 200 psig.
- c. Body Material: ASTM A 126, gray iron with bolted bonnet.
- d. Ends: Flanged.
- e. Stem: Brass alloy. OS &Y.
- f. Disc: Renewable bronze seat.
- g. Trim: Bronze.
- h. Packing and Gasket: Teflon impregnated, asbestos free.
- i. Handwheel: Cast iron

2.11 LUBRICATED PLUG VALVES

A. Class 125, Regular-Gland, Lubricated Plug Valves with Threaded Ends:

1. Description:

- a. Standard: MSS SP-78, Type II.
- b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.**
- c. Pattern: Regular or short.**
- d. Body Material: ASTM A 48 or ASTM A 126, cast iron with lubrication-sealing system.
- e. Plug: Cast iron or bronze with sealant groove.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine piping system for compliance³ with requirements for installation tolerances and other conditions affecting performance of valves. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. 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.
- C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- D. Examine threads on valve and mating pipe for form and cleanliness.
- E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

- F. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

- A. Install valves as indicated, according to manufacturer's written instructions.
- B. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of piping, fittings, and specialties.
- C. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- D. Locate valves for easy access and provide separate support where necessary.
- E. Install valves in horizontal piping with stem at or above center of pipe.
- F. Install valves in position to allow full stem movement.
- G. Install check valves for proper direction of flow and as follows:
 - 1. Swing Check Valves: In horizontal position with hinge pin level.
 - 2. Check Valves: In horizontal or vertical position, between flanges.
 - 3. Lift Check Valves: With stem upright and plumb.
 - 4. Install all check valves a minimum of five pipe diameters downstream of pump discharge or elbow to avoid flow turbulence. In extreme cases add flow straighteners as required to correct the turbulence.

3.3 ADJUSTING

- A. Adjust or replace 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. **Shutoff Service: Ball** or **butterfly** valves.
 - 2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
 - 3. **Throttling Service except Steam: Globe** valves.
 - 4. **Throttling Service, Steam: Globe** valves.
 - 5. Pump-Discharge Check Valves:
 - a. **NPS 2 and Smaller:** Bronze swing check valves with **bronze** disc.
 - b. **NPS 2-1/2 and Larger:** Iron swing check valves with lever and weight or with spring or iron, **metal**-seat check valves.
 - 6. Drain Service (except Steam): Two-Piece, Full Port Bronze Ball Valves with Bronze Trim. To be installed with NPS 3/4 hose thread outlet and hose cap with chain.

- B. 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.
- C. Select valves, except wafer types, with the following end connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
 - 2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - 3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
 - 4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
 - 5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - 6. For Steel Piping, NPS 5 and Larger: Flanged ends.

3.5 HEATING-WATER VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:
 - 1. **Bronze Valves:** May be provided with solder-joint ends instead of threaded ends.
 - 3. Ball Valves:
 - a. **Piece: Two**
 - b. **Port: Full.**
 - c. **Material/Trim: Bronze with:**
 - 1) **Bronze** trim.
 - 4. Bronze Swing Check Valves:
 - a. **Class 150**
 - b. **Bronze** disc.
 - 6. Bronze Globe Valves:
 - a. **Class 125**
 - b. **Bronze** disc.
- B. Pipe NPS 2-1/2 and Larger:
 - 1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
 - 2. Iron, Single-Flange Butterfly Valves, NPS 2-1/2 to NPS 12:
 - a. 200 CWP,
 - b. **Seat: EPDM.**
 - c. **Disc: Ductile-iron.**
 - 3. **Iron Swing Check Valves: Class 125**, metal seats.
 - 4. **Iron Globe Valves: Class 125.**

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SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC 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. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.

B. Related Sections:

1. **Division 05** for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 230516 "Expansion Fittings and Loops for HVAC Piping" for pipe guides and anchors.
3. Section 230548 "Vibration and Seismic Controls for HVAC" for vibration isolation devices.
4. Section 233113 "Metal Ducts" for duct hangers and supports.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Hangers and supports for HVAC 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 equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 ACTION SUBMITTALS

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

- B. Shop Drawings: **Signed and sealed by a qualified professional engineer.** Show fabrication and installation details and include calculations for the following; include Product Data for components:
1. Trapeze pipe hangers.
 2. Metal framing systems.

1.6 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

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. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 5. 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 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

- A. MFMA Manufacturer Metal Framing Systems:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International.
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. ERICO/Michigan Hanger Co. ; ERISTRUT Div.
 - d. FNW/Ferguson Enterprises
 - e. GS Metals Corp.
 - f. Hilti, Inc.insert manufacturer's name.
 - g. Power-Strut Div. Tyco International.
 - h. Thomas & Betts Corporation.
 - i. Tolco Inc.
 - j. Unistrut; an Atkore International company.

2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
3. Standard: MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
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**.
7. Metallic Coating:
 - a. **Electroplated zinc.**

B. Non-MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International; a subsidiary of Mueller Water Products, Inc.
 - b. Empire Industries, Inc.
 - c. ERICO International Corporation.
 - d. FNW/Ferguson Enterprises
 - e. Haydon Corporation.
 - f. NIBCO INC.
 - g. PHD Manufacturing, Inc.
 - h. PHS Industries, Inc.
2. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
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**.
7. Coating:
 - a. **Zinc.**

2.4 THERMAL-HANGER SHIELD INSERTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Carpenter & Paterson, Inc.
 2. Clement Support Services.
 3. ERICO International Corporation.
 4. National Pipe Hanger Corporation.
 5. PHS Industries, Inc.
 6. Pipe Shields Inc.
 7. Piping Technology & Products, Inc.
 8. Rilco Manufacturing Co., Inc.
 9. Value Engineered Products, Inc.

- B. Insulation-Insert Material for Hot Piping:
 - 1. **Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psi** minimum compressive strength.
- 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 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36, carbon-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.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

- A. Comply with SEI/ASCE 7 and with requirements for seismic-restraint devices in Section 230548 "Vibration and Seismic Controls for HVAC."
- B. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- C. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. 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, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- E. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

- F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- 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 lateral bracing with pipe hangers and supports to prevent swaying.
- I. 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. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- L. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating **above** Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - b. Do not exceed pipe stress limits allowed by 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.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
 - 5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
 - 6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 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/D1.1M 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 so contours of welded surfaces match adjacent contours.

3.3 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**.

3.4 PAINTING

- A. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in **Division 09**.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.5 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are 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** and attachments for general service applications.

- F. Use padded hangers for piping that is subject to scratching.
- G. Use thermal-hanger shield inserts for insulated piping and tubing.
- H. 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 up to 1050 deg F, pipes **NPS 4 to NPS 24**, 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 36**, 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. Pipe Hangers (MSS Type 5): For suspension of pipes **NPS 1/2 to NPS 4**, to allow off-center closure for hanger installation before pipe erection.
 - 6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes **NPS 3/4 to NPS 8**.
 - 7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes **NPS 1/2 to NPS 8**.
 - 8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes **NPS 1/2 to NPS 8**.
 - 9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes **NPS 1/2 to NPS 8**.
 - 10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes **NPS 3/8 to NPS 8**.
 - 11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes **NPS 3/8 to NPS 3**.
 - 12. U-Bolts (MSS Type 24): For support of heavy pipes **NPS 1/2 to NPS 30**.
 - 13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 - 14. 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 or carbon-steel plate.
 - 15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes **NPS 4 to NPS 36**, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
 - 16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes **NPS 2-1/2 to NPS 36** if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
 - 17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes **NPS 1 to NPS 30**, from two rods if longitudinal movement caused by expansion and contraction might occur.
 - 18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes **NPS 2-1/2 to NPS 24**, from single rod if horizontal movement caused by expansion and contraction might occur.
 - 19. 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.

20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes **NPS 2 to NPS 24** if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
 21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes **NPS 2 to NPS 30** if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- I. 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 24**.
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers **NPS 3/4 to NPS 24** if longer ends are required for riser clamps.
- J. 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.
- K. 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.
 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.
- L. 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.
 - M. Comply with MSS SP-69 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** instead of building attachments where required in concrete construction.

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SECTION 230548 - VIBRATION AND SEISMIC CONTROLS FOR HVAC

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 SCOPE

- A. Provide engineered vibration isolation and restraint systems in accordance with the requirements of this section including design, engineering, materials, testing, inspections and reports.
- B. Mechanical equipment with moving parts shall be mounted on or suspended from vibration isolators to reduce the transmission of vibration and mechanically transmitted sound to the building structure.
- C. All mechanical equipment, piping and ductwork shall be restrained as required by Federal, State and Local building codes to preserve the integrity of nonstructural building components during **seismic** events to minimize hazards to occupants and reduce property damage.

1.3 SUMMARY

- A. This Section includes the following:
 - 1. Elastomeric isolation pads.
 - 2. Elastomeric isolation mounts.
 - 3. Restrained elastomeric isolation mounts.
 - 4. Open-spring isolators.
 - 5. Housed-spring isolators.
 - 6. Restrained-spring isolators.
 - 7. Housed-restrained-spring isolators.
 - 8. Pipe-riser resilient supports.
 - 9. Resilient pipe guides.
 - 10. Air-spring isolators.
 - 11. Restrained-air-spring isolators.
 - 12. Elastomeric hangers.
 - 13. Spring hangers.
 - 14. Snubbers.
 - 15. Restraint channel bracings.
 - 16. Restraint cables.
 - 17. Seismic-restraint accessories.
 - 18. Mechanical anchor bolts.
 - 19. Adhesive anchor bolts.
 - 20. Vibration isolation equipment bases.
 - 21. Restrained isolation roof-curb rails.

22. Certification of **seismic** restraint designs.
23. Installation supervision.
24. Design of attachment of housekeeping pads.
25. All components requiring IBC compliance and certification.
26. All inspection and test procedures for components requiring IBC compliance.
27. Restraint of all mechanical equipment, pipe and ductwork, within, on, or outdoors of the building and entry of services to the building, up to but not including, the utility connection, is part of this Specification.
28. Seismic certification of equipment

1.4 DEFINITIONS

- A. IBC: International Building Code.
- B. ICC-ES: ICC-Evaluation Service.
- C. ASCE: American Society of Civil Engineers
- D. OSHPD: Office of Statewide Health Planning and Development for the State of California.
- E. Ip: Importance Factor.
- F. ESSENTIAL FACILITIES, (Occupancy Category IV, IBC-2012)
 1. Buildings and other structures that are intended to remain operational in the event of extreme environmental loading from flood, wind, snow or earthquakes.
- G. LIFE SAFETY
 1. All systems involved with fire protection, including sprinkler piping, jockey pumps, fire pumps, control panels, service water supply piping, water tanks, fire dampers, smoke exhaust systems and fire alarm panels.
 2. All mechanical, electrical, plumbing or fire protection systems that support the operation of, or are connected to, emergency power equipment, including all lighting, generators, transfer switches and transformers.
 3. All medical and life support systems.
 4. Hospital heating systems and air conditioning systems for maintaining normal ambient temperature.
 5. Automated supply, exhaust, fresh air and relief air systems on emergency control sequence, including air handlers, duct, dampers, etc., or manually-operated systems used for smoke evacuation, purge or fresh air relief by the fire department.
 6. Heating systems in any facility with Occupancy Category IV, IBC-2009 where the ambient temperature can fall below 32 degrees Fahrenheit.
- H. HIGH HAZARD

1. All gases or fluids that must be contained in a closed system which are flammable or combustible. Any gas that poses a health hazard if released into the environment and vented Fuel Cells.

1.5 REFERENCE CODES AND STANDARDS

- A. Codes and Standards: The following shall apply and conform to good engineering practices unless otherwise directed by the Federal, State or Local authorities having jurisdiction.
 1. IBC
 2. ASCE 7
 3. NFPA 13 (National Fire Protection Association)
 4. IBC 2018 replaces all references to IBC 2006, 2009.
- B. The following guides may be used for supplemental information on typical seismic installation practices. Where a conflict exists between the guides and these construction documents, the construction documents will preside.
 1. FEMA (Federal Emergency Management Agency) manuals 412, Installing Seismic Restraints for Mechanical Equipment and 414, Installing Seismic Restraints for Ductwork and Pipe.
 2. SMACNA (Sheet Metal and Air-conditioning Contractors' National Association) Seismic Restraint Manual Guidelines for Mechanical Systems, 3rd ed.
 3. ASHRAE (American Society for Heating, Refrigerating and Air-conditioning Engineers) A Practical Guide to Seismic Restraint
 4. MSS (Manufacturers Standardization Society of the Valve and Fittings Industry) MSS SP-127, Bracing for Piping Systems, Seismic – Wind – Dynamic, Design, Selection, Application.

1.6 ISOLATOR AND RESTRAINT MANUFACTURER'S RESPONSIBILITIES:

- A. Provide project specific vibration isolation and seismic restraint design prepared by a registered design professional in the state where the project is being constructed, and manufacturer certifications that the components are seismically qualified.
 1. Provide calculations to determine restraint loads resulting from seismic forces as required by IBC, Chapter 16 and ASCE 7, latest editions. Seismic calculations shall be certified by an engineer licensed in the state where the project is being constructed.
- B. Provide installation instructions and shop drawings for all materials supplied under this section of the specifications.
 1. Provide seismic restraint details with specific information relating to the materials, type, size, and locations of anchorages; materials used for bracing; attachment requirements of bracing to structure and component; and locations of transverse and longitudinal sway bracing and rod stiffeners.

2. Provide seismic bracing layout drawings indicating the location of all seismic restraints.
 - a. Each piece of rotating isolated equipment shall be tagged to clearly identify quantity and size of vibration isolators and seismic restraints.
- C. Provide, in writing, the special inspection requirements for all Designated Seismic Systems as indicated in Chapter 17 of the IBC.
- D. Provide training for installation, operation and maintenance of isolation and restraint systems.

1.7 PERFORMANCE REQUIREMENTS

- A. Seismic-Restraint Loading:
 1. Site Class as Defined in the IBC: Per the structural drawings and specifications.
 2. Assigned Occupancy Category as Defined in the IBC: Per the structural drawings and specifications.
 - a. Component Importance Factor: 1.5.
 - 1) Life safety components required to function after an earthquake.
 - 2) Components containing hazardous or flammable materials in quantities that exceed the exempted amounts for an open system listed in Chapter 4.
 - 3) For structures with an Occupancy Category IV, components needed for continued operation of the facility or whose failure could impair the continued operation of the facility.
 - 4) Storage racks in occupancies open to the general public (e.g., warehouse retail stores).
 - b. Component Importance Factor: 1.0.
 - 1) All other components
 - c. Component Response Modification Factor: Per the structural drawings and specifications.
 - d. Component Amplification Factor: Per the structural drawings and specifications.
 3. Design Spectral Response Acceleration at Short Periods: Per the structural drawings and specifications.
 4. Design Spectral Response Acceleration at 1-Second Period: Per the structural drawings and specifications.

1.8 ACTION SUBMITTALS

- A. Product Data: For the following:
 1. Submittals shall include catalog cut sheets and installation instructions for each type of anchor and seismic restraint used on equipment or components being isolated and/or restrained.
 2. Submittals for mountings and hangers incorporating springs shall include spring diameter and free height, rated load, rated deflection, and overload capacity for each vibration isolation device.

3. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
 - a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an **evaluation service member of ICC-ES**.
 - b. Annotate to indicate application of each product submitted and compliance with requirements.
 4. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.
- B. Shop Drawings:
1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
- C. Delegated-Design Submittal: For vibration isolation and seismic-restraint details 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. "Basis for Design" report: Statement from the registered design professional that the design complies with the requirements of the ASCE 7-05 Chapter 13, IBC 2009 chapter 1912 and ACI 318. In addition, the basis for compliance must also be noted, as listed below:
 - a. Project specific design documentation prepared and submitted by a registered design professional (ASCE 7, 13.2.1.1)
 - b. Submittal of the manufacturer's certification that the isolation equipment is seismically qualified by:
 - c. An engineered analysis conforming to the requirements of Chapter 13 of ASCE 7.
 - d. Testing by a nationally recognized testing standard procedure such as ICC-ES AC 156. The substantiated seismic design capacities shall exceed the seismic demands determined by Section 13.3 of ASCE 7.
 - e. Experience data conforming to a nationally recognized procedure. The substantiated seismic design capacities shall exceed the seismic demands determined by Section 13.3 of ASCE 7.
 2. Seismic restraint load ratings must be certified and substantiated by testing or calculations under direct control of a registered professional engineer. Copies of testing and calculations must be submitted as part of submittal documents. OSHPD pre-approved restraint systems are exempt from this requirement if their pre-approval is current and based upon the IBC 2009 (i.e. OPA-07 pre-approval numbers).
 3. Include design calculations and details for selecting vibration isolators, seismic restraints, and vibration isolation bases complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

4. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, **seismic** forces required to select vibration isolators, **seismic** restraints, and for designing vibration isolation bases.
 - a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Division 23 Sections for equipment mounted outdoors.
5. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.
6. Vibration Isolation Base Details: Detail overall dimensions, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.
7. **Seismic**-Restraint Details:
 - a. Design Analysis: To support selection and arrangement of **seismic** restraints. Include calculations of combined tensile and shear loads.
 - b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
 - c. Preapproval and Evaluation Documentation: By **an evaluation service member of ICC-ES**, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.9 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show coordination of seismic bracing for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and seismic restraints.
 1. Submittal drawings and calculations must be stamped by a registered professional engineer in the State where the project is being constructed who is responsible for the seismic restraint design.
 2. Calculations and restraint device submittal drawings shall specify anchor bolt type, embedment, concrete compressive strength, minimum spacing between anchors, and minimum distances of anchors from concrete edges. Concrete anchor locations shall not be near edges, stress joints, or an existing fracture. All bolts shall be ASTM A307 or better.
- B. Qualification Data: For professional engineer and testing agency.
- C. Welding certificates.
- D. Field quality-control test reports.

1.10 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
- B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

1.11 SEISMIC CERTIFICATION OF EQUIPMENT

- A. Component Importance Factor. All plumbing and mechanical components shall be assigned a component importance factor. The component importance factor, I_p , shall be taken as 1.5 if any of the following conditions apply:
 - 1. The component is required to function for life-safety purposes after an earthquake.
 - 2. The component contains hazardous materials.
 - 3. The component is in or attached to an Occupancy Category IV structure and it is needed for continued operation of the facility or its failure could impair the continued operation of the facility.
- B. All other components shall be assigned a component importance factor, I_p , equal to 1.0.
- C. For equipment or components where $I_p = 1.0$.
 - 1. Submit manufacturer's certification that the equipment is seismically qualified by:
 - a. An engineered analysis conforming to the requirements of Chapter 13 of ASCE 7.
 - b. Testing by a nationally recognized testing standard procedure such as ICC-ES AC 156. The substantiated seismic design capacities shall exceed the seismic demands determined by Section 13.3 of ASCE 7.
 - c. Experience data conforming to a nationally recognized procedure. The substantiated seismic design capacities shall exceed the seismic demands determined by Section 13.3 of ASCE 7.

2. The equipment and components listed below are considered rugged and shall not require Special Seismic Certification:
 - a. Valves (not in cast-iron housings, except for ductile cast iron).
 - b. Pneumatic operators.
 - c. Hydraulic operators.
 - d. Motors and motor operators.
 - e. Horizontal and vertical pumps (including vacuum pumps).
 - f. Air compressors
 - g. Refrigerators and freezers.
 - h. Elevator cabs.
 - i. Underground tanks.
 - j. Equipment and components weighing not more than 20 lbs. supported directly on structures (and not mounted on other equipment or components) with supports and attachments in accordance with Chapter 13, ASCE 7.
 3. Rugged equipment and components in this section are for factory assembled discrete equipment and components only and do not apply to site assembled or field assembled equipment or equipment anchorage. The list is based in part on OSHPD Code Application Notice 2-1708A.5.
- D. Special Certification requirements for Designated Seismic Systems (i.e. $I_p = 1.5$): Seismic Certificates of Compliance supplied by manufacturers shall be submitted for all components that are part of Designated Seismic Systems. In accordance with the ASCE 7, certification shall be via one of the following methods:
1. For active mechanical and electrical equipment that must remain operable following the design earthquake:
 - a. Testing as detailed by part C.1.b above.
 - b. Experience data as detailed by part C.1.c above.
 - c. Equipment that is considered "rugged" per part C.2 above.
 2. Components with hazardous contents shall be certified by the manufacturer as maintaining containment following the design earthquake by:
 - a. Testing as detailed by part C.1.b above.
 - b. Experience data as detailed by part C.1.c above.
 - c. Engineering analysis utilizing dynamic characteristics and forces. Tanks (without vibration isolators) designed by a registered design professional in accordance with ASME Boiler and Pressure Vessel Code, and satisfying the force and displacement requirements of Sections 13.3.1 and 13.3.2 of ASCE 7 having an importance factor, $I_p = 1.0$ shall be considered to satisfy the Special Seismic Certification requirements on the basis of ASCE 7 Section 13.6.9.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Amber/Booth Company, Inc.
 2. CalDyn (California Dynamics Corporation).
 3. ISAT (International Seismic Application Technology).
 4. Kinetics Noise Control.
 5. Mason Industries.
 6. Vibro-Acoustics
 7. VMC (Vibration Mountings & Controls, Inc.)
- B. Elastomeric Isolation Pads **P1**:
1. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
 2. Size: Factory or field cut to match requirements of supported equipment.
 3. Pad Material: Oil and water resistant with elastomeric properties.
 4. Surface Pattern: **Ribbed** pattern.
 5. Load-bearing metal plates adhered to pads.
- C. Double-Deflection, Elastomeric Isolation Mounts **M1**:
1. Mounting Plates:
 - a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded, or with threaded studs or bolts.
 - b. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.
 2. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.
- D. Restrained Elastomeric Isolation Mounts **M2**:
1. Description: All-directional isolator with seismic restraints containing two separate and opposing elastomeric elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
 - a. Housing: Cast-ductile iron or welded steel.
 - b. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.
- E. Spring Isolators **S1**: Freestanding, laterally stable, open-spring isolators.
1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 2. Minimum Additional Travel: 50 percent of the required deflection at rated load.

3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch-thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig.
 6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.
- F. Restrained Spring Isolators **S2**: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.
1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch-thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation. Baseplates shall limit floor load to 500 psig.
 2. Restraint: Seismic or limit stop as required for equipment and authorities having jurisdiction.
 3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
- G. Housed Restrained Spring Isolators **S3**: Freestanding, Steel, Open-Spring Isolators with Vertical-Limit Stop Restraint in Two-Part Telescoping Housing:
1. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators. Housings are equipped with **adjustable** snubbers to limit vertical movement.
 - a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
 - b. Threaded top housing with adjustment bolt and cap screw to fasten and level equipment.
 2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 6. Elastomeric pad: For high frequency absorption at the base of the spring.
- H. Elastomeric Hangers **H1**:
1. Description: Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods

- a. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.
 - b. Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.
- I. Spring Hangers **H2**: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.
1. Description: Combination Coil-Spring and Elastomeric-Insert Hanger with spring and Insert in Compression.
 - a. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
 - b. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - c. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - d. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - e. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - f. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
 - g. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.
- J. Spring Hangers with Vertical-Limit Stop **H3**: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.
1. Description: Combination Coil-Spring and Elastomeric-Insert Hanger with spring and insert in Compression and vertical limit stop.
 - a. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
 - b. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - c. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - d. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - e. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - f. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
 - g. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
 - h. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

K. Pipe Riser Resilient Support **R1**:

1. Description: All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch-thick neoprene.
 - a. Vertical-Limit Stops: Steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions.
 - b. Maximum Load Per Support: 500 psig on isolation material providing equal isolation in all directions.

L. Resilient Pipe Guides **R2**:

1. Description: Telescopic arrangement of two steel tubes or post and sleeve arrangement separated by a minimum 1/2-inch-thick neoprene.
 - a. Factory-Set Height Guide with Shear Pin: Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

M. Horizontal Thrust Restraints **T1**: Modified specification S2 isolator.

1. Horizontal thrust restraints shall consist of a modified specification S2 spring mounting. Restraint springs shall have the same deflection as the isolator springs.
2. The assembly shall be preset at the factory and fine tuned in the field to allow for a maximum of 1/4" movement from stop to maximum thrust.
3. The assemblies shall be furnished with rod and angle brackets for attachment to both the equipment and duct work or the equipment and the structure.
4. Restraints shall be attached at the center line of thrust and symmetrically on both sides of the unit.

2.2 SEISMIC-RESTRAINT DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amber/Booth Company, Inc.
2. CalDyn (California Dynamics Corporation).
3. ISAT (International Seismic Application Technology).
4. Kinetics Noise Control.
5. Mason Industries.
6. Vibro-Acoustics
7. VMC (Vibration Mountings & Controls, Inc.)

B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by **an evaluation service member of ICC-ES**.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

C. Snubbers: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.

1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
 2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
 3. Maximum 1/4-inch air gap, and minimum 1/4-inch-thick resilient cushion.
- D. Channel Support System: MFMA-4, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.
- E. Restraint Cables: ASTM A 603 galvanized or ASTM A 492 stainless-steel cables with end connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement. Cables located in exterior or other wet locations such as wash-down areas shall be stainless steel.
- F. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or reinforcing steel angle clamped to hanger rod.
- G. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.
- H. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.
- I. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.
- J. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.
- K. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.
- L. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.
- M. All post installed anchors utilized in the seismic design must be qualified for use in cracked concrete and approved for use with seismic loads.
- N. Expansion anchors shall not be used for anchorage of equipment with motors rated over 10 HP with the exception of undercut expansion anchors. Spring or internally isolated equipment are exempt from this requirement.
- O. All beam clamps utilized for vertical support must also incorporate retention straps.

- P. All seismic brace arm anchorages to include concrete anchors, beam clamps, truss connections, etc., must be approved for use with seismic loads.

2.3 FACTORY FINISHES

- A. Finish: Manufacturer's standard paint applied to factory-assembled and tested equipment before shipping.
 - 1. Powder coating on springs and housings.
 - 2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
 - 3. Baked enamel or powder coat for metal components on isolators for interior use.
 - 4. Color-code or otherwise mark vibration isolation and **seismic** control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and **seismic** control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by **an evaluation service member of ICC-ES** and per the seismic restraint manufacturer's design.
- B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 VIBRATION-CONTROL DEVICE INSTALLATION

- A. Comply with requirements in Division 07 Section "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.

- B. Comply with requirements in Division 23 Section "Hydronic Piping" for piping flexible connections.
- C. Isolate all mechanical equipment 0.75 hp and over per the isolator and seismic restraint schedule and these specifications. Vibration isolators shall be selected in accordance with the equipment, pipe or duct weight distribution so as to produce reasonably uniform deflections
- D. All isolation materials and seismic restraints shall be of the same vendor and shall be selected and certified using published or factory certified data
- E. Installation of all vibration isolation materials, flexible connectors and supplemental equipment bases specified in this section shall be accomplished as per the manufacturer's written instructions with mountings adjusted to level equipment. Any variance or non-compliance with the manufacturer's instructions shall be reviewed and approved in writing by the manufacturer or corrected by the contractor in an approved manner.
- F. Installation of vibration isolators must not cause any change of position of equipment, piping or duct work resulting in stresses or misalignment.
- G. Locate isolation hangers as near to the overhead support structure as possible.
- H. No rigid connections between isolated components and the building structure shall be made that degrades the noise and vibration control system herein specified. "Building" includes, but is not limited to, slabs, beams, columns, studs and walls. "Components" includes, but is not limited to, mechanical equipment, piping and ducts.
- I. Coordinate work with other trades to avoid rigid contact with the building.
- J. Any conflicts with other trades which will result in rigid contact with equipment or piping due to inadequate space or other unforeseen conditions should be brought to the architects/engineers attention prior to installation. Corrective work necessitated by conflicts after installation shall be at the responsible contractor's expense.
- K. Bring to the architects/engineers attention any discrepancies between the specifications and the field conditions or changes required due to specific equipment selection, prior to installation. Corrective work necessitated by discrepancies after installation shall be at the responsible contractor's expense.
- L. Correct, at no additional cost, all installations which are deemed defective in workmanship and materials at the contractor's expense.
- M. Use horizontal thrust restraints **T1** to protect Air handling equipment and centrifugal fans against excessive displacement which results from high air thrust when thrust forces exceed 10% of the equipment weight.
- N. On completion of installation of all isolation materials and before startup of isolated equipment all debris shall be cleared from areas surrounding and from beneath all isolated equipment, leaving equipment free to move on the isolation supports.
- O. All floor mounted isolated equipment shall be protected with specification M1, M2, S1, S2 or S3 isolator.

- P. Horizontal Pipe Isolation: All HVAC pumped water, pumped condensate, glycol, and refrigerant piping size 1-1/4" and larger within mechanical rooms shall be isolated. Outside equipment rooms this piping shall be isolated for the greater of 50' or 100 pipe diameters from rotating equipment. For the first three (3) support locations from externally isolated equipment provide specification H2 or H3 hangers or specification S1, S2 or S3 mounts with the same deflection as equipment isolators (max 2"). All other piping within the equipment rooms shall be isolated with the same specification isolators with a 3/4" minimum deflection. Steam piping size 1-1/4" and larger which is within an equipment room and connected to rotating equipment shall be isolated for three (3) support locations from the equipment. Provide specification H2 or H3 hangers, or specification S1 or S2 mounts with the same deflection as equipment isolators but a minimum of 3/4".
- Q. Duct Isolation: Isolate all duct work with a static pressure 2" W.C. and over in equipment rooms and to minimum of 50 feet from the fan or air handler. Use specification type H2 or H3 hangers or type S1 or S2 floor mounts.

3.4 SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Equipment Restraints:

1. On projects with Seismic Site Class A or B, seismic design or restraint is not required.
2. On projects with Seismic Design Category C: Components with an importance factor of 1.0 do not require seismic design or restraint.
3. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
4. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
5. Install seismic-restraint devices using methods approved by **an evaluation service member of ICC-ES** providing required submittals for component.
6. Suspended Equipment: All suspended equipment that meets any of the following conditions requires seismic restraints as specified by the supplier:
 - a. Rigidly attached to pipe or duct that is 75 lbs. and greater,
 - b. Items greater than 20 lbs and distribution systems weighing more than 5 lbs/lineal foot, with an importance factor of 1.0 hung independently or with flexible connections.
 - c. Possibility of consequential damage.
 - d. For importance factors greater than 1.0 all suspended equipment requires seismic restraint regardless of the above notes.
 - e. Wall mounted equipment weighing more than 20 lbs.
 - f. Exemptions:
 - 1) Equipment weighing less than 20 lbs and distribution systems weighing less than 5 lbs/lineal foot, with an $I_p = 1.0$ and where flexible

connections exist between the component and associated ductwork, piping or conduit.

7. Base Mounted Equipment: All base mounted equipment that meets any of the following conditions requires attachments and seismic restraints as specified by the supplier:
 - a. Connections to or containing hazardous material,
 - b. With an overturning moment.
 - c. Weight greater than 400 lbs.
 - d. Mounted on a stand 4 ft. or more from the floor
 - e. Possibility of consequential damage.
 - f. For importance factors greater than 1.0 all base mounted items require seismic restraints regardless of the above notes.
 - g. For equipment with high center of gravity additional cable restraints shall be furnished, as required by isolation manufacturer, to limit forces and motion caused by rocking.
 - h. Exemptions:
 - 1) Floor or curb-mounted equipment weighing less than 400 lbs and not resiliently mounted, where the Importance Factor, $I_p = 1.0$, the components are mounted at 4 feet or less above a floor level, flexible connections between the components and associated duct work, piping and conduit are provided and there is no possibility of consequential damage.
8. Roof Mounted Equipment:
 - a. To be installed on a structural frame, seismically rated roof curb, or structural curb frame mechanically connected to the structure. Items shall not be mounted onto sleepers or pads that are not mechanically and rigidly attached to the structure. Restraint must be adequate to resist both seismic and wind forces.
 - b. Roof curbs shall be installed directly to building structural steel or concrete roof deck and not to top of steel deck or roofing material.
 - c. Exemptions:
 - 1) Curb-mounted mushroom, exhaust and vent fans with curb area less than nine square feet are excluded.
9. Rigid Mounted Equipment:
 - a. Anchor floor and wall mounted equipment to the structure as per the stamped seismic certifications / drawings.
 - b. For equipment with high center of gravity additional cable restraints shall be furnished, as required by isolation manufacturer, to limit forces and motion caused by rocking.
 - c. Suspended equipment shall be restrained using seismic cable restraints, or struts, and hanger rods as per the stamped seismic certifications / drawings.
10. Vibration Isolated Equipment:
 - a. Seismic control shall not compromise the performance of noise control, vibration isolation or fire stopping systems.

- b. Equipment supported by vibration-isolation hangers shall be detailed and installed with approximately a 1/8" gap between the isolation hangers and the structure. Isolators at restraint locations must be fitted with uplift limit stops.
- B. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
- C. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
- D. Install seismic-restraint devices using methods approved by **an evaluation service member of ICC-ES** providing required submittals for component.
- E. Installation and adjustment of all seismic restraints specified in this section shall be accomplished as per the manufacturer's written instructions. Any deviation from the manufacturer's instructions shall be reviewed and approved by the manufacturer.
- F. Piping Restraints:
 1. Comply with requirements in MSS SP-127.
 4. Seismically restrain piping, with an $l_p = 1.0$, located in boiler rooms, mechanical equipment rooms and refrigeration equipment rooms that is 1¼" I.D. and larger.
 5. Seismically restrain all other $l_p = 1.0$ piping 2½" diameter and larger.
 6. Seismically restrain all $l_p = 1.5$ piping larger than 1" diameter.
 7. Branch lines may not be used to brace main lines.
 8. Exemptions:
 - a. All high deformability pipe 3" or less in diameter suspended by individual hanger rods where $l_p = 1.0$.
 - b. High deformability pipe or conduit in Seismic Design Category C, 2" or less in diameter suspended by individual hanger rods where $l_p = 1.5$.
 - c. High deformability pipe in Seismic Design Category D, E or F, 1" or less in diameter suspended by individual hanger rods where $l_p = 1.5$.
 - d. All clevis supported pipe runs installed less than 12" from the top of the pipe to the underside of the support point and trapeze supported pipe suspended by hanger rods having a distance less than 12" in length from the underside of the pipe support to the support point of the structure.
 - e. Piping systems, including their supports, designed and constructed in accordance with ASME B31.
 - f. Piping systems, including their supports, designed and constructed in accordance with NFPA, provided they meet the force and displacement requirements of Section 13.3.1 and 13.3.2 (ASCE 7).
- G. Install flexible metal hose loops in piping which crosses building seismic joints, sized for the anticipated amount of movement.
- H. Install flexible piping connectors where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment.

- I. Where pipe sizes reduce below dimensions required for seismic, the final restraint shall be installed at the transition location.
- J. Restraint Spacing For Piping: Sizes shown are maximum. Actual spacing determined by calculation.
 - 1. For non-ductile piping (e.g., cast iron, PVC) space transverse supports a maximum of 20' o.c., and longitudinal supports a maximum of 40' o.c.
 - 2. For piping with hazardous material inside (e.g., natural gas, medical gas) space Transverse supports a maximum of 20' o.c., and longitudinal supports a maximum of 40' o.c.
 - 3. For pipe risers, restrain the piping at floor penetrations using the same spacing requirements as above.
 - 4. For all other ductile piping see Table "A" below
- K. Seismic Restraint of Ductwork: Seismically restrain per specific code requirements, all ductwork listed below (unless otherwise indicated on the drawings), using seismic cable restraints: (Ductwork not meeting criteria listed below is to be "Exempt")
 - 1. Restrain rectangular ductwork with cross sectional area of 6 square feet or larger. Duct with and an importance factor of 1.5 must be braced with no exceptions regardless of size or distance requirements.
 - 2. Restrain round ducts with diameters of 28" or larger. Duct with an importance factor of 1.5 must be braced with no exceptions regardless of size or distance requirements.
 - 3. Restrain flat oval ducts the same as rectangular ducts of the same nominal size.
 - 4. Duct must be reinforced at the restraint locations. Reinforcement shall consist of an additional angle on top of the ductwork that is attached to the support hanger rods. Ductwork is to be attached to both upper angle and lower trapeze. Additional reinforcing is not required if duct sections are mechanically fastened together with frame bolts and positively fastened to the duct support suspension system.
 - 5. A group of ducts may be combined in a larger frame so that the combined weights and dimensions of the ducts are less than or equal to the maximum weight and dimensions of the duct for which bracing details are selected.
 - 6. Walls, including gypsum board non-bearing partitions, which have ducts running through them, may replace a typical transverse brace. Provide channel framing around ducts and solid blocking between the duct and frame.
 - 7. If ducts are supported by angles, channels or struts, ducts shall be fastened to it at seismic brace locations in lieu of duct reinforcement.
 - 8. All ductwork weighing more than 17 lb/ft.
 - 9. Exemptions:
 - a. Duct runs supported at locations by two rods less than 12 inches in length from the structural support to the structural connection to the ductwork. This exemption does not apply to ducts with an importance factor of 1.5.
 - 10. See Table "A" below for restraint spacing.
- L. Exemptions do not apply for:
 - 1. Life Safety or High Hazard Components

- a. Including gas, fire protection, medical gas, fuel oil and compressed air needed for the continued operation of the facility or whose failure could impair the facility's continued operation, Occupancy Category IV, IBC-2009 as listed in Section 1.3 B regardless of governing code for HVAC, Plumbing, Electrical piping or equipment. (A partial list is illustrated.) High Hazard is additionally classified as any system handling flammable, combustible or toxic material. Typical systems not excluded are additionally listed below.
- 2. Piping
 - a. Fuel oil, gasoline, natural gas, medical gas, steam, compressed air or any piping containing hazardous, flammable, combustible, toxic or corrosive materials. Fire protection standpipe, risers and mains. Fire Sprinkler Branch Lines must be end tied.
- 3. Duct
 - a. Smoke evacuation duct or fresh air make up connected to emergency system, emergency generator exhaust, boiler breeching or as used by the fire department on manual override.
- 4. Equipment
 - a. Previously excluded non life safety duct mounted systems such as fans, variable air volume boxes, heat exchangers and humidifiers having a weight greater than 75 lbs require independent seismic bracing.

M. Spacing Chart For Suspended Components:

Table "A" Seismic Bracing (Maximum Allowable Spacing Shown- Actual Spacing to Be Determined by Calculation)			
Equipment	On Center Transverse	On Center Longitudi- nal	Change Of Direction
Duct			
All Sizes	30 Feet	60 Feet	4 Feet
Pipe Threaded, Welded, Soldered Or Grooved			
To 16"	40 Feet	80 Feet	4 Feet
18" – 28"	30 Feet	60 Feet	4 Feet
30" – 40"	20 Feet	60 Feet	4 Feet
42" & Larger	10 Feet	30 Feet	4 Feet

- N. Roof mounted duct is to be installed on sleepers or frames mechanically connected to the building structure. Roof anchors and seismic cables or frames shall be used to resist seismic and wind loading. Wind loading factors shall be determined by the registered design professional.
- O. Where duct sizes reduce below dimensions required for seismic restraint the final restraint shall be installed at the transition location.
- P. Install cables so they do not bend across edges of adjacent equipment or building structure.

- Q. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- R. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- S. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- T. Seismically Rated Beam Clamps are required where welding to or penetrations to steel beams are not approved.
- U. Drilled-in Anchors:
 - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 - 4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in 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.
 - 5. Set anchors to manufacturer's recommended torque, using a torque wrench.
 - 6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.5 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Division 23 Section "Hydronic Piping" for piping flexible connections.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.

1. A representative of the vibration isolation system manufacturer shall review the project installation and provide documentation indicating conformance to vibration isolation design intent
- C. Remove and replace malfunctioning units and retest as specified above.
- D. Prepare test and inspection reports.
 1. The installing contractor shall submit a report upon request to the building architect and/or engineer, including the manufacturer's representative's final report, indicating that all seismic restraint material has been properly installed, or steps that are to be taken by the contractor to properly complete the seismic restraint work as per the specifications.

3.7 ADJUSTING

- A. Adjust isolators after piping system is at operating weight.
- B. Adjust leveling devices as required to distribute loading uniformly on isolators. Shim units as required where leveling devices cannot be used to distribute loading properly.
 1. Adjust active height of spring isolators.
- C. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
- D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION

SECTION 230550 - OPERATION AND MAINTENANCE OF HVAC SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. All pertinent sections of Division 21, 22, & 23 Mechanical General Requirements, are part of the work of this Section. Division 1 is part of this and all other sections of these specifications.
 - 1. Testing and Balancing is specified in section 230594.
 - 2. Training and Instructions to Owner's Representative is specified in section 230100.

1.2 SCOPE OF WORK

- A. Submission of Operating and Maintenance Manuals complete with Balancing reports. (Coordinate with Division 1).
- B. Coordination of work required for system commissioning.
- C. Provide a hard copy and an electronic copy on CD of the O and M manual fully searchable in PDF format.**

1.3 SUBMITTALS

- A. Submit product data in accordance with Division 1 and Section 230100. Submit the following:
 - 1. Sample of O and M manual outline.
 - 2. Hard copy and an electronic copy on CD of the O and M manual fully searchable in PDF format. Both the hard copy and the electronic copy are to be fully indexed. The electronic copy shall also have a linked index.

PART 2 - PRODUCTS

2.1 O & M MANUALS

- A. The operating and maintenance manuals shall be as follows:
 - 1. Binders shall be red buckram with easy-view metal for size 8-1/2 x 11-inch sheets, with capacity expandable from 2 inches to 3-1/2 inches as required for the project. Construction shall be rivet-through with library corners. No. 12 backbone and lining shall be the same material as the cover. The front cover and backbone shall be foil-stamped in white as follows: (coordinate with **Division 01**)

OPERATING AND MAINTENANCE

MANUAL
FOR THE

(INSERT PROJECT NAME)

(INSERT PROJECT COMPLETION YEAR)

VOLUME No. ()

VAN BOERUM & FRANK ASSOCIATES, INC.
MECHANICAL ENGINEER

(INSERT ARCHITECT)

PART 3 - EXECUTION

3.1 OPERATING AND MAINTENANCE MANUALS:

- A. Work under this section shall be performed in concert with the contractor performing the system testing and balancing. Six (6) copies of the manuals shall be furnished to the Architect for distribution to the owner.
- B. The "Start-Up and Operation" section is one of the most important in the manual. Information in this section shall be complete and accurately written and shall be verified with the actual equipment on the job, such as switches, starters, relays, automatic controls, etc. A step-by-step start-up procedure shall be described.
- C. The manuals shall include air and water-balancing reports, system commissioning procedures, start-up tests and reports, equipment and system performance test reports, warranties, and certificates of training given to the owner's representatives.

An index sheet typed on AICO Gold-Line indexes shall be provided in the front of the binder. The manual shall include the following:

SYSTEM DESCRIPTIONS

START-UP PROCEDURE AND OPERATION OF SYSTEM

MAINTENANCE AND LUBRICATION TABLE

OPERATION AND MAINTENANCE BULLETINS

AUTOMATIC TEMPERATURE CONTROL DESCRIPTION OF OPERATION, INTERLOCK AND CONTROL DIAGRAMS, AND CONTROL PANELS.

AIR AND WATER SYSTEM BALANCING REPORTS

EQUIPMENT WARRANTIES AND TRAINING CERTIFICATES

SYSTEM COMMISSIONING REPORTS

EQUIPMENT START-UP CERTIFICATES

END OF SECTION

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SECTION 230553 - IDENTIFICATION FOR HVAC 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. Danger, Warning and Caution signs and labels.
3. Pipe labels.
4. Duct labels.
5. Stencils.
6. Valve tags.
7. Danger tags.
8. Warning tags.
9. Caution tags.
10. Ceiling grid.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- C. Valve numbering scheme.
- D. Valve Schedules: For each piping system to include in maintenance manuals.

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.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Minimum Thickness, predrilled or stamped holes for attachment hardware:
 - a. **Brass, 0.032-inch .**
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;
 - a. **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, and having predrilled holes for attachment hardware, **1/16 inch** thick.
2. Letter Color:
 - a. **Black.**
3. Background Color:
 - a. **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**.
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;
 - a. **Rivets or self-tapping screws**
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. 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.

D. 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 DANGER, WARNING AND CAUTION SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, having predrilled holes for attachment hardware; **1/16 inch** thick.
- B. Danger signs, colors:
 - 1. Letter Color:
 - a. **White.**
 - 2. Background Color:
 - a. **Red.**
- C. Warning signs, colors:
 - 1. Letter Color:
 - a. **Black.**
 - 2. Background Color:
 - a. **Orange.**
- D. Caution signs, colors:
 - 1. Letter Color:
 - a. **Black.**
 - 2. Background Color:
 - a. **Yellow.**
- E. Maximum Temperature: Able to withstand temperatures up to **160 deg F.**
- F. Minimum Label Size: Length and width vary for required label content, but not less **than 2-1/2 by 3/4 inch.**
- G. 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.
- H. Fasteners: Stainless-steel;
 - 1. Rivets or self-tapping screws
 - 2. Rivets.
- I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- J. 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.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to **partially cover** circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

- D. 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, having predrilled holes for attachment hardware; **1/16 inch** thick.
- B. Letter Color:
1. White.
- C. Background Color:
1. Black.
- 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;
1. Rivets or self-tapping screws
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. 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:
a. Aluminum .

2. Stencil Paint:
 - a. Exterior, gloss, **alkyd enamel** black unless otherwise indicated.
 - b. Paint may be in pressurized spray-can form.
3. Identification Paint:
 - a. Exterior, **alkyd 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, predrilled or stamped holes for attachment hardware, minimum thickness:
 - a. **Brass, 0.032-inch**
 2. Fasteners: Brass;
 - a. **Wire-link or beaded chain; or S-hook**
- B. Valve Schedules:
 1. For each piping system, on **8-1/2-by-11-inch** bond paper, tabulate:
 - a. Valve number.
 - b. Piping system.
 - c. System abbreviation (as shown on valve tag).
 - d. Location of valve (room or space).
 - e. Normal-operating position (open, closed, or modulating).
 - f. Variations for identification.
 - g. Mark valves for emergency shutoff and similar special uses.
 2. Valve-tag schedule:
 - a. Shall be included in operation and maintenance data.

2.7 DANGER TAGS

- A. Danger Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
 1. Size:
 - a. **3 by 5-1/4 inches minimum**
 2. Fasteners:
 - a. **Brass grommet and wire.**
 3. Nomenclature: Large-size primary caption such as "DANGER," and "DO NOT OPERATE."
 4. Color: Red background with white lettering.

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:
 - a. **3 by 5-1/4 inches minimum**
2. Fasteners:
 - a. **Brass grommet and wire.**
3. Nomenclature: Large-size primary caption such as "WARNING" and "DO NOT OPERATE."
4. Color: Yellow background with black lettering.

2.9 CAUTION TAGS

- A. Caution Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
 1. Size:
 - a. **3 by 5-1/4 inches minimum**
 2. Fasteners:
 - a. **Brass grommet and wire.**
 3. Nomenclature: Large-size primary caption such as "CAUTION," and "DO NOT OPERATE."
 4. Color: Orange background with black lettering.

2.10 CEILING GRID

- A. Provide red lettering on the ceiling tile grid of the locations of all fire dampers, smoke dampers and fire/smoke dampers. Size of lettering and verbiage is to conform to IBC and NFPA standards.
- B. Provide valve identification for all HVAC valves located above the ceiling on the ceiling grid below the valve.
- C. Provide VAV box identification for all VAV boxes located above the ceiling on the ceiling grid below the VAV box.

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. Piping Color-Coding: Painting of piping is specified in **Division 09**.
- B. Stenciled Pipe Label Option:
 - 1. Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option.
 - 2. Install stenciled pipe labels **with painted, color-coded bands or rectangles** on each piping system.
 - a. Identification Paint: Use for contrasting background.
 - b. Stencil Paint: Use for pipe marking.
- C. 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 **50 feet** along each run. Reduce intervals to **25 feet** in areas of congested piping and equipment.
 - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- D. Pipe Label Color Schedule: (See Drawing Schedules)

3.4 DUCT LABEL INSTALLATION

- A. Install **plastic-laminated** duct labels with permanent adhesive on air ducts in the following color codes:
 - 1. **Blue** : For cold-air supply ducts.
 - 2. **Yellow** : For hot-air supply ducts.
 - 3. **Green** : For exhaust-, outside-, relief-, return-, and mixed-air ducts.
 - 4. ASME A13.1 Colors and Designs: For hazardous material exhaust.
- B. 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.

3.5 VALVE-TAG INSTALLATION (See Drawing Schedules.)

- 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 HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

3.6 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

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. Balancing Air Systems:
 - a. Constant-volume air systems.
 - b. Variable-air-volume systems.
 - 2. Balancing Hydronic Piping Systems:
 - a. Variable-flow hydronic systems.
 - 3. Various HVAC Equipment.
 - a. Heat Transfer Coils.
 - 4. Existing Systems.
 - 5. Domestic Heater Systems.

1.3 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. NEBB: National Environmental Balancing Bureau.
- C. TAB: Testing, adjusting, and balancing.
- D. TABB: Testing, Adjusting, and Balancing Bureau.
- E. TAB Specialist: An entity engaged to perform TAB Work.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Within the following number of days of the Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article;
 - 1. **30 days.**

- B. Certified TAB reports.
- C. 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.

1.5 QUALITY ASSURANCE

- A. TAB Contractor Qualifications: Engage a TAB entity certified by **AABC** or **NEBB**.
 - 1. TAB Field Supervisor: Employee of the TAB contractor and certified by **AABC** or **NEBB** and shall be the same as the TAB Contractor.
 - 2. TAB Technician: Employee of the TAB contractor and who is certified by **AABC** or **NEBB** as a TAB technician and shall be the same as the TAB Contractor.
- B. Certify TAB field data reports and perform the following:
 - 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
 - 2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.
- C. TAB Report Forms: Use standard TAB contractor's forms approved by:
 - 1. **Architect**.
- D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

1.6 PROJECT CONDITIONS

- A. 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.

1.7 COORDINATION

- A. Notice: Provide [**seven**] days' advance notice for each test. Include scheduled test dates and times.
- B. Perform TAB after leakage and pressure tests on the following distribution systems have been satisfactorily completed:
 - 1. **Air**.
 - 2. **Water**.
 - 3. **Air and water**.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 TAB SPECIALISTS

A. Subject to compliance with requirements, **engage one of the following:**

1. Bonneville Test and Balance
2. BTC Service.
3. Certified Test & Balance.
4. Diamond Test & Balance.
5. RS Analysis.
6. Test & Balance Inc.
7. Payson Sheetmetal.
8. QT&B Inc.

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 systems for installed 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 accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine:
 1. Ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in:
 - a. **Section 233113 "Metal Ducts"**
 2. Verify ceiling plenums and underfloor air plenums used for supply, return or relief air are properly separated from adjacent areas.
 3. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
- F. 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.

- G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- H. Examine test reports specified in individual system and equipment Sections.
- I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.
- K. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.
- L. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.
- M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- N. Examine system pumps to ensure absence of entrained air in the suction piping.
- O. Examine operating safety interlocks and controls on HVAC equipment.
- P. 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 strategies and step-by-step procedures.
- B. Complete system-readiness checks and prepare reports. Verify the following:
 - 1. Permanent electrical-power wiring is complete.
 - 2. Hydronic systems are filled, clean, and free of air.
 - 3. Automatic temperature-control systems are operational.
 - 4. Equipment and duct access doors are securely closed.
 - 5. Balance, smoke, and fire dampers are open.
 - 6. Isolating and balancing valves are open and control valves are operational.
 - 7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
 - 8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.4 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in this section and:
 - 1. **AABC's "National Standards for Total System Balance"**
- B. 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, patch probe holes in ducts with same material and thickness as used to construct ducts.
 - 2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation," Section 230716 "HVAC Equipment Insulation," and Section 230719 "HVAC Piping Insulation."
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in **inch-pound (IP)** .

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. Crosscheck 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 233113 "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. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
 2. Measure fan static pressures as follows to determine actual static pressure:
 - a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
 - b. Measure static pressure directly at the fan outlet or through the flexible connection.
 - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
 - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
 3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
 - a. Report the cleanliness status of filters and the time static pressures are measured.
 4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
 5. 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.
 6. Obtain approval from one of the following entities 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:
 - a. **Architect .**
 7. 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 will occur. 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 within specified tolerances.
1. Measure airflow of submain and branch ducts.

- a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
 2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
 3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- C. Measure air outlets and inlets without making adjustments.
 1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
- D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.
 1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
 2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.7 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

- A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a minimum set-point airflow with the remainder at maximum-airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced-airflow terminal units so they are distributed evenly among the branch ducts.
- B. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
 1. Set outdoor-air dampers at minimum, and set return- and exhaust-air dampers at a position that simulates full-cooling load.
 2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
 3. Measure total system airflow. Adjust to within indicated airflow.
 4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.
 5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow the same as described for constant-volume air systems.

- a. If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.
 6. Remeasure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.
 7. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure that adequate static pressure is maintained at the most critical unit.
 8. Record final fan-performance data.
- C. Pressure-Dependent, Variable-Air-Volume Systems without Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
1. Balance variable-air-volume systems the same as described for constant-volume air systems.
 2. Set terminal units and supply fan at full-airflow condition.
 3. Adjust inlet dampers of each terminal unit to indicated airflow and verify operation of the static-pressure controller. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.
 4. Readjust fan airflow for final maximum readings.
 5. Measure operating static pressure at the sensor that controls the supply fan if one is installed, and verify operation of the static-pressure controller.
 6. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow the same 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.
 7. Measure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.
- D. Pressure-Dependent, Variable-Air-Volume Systems with Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
1. Set system at maximum indicated airflow by setting the required number of terminal units at minimum airflow. Select the reduced-airflow terminal units so they are distributed evenly among the branch ducts.
 2. Adjust supply fan to maximum indicated airflow with the variable-airflow controller set at maximum airflow.
 3. Set terminal units at full-airflow condition.
 4. Adjust terminal units starting at the supply-fan end of the system and continuing progressively to the end of the system. Adjust inlet dampers of each terminal unit to indicated airflow. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.
 5. Adjust terminal units for minimum airflow.
 6. Measure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.

3.8 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. Prepare test reports with pertinent design data, and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against the approved pump flow rate. Correct variations that exceed plus or minus 5 percent.
- B. Prepare schematic diagrams of systems' "as-built" piping layouts.
- C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:
 - 1. Open all manual valves for maximum flow.
 - 2. Check liquid level in expansion tank.
 - 3. Check makeup water-station pressure gage for adequate pressure for highest vent.
 - 4. Check flow-control valves for specified sequence of operation, and set at indicated flow.
 - 5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
 - 6. Set system controls so automatic valves are wide open to heat exchangers.
 - 7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
 - 8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

3.9 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

- A. Measure water flow at pumps. Use the following procedures except for positive-displacement pumps:
 - 1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
 - a. If impeller sizes must be adjusted to achieve pump performance, obtain approval from the following entity and comply with requirements in Section 232123 "Hydronic Pumps." :
 - 1) [Architect] .**
 - 2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.
 - a. Monitor motor performance during procedures and do not operate motors in overload conditions.
 - 3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump

- motor. Report conditions where actual amperage exceeds motor nameplate amperage.
4. Report flow rates that are not within plus or minus 10 percent of design.
- B. Measure flow at all automatic flow control valves to verify that valves are functioning as designed.
- C. Measure flow at all pressure-independent characterized control valves, with valves in fully open position, to verify that valves are functioning as designed.
- D. Set calibrated balancing valves, if installed, at calculated presettings.
- E. Measure flow at all stations and adjust, where necessary, to obtain first balance.
1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.
- F. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.
- G. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:
1. Determine the balancing station with the highest percentage over indicated flow.
 2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
 3. Record settings and mark balancing devices.
- H. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.
- I. Measure the differential-pressure-control-valve settings existing at the conclusion of balancing.
- J. Check settings and operation of each safety valve. Record settings.
- 3.10 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS
- A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.
- 3.11 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. Efficiency rating.
 5. Nameplate and measured voltage, each phase.
 6. Nameplate and measured amperage, each phase.
 7. Starter thermal-protection-element rating.
- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.
1. Refrigerant suction pressure and temperature.

3.12 TOLERANCES

- A. Set HVAC system's air flow rates and water flow rates within the following tolerances:
1. Supply, Return, and Exhaust Fans and Equipment with Fans: **Plus or minus 10 percent** .
 2. Air Outlets and Inlets: **Plus or minus 10 percent** .
 3. Heating-Water Flow Rate: **Plus or minus 10 percent** .
 4. Cooling-Water Flow Rate: **Plus or minus 10 percent** .

3.13 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 progress reports on the following interval 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;
1. **Weekly.**

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.
- B. Final Report Contents: In addition to certified field-report data, include the following:
1. Pump curves.

2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. 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 contractor.
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.
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 and steam 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. 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.
 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.
 - 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. 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 air flow rate in cfm.
 - h. Indicated velocity in fpm.
 - i. Actual air flow rate in cfm.
 - j. Actual average velocity in fpm.
 - k. Barometric pressure in psig.
- G. 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. Air flow rate in cfm.
 - b. Air velocity in fpm.
 - c. Preliminary air flow rate as needed in cfm.
 - d. Preliminary velocity as needed in fpm.
 - e. Final air flow rate in cfm.
 - f. Final velocity in fpm.
 - g. Space temperature in deg F.
- H. 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. Air flow 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.
- I. Instrument Calibration Reports:
1. Report Data:
 - a. Instrument type and make.
 - b. Serial number.
 - c. Application.
 - d. Dates of use.
 - e. Dates of calibration.

3.15 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
2. Check the following for each system:
 - a. Measure airflow of at least **10** percent of air outlets.
 - b. Measure water flow of at least **5** percent of terminals.
 - c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
 - d. Verify that balancing devices are marked with final balance position.
 - e. Note deviations from the Contract Documents in the final report.

B. Final Inspection:

1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by:
 - a. **Architect**.
2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of:
 - a. Architect.
3. The following entity 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:
 - a. **Architect**.
4. 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."
5. 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.

C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

1. 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 contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.

D. 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

SECTION 230713 - DUCT INSULATION

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 insulating the following duct services:
 - 1. Indoor, concealed supply and return.
- B. Related Sections:
 - 1. Section 230716 "HVAC Equipment Insulation."
 - 2. Section 230719 "HVAC Piping Insulation."
 - 3. Section 233113 "Metal Ducts" for duct liners.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
 - 3. Detail application of field-applied jackets.
 - 4. Detail application at linkages of control devices.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- C. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- 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.
 - 2. Insulation Installed Outdoors: Flame-spread index of **75** or less, and smoke-developed index of 150 or less.

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 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. 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 "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation 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 Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type II for sheet materials.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA, Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - c. K-Flex USA; Insul-Sheet, K-Flex Gray Duct Liner, and K-FLEX LS.
- G. 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.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corp.; SoftTouch Duct Wrap.
 - b. Johns Manville; Microlite.
 - c. Knauf Insulation; Friendly Feel Duct Wrap.
 - d. Manson Insulation Inc.; Alley Wrap.
 - e. Owens Corning; SOFTR All-Service Duct Wrap.
- H. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation **with factory-applied ASJ**. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corp.; Commercial Board.
 - b. Fibrex Insulations Inc.; FBX.
 - c. Johns Manville; 800 Series Spin-Glas.

- d. Knauf Insulation; Insulation Board.
 - e. Manson Insulation Inc.; AK Board.
 - f. Owens Corning; Fiberglas 700 Series.
- I. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials and Type II, Grade 1 for sheet materials.
- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Armacell LLC; Tubolit.
 - b. Nomaco Insulation; IMCOLOCK, IMCOSHEET, NOMALOCK, and NOMAPLY.

2.2 FIRE-RATED INSULATION SYSTEMS

- A. Fire-Rated Board: Structural-grade, press-molded, xonolite calcium silicate, fireproofing board suitable for operating temperatures up to **1700 deg F**. Comply with ASTM C 656, Type II, Grade 6. Tested and certified to provide a:
- a. 2-hour fire rating by an NRTL acceptable to authorities having jurisdiction
1. Products: Subject to compliance with requirements, provide the following :
- a. Johns Manville; Super Firetemp M.
- B. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a:
- a. **2**-hour fire rating by an NRTL acceptable to authorities
1. Products: Subject to compliance with requirements, provide one of the following :
- a. CertainTeed Corp.; FlameChek.
 - b. Johns Manville; Firetemp Wrap.
 - c. Nelson Fire Stop Products; Nelson FSB Flameshield Blanket.
 - d. Thermal Ceramics; FireMaster Duct Wrap.
 - e. 3M; Fire Barrier Wrap Products.
 - f. Unifrax Corporation; FyreWrap.

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 and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
1. Products: Subject to compliance with requirements, provide one of the following:
- a. Aeroflex USA, Inc.; Aeroseal.
 - b. Armacell LLC; Armaflex 520 Adhesive.

- c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
 - d. K-Flex USA; R-373 Contact Adhesive.
 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
 - d. Mon-Eco Industries, Inc.; 22-25.
 2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - D. FSK Jacket Adhesive, and ASJ Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 1. Products: Subject to compliance with requirements, **provide one of the following:**
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
 - d. Mon-Eco Industries, Inc.; 22-25.
 2. For indoor applications, adhesive shall have 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-PRF-19565C, Type II.
 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
 - b. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, **0.013 perm** at **43-mil** dry film thickness.
 3. Service Temperature Range: **Minus 20 to plus 180 deg F**.
 4. Solids Content: ASTM D 1644, **58 percent** by volume and **70 percent** by weight.
 5. Color: White.
- C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
 - b. Eagle Bridges - Marathon Industries; 550.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
 - d. Mon-Eco Industries, Inc.; 55-50.
 - e. Vimasco Corporation; WC-1/WC-5.
 2. Water-Vapor Permeance: ASTM F 1249, **1.8 perms** at **0.0625-inch** dry film thickness.
 3. Service Temperature Range: **Minus 20 to plus 180 deg F**.
 4. Solids Content: **60 percent** by volume and **66 percent** by weight.
 5. Color: White.

2.5 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
1. For indoor applications, use lagging adhesives that have a VOC content of **50 g/L** or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.
 - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
 - c. Vimasco Corporation; 713 and 714.
 3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct insulation.
 4. Service Temperature Range: **0 to plus 180 deg F**.
 5. Color: White.

2.6 SEALANTS

- A. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 - b. Eagle Bridges - Marathon Industries; 405.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
 - d. Mon-Eco Industries, Inc.; 44-05.
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, sealants shall have a VOC content of **420 g/L** or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.7 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. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.8 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.
- C. Metal Jacket:
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
 - b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
 - c. RPR Products, Inc.; Insul-Mate.
 2. Aluminum Jacket: Comply with **ASTM B 209**, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 - a. **Sheet and roll stock ready for shop or field sizing**
 - b. Finish and thickness are indicated in field-applied jacket schedules.
 - c. Moisture Barrier for Indoor Applications: **3-mil-thick, heat-bonded polyethylene and kraft paper.**
 - d. Moisture Barrier for Outdoor Applications: **3-mil-thick, heat-bonded polyethylene and kraft.**

2.9 TAPES

- A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ABI, Ideal Tape Division; 491 AWF FSK.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
 - c. Compac Corporation; 110 and 111.
 - d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.
 2. Width: **3 inches**.
 3. Thickness: **6.5 mils**.
 4. Adhesion: **90 ounces force/inch** in width.
 5. Elongation: **2** percent.
 6. Tensile Strength: **40 lbf/inch** in width.
 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- B. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ABI, Ideal Tape Division; 488 AWF.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
 - c. Compac Corporation; 120.
 - d. Venture Tape; 3520 CW.
 2. Width: **2 inches**.
 3. Thickness: **3.7 mils**.
 4. Adhesion: **100 ounces force/inch** in width.
 5. Elongation: **5** percent.
 6. Tensile Strength: **34 lbf/inch** in width.

2.10 SECUREMENTS

- A. Bands:
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ITW Insulation Systems; Gerrard Strapping and Seals.
 - b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.
 2. Aluminum: **ASTM B 209**, Alloy 3003, 3005, 3105, or 5005; Temper H-14, **0.020 inch** thick, **3/4 inch** wide with **wing seal**.
 3. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.
- B. Insulation Pins and Hangers:
1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, **0.135-inch**-diameter shank, length to suit depth of insulation indicated.

- a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) AGM Industries, Inc.; CWP-1.
 - 2) GEMCO; CD.
 - 3) Midwest Fasteners, Inc.; CD.
 - 4) Nelson Stud Welding; TPA, TPC, and TPS.
2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, **0.135-inch**- diameter shank, length to suit depth of insulation indicated with integral **1-1/2-inch** galvanized carbon-steel washer.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) AGM Industries, Inc.; CHP-1.
 - 2) GEMCO; Cupped Head Weld Pin.
 - 3) Midwest Fasteners, Inc.; Cupped Head.
 - 4) Nelson Stud Welding; CHP.
3. 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. Products: Subject to compliance with requirements, provide one of the following:
 - 1) AGM Industries, Inc.; Tactoo Perforated Base Insul-Hangers.
 - 2) GEMCO; Perforated Base.
 - 3) Midwest Fasteners, Inc.; Spindle.
 - b. Baseplate: Perforated, galvanized carbon-steel sheet, **0.030 inch** thick by **2 inches** square.
 - c. Spindle: **Copper- or zinc-coated, low-carbon steel** fully annealed, **0.106-inch**- diameter shank, length to suit depth of insulation indicated.
 - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
4. 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. Products: Subject to compliance with requirements, provide one of the following:
 - 1) GEMCO; Nylon Hangers.
 - 2) Midwest Fasteners, Inc.; Nylon Insulation Hangers.

- b. Baseplate: Perforated, nylon sheet, **0.030 inch** thick by **1-1/2 inches** in diameter.
 - c. Spindle: Nylon, **0.106-inch-** diameter shank, length to suit depth of insulation indicated, up to **2-1/2 inches**.
 - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
5. 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. Products: Subject to compliance with requirements, provide one of the following:
 - 1) AGM Industries, Inc.; Tactoo Self-Adhering Insul-Hangers.
 - 2) GEMCO; Peel & Press.
 - 3) Midwest Fasteners, Inc.; Self Stick.
 - b. Baseplate: Galvanized carbon-steel sheet, **0.030 inch** thick by **2 inches** square.
 - c. Spindle: **Copper- or zinc-coated, low-carbon steel**, fully annealed, **0.106-inch-** diameter shank, length to suit depth of insulation indicated.
 - d. Adhesive-backed base with a peel-off protective cover.

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 throughout the length of ducts and fittings.

- B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system 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. 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.
- 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**. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at:
 - a. **2 inche** o.c.
 - b. 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 duct 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.
- 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.

3.4 PENETRATIONS

- A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: 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 Section 078413 "Penetration Firestopping" firestopping and fire-resistive joint sealers.

3.5 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.6 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
 - 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for:
 - a. **100** percent coverage of duct and plenum surfaces.
 - 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 - 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions **18 inches** and smaller, place pins along longitudinal centerline of duct. Space **3 inches** maximum from insulation end joints, and **16 inches** o.c.
 - b. On duct sides with dimensions larger than **18 inches**, place pins **16 inches** o.c. each way, and **3 inches** maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Impale insulation over pins and attach speed washers.

- f. 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.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing **2 inches** from one edge and one end of insulation segment. Secure laps to adjacent insulation section with **1/2-inch** outward-clinching staples, **1 inch** o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below **50 deg F** at **18-foot** intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than **3 inches**.
 5. Overlap unfaced blankets a minimum of **2 inches** on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of **18 inches** o.c.
 6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with **6-inch-** wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced **6 inches** o.c.
- B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for:
 - a. 50 percent coverage of duct and plenum surfaces.
 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions **18 inches** and smaller, place pins along longitudinal centerline of duct. Space **3 inches** maximum from insulation end joints, and **16 inches** o.c.
 - b. On duct sides with dimensions larger than **18 inches**, space pins **16 inches** o.c. each way, and **3 inches** maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.

- e. 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.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing **2 inches** from one edge and one end of insulation segment. Secure laps to adjacent insulation section with **1/2-inch** outward-clinching staples, **1 inch** o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with **6-inch-** wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced **6 inches** o.c.

3.7 FIELD-APPLIED JACKET INSTALLATION

- A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
 1. Draw jacket smooth and tight to surface with **2-inch** overlap at seams and joints.
 2. Embed glass cloth between two **0.062-inch-** thick coats of lagging adhesive.
 3. Completely encapsulate insulation with coating, leaving no exposed insulation.
- B. 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.
- C. Where PVC 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.
- D. Where metal jackets are indicated, install with **2-inch** overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with

weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands **12 inches** o.c. and at end joints.

3.8 FIRE-RATED INSULATION SYSTEM INSTALLATION

- A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.
- B. Insulate duct access panels and doors to achieve same fire rating as duct.
- C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Section 078413 "Penetration Firestopping."

3.9 FINISHES

- A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
 - 1. Flat Acrylic Finish: **Two** finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

3.10 FIELD QUALITY CONTROL

- A. Testing Agency:
 - a. Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
 - 1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to **one** location for each duct system defined in the "Duct Insulation Schedule, General" Article.
- D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.11 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply and outdoor air.
2. Indoor, concealed return located in unconditioned space.

B. Items Not Insulated:

1. Fibrous-glass ducts.
2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
3. Factory-insulated flexible ducts.
4. Factory-insulated plenums and casings.
5. Flexible connectors.
6. Vibration-control devices.
7. Factory-insulated access panels and doors.

3.12 Insulation shall have an R value that meets the minimum requirements of the latest International Energy Conservation Code (IECC).

3.13 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. All supply and return ducts and plenums shall be insulated with not less than R-6 insulation.

B. Concealed, round and flat-oval, supply-air duct insulation shall be **one of** the following:

1. Flexible Elastomeric: **1-1/2 inch** thick.
2. Mineral-Fiber Blanket: **2 inches** thick and **0.75-lb/cu. ft.** nominal density.

C. Concealed, round, return-air duct insulation shall be **one of** the following:

1. Flexible Elastomeric: **1-1/2 inch** thick.
2. Mineral-Fiber Blanket: **2 inches** thick and **0.75-lb/cu. ft.** nominal density.

D. Concealed, rectangular, supply-air duct insulation shall be **one of** the following:

1. Flexible Elastomeric: **1-1/2 inch** thick.
2. Mineral-Fiber Blanket: **2 inches** thick and **0.75-lb/cu. ft.** nominal density.

E. Concealed, rectangular, return-air duct insulation shall be **one of** the following:

1. Flexible Elastomeric: **1-1/2 inch** thick.
2. Mineral-Fiber Blanket: **2 inches** thick and **0.75-lb/cu. ft.** nominal density.

END OF SECTION

SECTION 230719 - HVAC PIPING INSULATION

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 insulating the following HVAC piping systems:
 - 1. Heating hot-water piping.
- B. Related Sections:
 - 1. Section 230713 "Duct Insulation."

1.3 DEFINITIONS:

- A. Refer to Section 230500 "Common Work Results for HVAC".

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail attachment and covering of heat tracing inside insulation.
 - 3. Detail insulation application at pipe expansion joints for each type of insulation.
 - 4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 5. Detail removable insulation at piping specialties.
 - 6. Detail application of field-applied jackets.
 - 7. Detail application at linkages of control devices.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation

materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to 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 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.

1.7 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.

1.8 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.9 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. 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 "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Insulation for below-ambient service requires a vapor-barrier.
- C. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- D. 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.
- E. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- F. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- G. Mineral-Fiber, Preformed Pipe Insulation:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; Micro-Lok.
 - b. Knauf Insulation; 1000-Degree Pipe Insulation.
 - c. Manson Insulation Inc.; Alley-K.
 - d. Owens Corning; Fiberglas Pipe Insulation.
 - e. Type I, **850 deg F** Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, **Type I, Grade A:**
 - 1) with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- H. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied:
 - 1. **ASJ** 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.
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corp.; CrimpWrap.
 - b. Johns Manville; MicroFlex.
 - c. Knauf Insulation; Pipe and Tank Insulation.
 - d. Manson Insulation Inc.; AK Flex.
 - e. Owens Corning; Fiberglas Pipe and Tank Insulation.

- I. Prefabricated Thermal Insulating Fitting Covers: Comply with ASTM C 450 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

2.2 INSULATING CEMENTS

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
 1. Products: Subject to compliance with requirements, provide the following:
 - a. Ramco Insulation, Inc.; Super-Stik.
- B. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.
 1. Products: Subject to compliance with requirements, provide the following:
 - a. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.

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. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
 - d. Mon-Eco Industries, Inc.; 22-25.
 2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
 - d. Mon-Eco Industries, Inc.; 22-25.
 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

- D. PVC Jacket Adhesive: Compatible with PVC jacket.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 739, Dow Silicone.
 - b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
 - c. P.I.C. Plastics, Inc.; Welding Adhesive.
 - d. Speedline Corporation; Polyco VP Adhesive.
 2. For indoor applications, adhesive shall have 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-PRF-19565C, Type II.
1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
 - b. Vimasco Corporation; 749.
 2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, **0.013 perm** at **43-mil** dry film thickness.
 3. Service Temperature Range: **Minus 20 to plus 180 deg F.**
 4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 5. Color: White.
- C. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel.
 - b. Eagle Bridges - Marathon Industries; 570.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.
 2. Water-Vapor Permeance: ASTM F 1249, **0.05 perm** at **30-mil** dry film thickness.
 3. Service Temperature Range: **Minus 50 to plus 220 deg F.**
 4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
 5. Color: White.
- D. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
 - b. Eagle Bridges - Marathon Industries; 550.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
 - d. Mon-Eco Industries, Inc.; 55-50.
 - e. Vimasco Corporation; WC-1/WC-5.
2. Water-Vapor Permeance: ASTM F 1249, **1.8 perms** at **0.0625-inch** dry film thickness.
3. Service Temperature Range: **Minus 20 to plus 180 deg F.**
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.5 SEALANTS

A. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
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: White.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

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-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 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. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; Zeston.

- b. P.I.C. Plastics, Inc.; FG Series.
 - c. Proto Corporation; LoSmoke.
 - d. Speedline Corporation; SmokeSafe.
2. Adhesive: As recommended by jacket material manufacturer.
 3. Color: Color-code jackets based on system:
 - a. White
 4. 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, mechanical joints, and P-trap and supply covers for lavatories.

C. Metal Jacket:

1. Products: Subject to compliance with requirements, **provide one of the following**:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
 - b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
 - c. RPR Products, Inc.; Insul-Mate.
2. Aluminum Jacket: Comply with **ASTM B 209**, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 - a. Sheet and roll stock ready for shop or field sizing or factory cut and rolled to size.
 - b. Finish and thickness are indicated in field-applied jacket schedules.
 - c. Moisture Barrier for Indoor Applications:
 - 1) **1-mil-** thick, heat-bonded polyethylene and kraft paper.
 - d. Moisture Barrier for Outdoor Applications:
 - 1) **3-mil-** thick, heat-bonded polyethylene and kraft paper.
 - e. Factory-Fabricated Fitting Covers:
 - 1) Same material, finish, and thickness as jacket.
 - 2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - 3) Tee covers.
 - 4) Flange and union covers.
 - 5) End caps.
 - 6) Beveled collars.
 - 7) Valve covers.
 - 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.8 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
 1. Products: Subject to compliance with requirements, provide one of the following:

- a. ABI, Ideal Tape Division; 428 AWF ASJ.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
 - c. Compac Corporation; 104 and 105.
 - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
2. Width: **3 inches**.
 3. Thickness: **11.5 mils**.
 4. Adhesion: **90 ounces force/inch** in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: **40 lbf/inch** in width.
 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ABI, Ideal Tape Division; 370 White PVC tape.
 - b. Compac Corporation; 130.
 - c. Venture Tape; 1506 CW NS.
 2. Width: **2 inches**.
 3. Thickness: **6 mils**.
 4. Adhesion: **64 ounces force/inch** in width.
 5. Elongation: 500 percent.
 6. 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.

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.
 3. 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.

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 piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system 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
 - a. **2 inches o.c.**
 - b. 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.
- 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. Manholes.
 5. Handholes.
 6. Cleanouts.

3.4 PENETRATIONS

- A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- B. 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 Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

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.

- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 8. For services not specified to receive a field-applied jacket except for flexible elastomeric, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least **2 inches** over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 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.

3.7 FIELD-APPLIED JACKET INSTALLATION

- A. Where PVC jackets are indicated, install with **1-inch** overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.
1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

3.8 FINISHES

- A. Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
1. Flat Acrylic Finish: **Two** finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

3.9 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. 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. Drainage piping located in crawl spaces.
 2. Underground piping.
 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.
- 3.10 Insulation shall have a k value that meets the minimum requirements of the latest International Energy Conservation Code (IECC).
- 3.11 INDOOR PIPING INSULATION SCHEDULE
- A. Heating-Hot-Water Supply and Return, **200 Deg F** and Below:
1. **NPS 1 1/2** and Smaller: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe, Type I:
 - 1) 1-1/2 inch thick
 2. Greater than **NPS 1-1/2 inch** : Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe, Type I or Pipe and Tank Insulation:
 - 1) **2 inches** thick
 3. Insulation for runouts not exceeding **48 inches** in length for connection to equipment shall be the following:
 - a. Mineral-Fiber, Preformed Pipe, Type I: **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. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Concealed:
1. None.
- D. Piping, Exposed:
1. **PVC:**
 - a. White: **30 mils** thick.

END OF SECTION

SECTION 2309 00 - BUILDING AUTOMATION SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes control equipment and installation for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-furnished controls.
- B. See "Sequences of Operation" for requirements that relate to this Section.
- C. The BAS control system shall be extension of the existing Siemens Apogee BAS and all controllers and software shall match existing or be latest version of existing.
- D. ATC control panels shall be equipped with a UPS and will be connected to emergency power (by Division 26).

1.2 RELATED DOCUMENTS

- A. Drawings and Specification Sections of the Contract, including General and Supplementary Conditions, apply to this Section.
 - 1. General Requirements Section 01 00 00
 - 2. Section 01 00 00 – General and Special Requirements
 - 3. Section 01 33 00 – Submittal Requirements
 - 4. Section 01 91 13 – General Commissioning Requirements
 - 5. Section 27 05 26 – Commissioning of HVAC
 - 6. Section 05 45 19 – Commissioning of Integrated Automation
 - 7. Section 23 31 03 – Detection and Alarm (Fire and Smoke Alarm Systems)
 - 8. Section 01 60 00 – Materials and Equipment
 - 9. Section 23 05 00 – Common Work Results for HVAC
 - 10. Section 23 05 93 – Testing, Adjusting, and Balancing for HVAC
 - 11. Section 23 08 00 – HVAC Commissioning Requirements
 - 12. Section 26 01 00 – General Electrical Provisions for Electrical Work
 - 13. Section 26 05 00 – Common Work Results for Electrical
 - 14. Section 26 05 19 – Low Voltage Electrical Power Conductors and Cables
 - 15. Section 26 05 29 – Hangers and Supports for Electrical Systems
 - 16. Section 26 05 33 – Raceway and Boxes for Electrical Systems
 - 17. Section 26 05 53 – Identification for Electrical Systems
 - 18. Section 26 27 26 – Wiring Devices

1.3 DEFINITIONS

- A. DDC: Direct digital controls

- B. IP: Internet Protocol
- C. I/O: Input/Output
- D. LAN: Local area network. MS/TP: Master-slave/token-passing. Refer to AHSRAE standard 135-2010
- E. TCP: Transfer Control Protocol
- F. Scope Terminology
 - 1. Provide = Furnish equipment, engineer, program and install
 - 2. Furnish = Furnish equipment, engineer and program
 - 3. Mount = securely fasten or pipe
 - 4. Install = mount and wire
 - 5. Wire = wire only

1.4 SYSTEM DESCRIPTION

- A. The Building Automation System (BAS) contractor shall furnish and install a networked system of HVAC controls. The contractor shall incorporate direct digital control (DDC) for building ventilation equipment, supplemental heating and cooling equipment, and terminal units.
- B. Provide networking to new DDC equipment using communication standards. Match the existing protocol. The system shall not be limited to only standard protocols, but shall also be able to integrate to a wide variety of third-party devices and applications via drivers and gateways.
- C. Provide standalone controls where called for on the drawings or sequences.

1.5 WORK INCLUDED

- A. The installation of the control system shall be performed under the direct supervision of the controls manufacturer with the shop drawings, flow diagrams, bill of materials, component designation, or identification number and sequence of operation all bearing the name of the manufacturer.
- B. Furnish a complete distributed direct digital control system in accordance with this specification section. This includes all system controllers, logic controllers, and all input/output devices. Items of work included are as follows:
 - 1. Provide a submittal that meets the requirements below for approval.
 - 2. Coordinate installation schedule with the mechanical contractor and general contractor.
 - 3. Provide installation of all panels and devices unless otherwise stated.
 - 4. Provide power for panels and control devices.
 - 5. Provide all low voltage control wiring for the DDC system.
 - 6. Provide miscellaneous control wiring for HVAC and related systems regardless of voltage.

7. Provide engineering and technician labor to program and commission software for each system and operator interface. Submit commissioning reports for approval.
8. Participate in commissioning for all equipment that is integrated into the BAS (Refer to Commissioning sections of the equipment or systems in other parts of this specification.)
9. Provide testing, demonstration and training as specified below.

1.6 SYSTEM PERFORMANCE

- A. Comply with the following performance requirements:
1. Graphic Display: Display graphic with minimum 20 dynamic points with current data within 5 seconds.
 2. Graphic Refresh: Update graphic with minimum 20 dynamic points with current data within 5 seconds.
 3. Object Command: Reaction time of less than 5 seconds between operator command of a binary object and device reaction.
 4. Object Scan: Transmit change of state and change of analog values to control units or workstation within 5 seconds.
 5. Alarm Response Time: Annunciate alarm at workstation within 2 seconds. Multiple workstations must receive alarms within five seconds of each other.
 6. Program Execution Frequency: Programmable controllers shall execute DDC PI control loops, and scan and update process values and outputs at least once per second.
 7. Reporting Accuracy and Stability of Control: Report values and maintain measured variables within tolerances as follows:
 - a. Water Temperature: Plus or minus 1 deg F.
 - b. Water Flow: Plus or minus 5 percent of full scale.
 - c. Water Pressure: Plus or minus 2 percent of full scale.
 - d. Space Temperature: Plus or minus 1 deg F.
 - e. Ducted Air Temperature: Plus or minus 1 deg F.
 - f. Outside Air Temperature: Plus or minus 2 deg F.
 - g. Dew Point Temperature: Plus or minus 3 deg F.
 - h. Temperature Differential: Plus or minus 0.25 deg F.
 - i. Relative Humidity: Plus or minus 2 percent.
 - j. Airflow (Pressurized Spaces): Plus or minus 3 percent of full scale.
 - k. Airflow (Measuring Stations): Plus or minus 5 percent of full scale.
 - l. Airflow (Terminal): Plus or minus 10 percent of full scale.
 - m. Air Pressure (Space): Plus or minus 0.01-inch wg.
 - n. Air Pressure (Ducts): Plus or minus 0.1-inch wg.
 - o. Carbon Monoxide: Plus or minus 5 percent of reading.
 - p. Carbon Dioxide: Plus or minus 50 ppm.
 - q. Electrical: Plus or minus 5 percent of reading.

1.7 SUBMITTALS

- A. Provide submittals for fast track items that need to be approved and released to meet the schedule of the project. Provide submissions for the following items separately:
1. Valve schedule and cut sheets
 2. Factory mounting and wiring diagrams and cut sheets

3. Thermostat locations
- B. Provide a complete submittal with all controls system information for approval before construction starts. Include the following:
1. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
 2. Wiring Diagrams: Power, signal, and control wiring.
 3. Details of control panel faces, including sizes, controls, instruments, and labeling.
 4. Schedule of dampers and actuators including size, leakage, and flow characteristics.
 5. If dampers are furnished by other, submit a damper actuator schedule coordinating actuator sizes with the damper schedule.
 6. Schedule of valves including leakage and flow characteristics.
 7. Written description of the Sequence of Operations.
 8. Network riser diagram showing wiring types, network protocols, locations of floor penetrations and number of control panels. Label control panels with network addresses. Show all routers, switches, hubs and repeaters.
 9. Point list for each system controller including both inputs and outputs (I/O), point numbers, controlled device associated with each I/O point, and location of I/O device.
 10. Starter and variable frequency drive wiring details of all automatically controlled motors.
 11. Reduced size floor plan drawings showing locations of control panels, thermostats and any devices mounted in occupied space.
- C. Product Data: Include manufacturer's technical literature for each control device indicated, labeled with setting or adjustable range of control. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated. Submit a write-up of the application software that will be used on the operator workstation including revision level, functionality and software applications required to meet the specifications.
- D. Submit a description of the application software that will be used on the operator workstation including revision level, functionality and software applications required to meet the specifications.
- E. Wiring Diagrams: Detail the wiring of the control devices and the panels. Show point-to-point wiring from field devices to the control panel. Show point-to-point wiring of hardwired interlocks. Show a ladder diagram or schematic of wiring internal to the panels, including numbered terminals. Clearly designate wiring that is done at a factory, at a panel shop or in the field.
- F. Submit blank field check-out and commissioning test reports, customized for each panel or system, which will be filled out by the technician during start-up.
- G. Submit sample graphics for approval before starting system commissioning.
- H. Variance letter: Submit a letter detailing each item in the submission that varies from the contract specification or sequence of operation in any way.

- I. After the BAS system is approved for construction, submit sample operator workstation graphics for typical systems for approval. Print and submit the graphics that the operator will use to view the systems, change setpoints, modify parameters and issue manual commands. Programming shall not commence until typical graphics are approved.

1.8 QUALITY ASSURANCE

A. Codes

1. Perform all wiring in accordance with Division 26, NEC, local codes and Owner's requirements.
2. Uniform Building Code (UBC)
3. 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.
4. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilation Systems."
5. All equipment shall be UL listed and approved and shall meet with all applicable NFPA standards, including UL 916 - PAZX Energy Management Systems,
6. Provide UL 864 – UUKL Smoke Control, where controllers and networks are used for that purpose.
 - a. Provide written approvals and certifications after installation has been completed.
7. All electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Governing Radio Frequency Electromagnetic Interference and be so labeled.
8. The manufacturer of the building automation system shall provide documentation supporting compliance with ISO-9002 (Model for Quality Assurance in Production, Installation, and Servicing) and ISO-140001 (The application of well-accepted business management principles to the environment). The intent of this specification requirement is to ensure that the products from the manufacturer are delivered through a Quality System and Framework that will assure consistency in the products delivered for this project.

B. Qualifications

1. Installing contractor shall be in the business of installing and servicing DDC controls for mechanical systems, temperature and ventilation control, environmental control, lighting control, access and security controls, and energy automation as their primary business. Installer Qualifications: An experienced installer who is the authorized representative of the automatic control system manufacturer for both installation and maintenance of controls required for this Project.
2. Engineering, drafting, programming, and graphics generation shall be performed by the local branch engineers and technicians directly employed by the Building Automation System Contractor.
3. Supervision, checkout and commissioning of the system shall be by the local branch engineers and technicians directly employed by the Building Automation System Contractor. They shall perform commissioning and complete testing of the BAS system.

- C. The BMS contractor shall maintain a service organization consisting of factory trained service personnel and provide a list of ten (10) projects, similar in size and scope to this project, completed within the last five years.
- D. Final determination of compliance with these specifications shall rest solely with the Engineers and Owner who will require proof of prior satisfactory performance.
- E. For any BAS system and equipment submitted for approval, the BAS contractor shall state what, if any, specific points of system operation differ from these specifications.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to unit manufacturer.

1.10 COORDINATION

- A. Coordinate location of thermostats, humidistats, panels, and other exposed control components with plans and room details before installation.
- B. Coordinate equipment with Section 26 00 00 "Fire Alarm" to achieve compatibility with equipment that interfaces with that system.
- C. Coordinate power for control units and operator workstation with electrical contractor.
- D. Coordinate equipment with provider of starters and drives to achieve compatibility with motor starter control coils and VFD control wiring.
- E. Coordinate scheduling with the mechanical contractor and general contractor. Submit a schedule for approval based upon the installation schedule of the mechanical equipment.
- F. Products Furnished but Not Installed Under This Section
 - 1. Hydronic Piping:
 - a. Control Valves
 - b. Temperature Sensor Wells and Sockets
 - c. Flow Switches
 - d. Flow Meters
 - 2. Refrigerant Piping
 - a. Pressure and Temperature Sensor Wells and Sockets
 - 3. Sheetmetal accessories
 - a. Dampers
 - b. Airflow Stations
 - c. Terminal Unit Controls
- G. Products Installed but Not Furnished Under This Section
 - 1. Refrigeration Equipment:
 - a. Refrigerant Leak Detection System
 - b. Proof of flow pressure switches
 - 2. Rooftop Air Handling Equipment:

- a. Thermostats
 - b. Duct Static Pressure Sensors
- H. Products Integrated To but Not Furnished or Installed Under This Section
- 1. Heat pumps
 - 2. Packaged rooftops
 - 3. Packaged AC units
 - 4. Computer room AC units
 - 5. Geothermal water pumping system
 - 6. Pre-fabricated AHUs
 - 7. Chillers
 - 8. Boilers
 - 9. VFDs
 - 10. ATS
 - 11. PDU
 - 12. UPS
 - 13. Emergency Generators
 - 14. Lighting Control panels
 - 15. Fire Alarm monitoring

1.11 WARRANTY

- A. Conform to the warranty requirement of the Contract Documents, General Requirements and this section or a minimum of 12 months. Provide the strictest.
- B. Warranty shall cover all costs for parts, labor, associated travel, and expenses for a period of one year from completion of system demonstration.
- C. Hardware and software personnel supporting this warranty agreement shall provide on-site or off-site service in a timely manner after failure notification to the vendor. The maximum acceptable response time to provide this service at the site shall be 24 hours.
- D. During normal building occupied hours, failure of items that are critical for system operation shall be provided within 4 hours of notification from the Owner's Representative.
- E. This warranty shall apply equally to both hardware and software.

PART 2 - PRODUCTS

2.1 ACCEPTABLE SYSTEMS

- A. Provide a Building Automation System based upon the following:
 - 1. Siemens APOGEE System as installed by the Siemens Industry branch office

2.2 BAS NETWORK

- A. Match the existing BAS protocol.

- B. Access to system data shall not be restricted by the hardware configuration of the building management system. The hardware configuration of the BMS network shall be totally transparent to the user when accessing data or developing control programs.
 - 1. Software applications, features, and functionality, including administrative configurations, shall not be separated into several network control engines working together.
- C. Provide at a minimum 1 operator interface to be designated as the BAS Server with server application software. Additional operator interfaces shall use operator workstation licenses or connect via a thick or thin-client application.
- D. BAS Server shall be capable of simultaneous direct connection and communication with BACnet/IP, OPC and TCP/IP corporate level networks without the use of interposing devices.
- E. Any break in Ethernet communication from the PC to the controllers on the Primary Network shall result in a notification at the PC.
- F. Any break in Ethernet communication between the standard client and server workstations on the Primary Network shall result in a notification at each workstation.
- G. The network architecture shall consist of three levels of networks:
 - 1. The Management level shall utilize Apogee TCP/IP or BACnet/IP over Ethernet along with other standardized protocol, such as web services, html, JAVA, SOAP, XML, etc., to transmit data to non-BAS softwares and databases.
 - 2. The Automation level network shall be Apogee TCP/IP or BACnet/IP over Ethernet. It shall network the Automation Server, Operator workstations, and BC level controllers. Provide network media converters, routers and switches as necessary for a complete network.
 - 3. The Floor level network shall be Apogee P1 (FLN) or BACnet over MS/TP. It shall network to all of the DDC controlled equipment on a floor or in a system and network to a router that connects to the Automaton level BAS backbone.
- H. The primary backbone network between the building level controllers, BAS Server and Operator Workstations shall be based upon Apogee TCP/IP or BACnet/IP. Ethernet Network switches shall be strategically placed through the building to cover several floors or several mechanical rooms that are within 300 ft wiring-feet of each other.
- I. Controllers for the central plant and large infrastructure air handlers shall reside on the TCP/IP backbone or BACnet/IP network.
- J. The Building Level Controllers shall be able to support subnetwork protocols that may be needed depending on the type of equipment or application. Subnetworks shall be limited to :
 - 1. BACnet MS/TP
 - 2. Apogee FLN
 - 3. Modbus
- K. Advanced Application Controllers for smaller single zone, supplemental or special systems can reside on the BACnet/IP network or on a subnetwork.

- L. Application Specific Controllers, Floor level controllers, terminal units, package AC units, auxiliary equipment, VFDs, meters shall reside on one of the subnetworks above.
- M. Provide all communication media, connectors, repeaters, bridges, switches, and routers necessary for the internetwork.
- N. Use fiber optic cabling for all Ethernet runs longer than 300 ft.
- O. Provide all communication media, connectors, repeaters, bridges, switches, and routers necessary for the internetwork.
- P. The system shall meet peer-to-peer communication services such that the values in any one BC or AAC level controller can be read or changed from all other controllers with the need for intermediary devices. The software shall provide transparent transfer of all data, control programs, schedules, trends, and alarms from any one controller through the internetwork to any other controller, regardless of subnetwork routers.
- Q. Systems that use variations of BACnet using Point-to-Point (PTP) between controllers, gateways, bridges or networks that are not peer-to-peer are not allowed.
- R. Remote Communications: Provide a TCP/IP compatible communication port for connection to the Owner's network for remote communications. Provide coordination with the Owner for addressing and router configuration on both ends of the remote network.
- S. Where a smoke control application is required, provide UUKL listed network switches, and NFPA approved cabling, enclosures and installation methods.
- T. The system shall be installed with a 10% spare capacity on each subnetwork for the addition of future controllers.

2.3 DISTRIBUTED CONTROL REQUIREMENTS

- A. The loss of any one DDC controller shall not affect the operation of other HVAC systems, only for the points connected to the DDC controller.
- B. The system shall be scalable in nature and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, DDC Controllers, and operator devices.
- C. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution. Each DDC Controller shall operate independently by performing its own specified control, alarm management, operator I/O, and data collection. The failure of any single component or network connection shall not interrupt the execution of any control strategy, reporting, alarming and trending function, or any function at any operator interface device.
- D. DDC Controllers shall be able to access any data from, or send control commands and alarm reports directly to, any other DDC Controller on the network without dependence upon a central processing device. DDC Controllers shall also be able to

send alarms to multiple operator workstations without dependence upon a central or intermediate processing device.

- E. The DDC control panel shall be mounted in the same mechanical room as the equipment being controlled, or an adjacent utility room.
- F. Multiple systems can be programmed on the same controller as long as they are in the same room. Systems on separate floors shall have separate controllers.
- G. VAV boxes subnetworks shall be connected to the AHU controller that feeds those boxes. If multiple subnetworks are needed, then the VAV shall be grouped into subnetworks in an orderly method, such as per floor, per wing, etc.
- H. Remote sensors shall be wired to the control panel of the equipment it is controlling, not across the network.
- I. Signals to remote motor control centers shall be hard wired to the control panel, not across the network.
- J. Terminal units shall each have their own controller. Only exceptions are:
 - 1. Groups of reheat coils
 - 2. Groups of exhaust fans
 - 3. Groups of chilled beams serving same zone or several adjacent zones

2.4 BUILDING AUTOMATION SERVER HARDWARE

- A. Provide a PC for the BAS Server database. Provide the latest model of the nominal speed, RAM and memory for a commercial office grade PC from a named brand manufacturer. Minimum requirements and accessories shall be:
 - 1. Processor: Intel "i5" series or AMD equal
 - 2. 3GHz processor speed minimum 6M cache
 - 3. 4GB Ram, Dual Channel, DDR3 SDRam at 1333MHz minimum
 - 4. 16x R/W CD and DVD
 - 5. 500GB Hard disk space, 7200RPM
 - 6. USB Ports
 - 7. NIC Card
 - 8. 101 key enhanced keyboard, Mouse, power strip
 - 9. UPS for 15 minute backup
- B. Provide an active matrix LCD, flat panel type monitor that supports a minimum display resolution of no less than 1600 × 1200 pixels, Energy Star compliant. The display shall have a minimum of 20-inch visible area in diagonal measurement. Separate controls shall be provided for color, contrasts and brightness. The screen shall be non-reflective.
- C. Printer: Provide a compatible inkjet or laser printer for alarms, operator transactions and system reports. Provide drivers.
- D. Printer2: Provide a color printer for printing of dynamic trend graph report, Excel reports, graphics and any other screen displays. Printer shall include as a minimum Okidata Microline 590 or equivalent.
- E. Locate the BAS Server in a clean, secure, dry and temperature controlled environment

- F. The server shall reside on the same IP protocol network as the System Controllers.
- G. Provide software licenses for interfacing to the BAS. Load software, configure and setup for viewing the BAS system.
- H. Provide with the PC an operating system, such as Windows XP, Windows 7 or Windows Server 2008 or other operating systems compatible with the BAS software.
- I. Software: Provide the following application software licenses, preloaded on the PC for the Owner: MS Office Professional, PC anywhere or terminal services, Internet Explorer or equal browser, MS Outlook, Acrobat Reader, CAD Viewer, Micrographx Designer. Set up an icon on the desktop to take the Owner directly to the BAS system login page.

2.5 ELECTRONIC DOCUMENTATION

- A. Provide software applications and files to view documentation through the GUI.
- B. Provide a CAD viewer to view all project AutoCAD documents that are made available by the Architect and Owner.
- C. Provide all controls cut sheets in PDF format. Make them available to any user accessing the system over the Internet.
- D. Provide a text version of the sequence of operation. Make the written sequence available from the graphic that represents each system. The sequence shall pop up in a printable format such as HTML or PDF.

2.6 CONTROLLER SOFTWARE (i.e. Building Controller software, , DDC software, Field Panel software)

- A. Provide a full capability user license to the owner for the operator to be able to see, modify, create, upload, download and save control programs to the DDC controllers.
- B. The software program shall be provided as an integral part of DDC Controllers and shall not be dependent upon any higher level computer or another controller for execution.
- C. The software application shall be accessible from a PC using the Windows environment, but shall use all of its own services and data files so as to not be susceptible to Microsoft Windows operating systems based viruses.
- D. The software shall be provided with an interactive HELP function to assist operators with syntax, abbreviations, commands and saving programs.
- E. Point naming and communication format:
 - 1. All points, panels, and programs shall be identified by a 30-character name. All points shall also be identified by a 16-character point descriptor. The same names shall be displayed at both Building Controller and the Operator Interface.
 - 2. All digital points shall have a consistent, user-defined, two-state status indication with 8 characters minimum (e.g., Summer, Enabled, Disabled, Abnormal).
 - 3. Match the existing protocol.

- F. System Security
1. User access shall be secured using individual security passwords and user names.
 2. Passwords shall restrict the user to the objects, applications, and system functions as assigned by the system manager.
 3. Building Controllers shall be able to assign a minimum of 50 passwords access and control priorities to each point individually. The logon password (at any Operator Interface or portable operator terminal) shall enable the operator to monitor, adjust and control only the points that the operator is authorized for. All other points shall not be displayed at the Operator Interface or portable terminal. Passwords and priorities for every point shall be fully programmable and adjustable.
 4. User Log On/Log Off attempts shall be recorded.
 5. The system shall protect itself from unauthorized use by automatically logging off following the last keystroke. The delay time shall be user-definable.
 6. Use of workstation resident security as the only means of access control is not an acceptable alternative to resident system security in the DDC controller software.
- G. User Defined Control Applications: The applications software shall program DDC routines to meet the sequences of operations.
1. Building Controllers shall have the ability to perform energy management routines including but not limited to time of day scheduling, calendar-based scheduling, holiday scheduling, temporary schedule overrides, start stop time optimization, automatic daylight savings time switch over, night setback control, enthalpy switch over, peak demand limiting, temperature-compensated duty cycling, heating/cooling interlock, supply temperature reset, priority load shedding, and power failure restart.
 2. The Building Controllers shall have the ability to perform the following pre tested control algorithms:
 - a. Two position with differential control and time delays
 - b. Floating control
 - c. Proportional control
 - d. Proportional plus integral control
 - e. Proportional, integral, plus derivative control
 - f. Automatic tuning of control loops
 - g. Model-free adaptive control
 3. Controllers shall be able to execute custom, job-specific processes defined by the user, to automatically perform calculations and special control routines.
 4. Each controller shall support plain language text comment lines in the operating program to allow for quick troubleshooting, documentation, and historical summaries of program development.
- H. Peer-to-peer access to other DDC controllers
1. It shall be possible to use any actual or virtual point data or status, any system calculated data, a result from any process, or any user-defined constant in any controller in the system.
 2. Any process shall be able to issue commands to points in any and all other controllers in the system.
 3. Processes shall be able to generate operator messages and advisories to other operator I/O devices. A process shall be able to directly send a message to a specified device or cause the execution of an advanced annunciation feature, such as:
 - a. Generate a report

- b. Annunciate an alarm
 - c. Issue a text message or email
- I. Alarm Management
1. Alarm management shall be provided within the controller software to monitor and direct alarm information to operator devices.
 2. Each Building Controller shall perform distributed, independent alarm analysis, minimize network traffic and prevent alarms from being lost. At no time shall the Building Controllers ability to report alarms be affected by either operator or activity at a PC workstation, local I/O device or communications with other panels on the network.
 3. Conditional alarming shall allow generation of alarms based upon user defined multiple criteria.
 4. An Alarm "shelving" feature shall be provided to disable alarms during testing. (Pull the Plug, etc.).
 5. Binary Alarms. Each binary alarm object shall be set to alarm based on the operator-specified state. Provide the capability to automatically and manually disable alarming.
 6. Analog Alarms. Each analog alarm object shall have both high and low alarm limits. Alarming must be able to be automatically and manually disabled.
 7. All alarm shall include the point's user-defined language description and the time and date of occurrence.
 8. Alarm reports and messages shall be routed to user-defined list of operator workstations, or other devices based on time and other conditions. An alarm shall be able to start programs, print reports, be logged in the event log, generate custom messages, and display graphics.
 9. The user shall be able to add a 200-character alarm message to each alarm point to more fully describe the alarm condition or direct operator response. Each Building Controller shall be capable of storing a library of at least 50 alarm messages. Each message may be assigned to any number of points in the Controller.
 10. Operator-selected alarms shall be capable of initiating a trigger to an advanced annunciation, such as text, email, etc.
 11. An alarm history log shall report the start of the alarm condition, acknowledgement by a user and return of the alarm to normal condition.
- J. Scheduling:
1. Provide a comprehensive menu driven program to automatically start and stop designated multiple objects or events in the system according to a stored time.
 2. Schedules shall reside in the building controller and shall not rely on external processing or network.
 3. It shall be possible to define a group of objects as a custom event (i.e., meeting, athletic activity, etc.). Events can then be scheduled to operate all necessary equipment automatically.
 4. For points assigned to one common load group, it shall be possible to assign variable time delays between each successive start and/or stop within that group.
 5. The operator shall be able to define the following information:
 - a. Time, day
 - b. Commands such as on, off, auto, etc.
 - c. Time delays between successive commands.

- d. There shall be provisions for manual overriding of each schedule by an authorized operator.
6. It shall be possible to schedule calendar-based events up to one year in advance based on the following:
 - a. Weekly Schedule. Provide separate schedules for each day of the week. Each of these schedules should include the capability for start, stop, optimal start, optimal stop, and night economizer. When a group of objects are scheduled together as an Event, provide the capability to adjust the start and stop times for each member.
 - b. Exception Schedules. Provide the ability for the operator to designate any day of the year as an exception schedule. Exception schedules may be defined up to a year in advance. Once an exception schedule is executed, it will be discarded and replaced by the standard schedule for that day of the week.
- K. Peak Demand Limiting (PDL):
 1. The Peak Demand Limiting (PDL) program shall limit the consumption of electricity to prevent electrical peak demand charges.
 2. PDL shall continuously track the amount of electricity being consumed, by monitoring one or more electrical kilowatt-hour/demand meters. These meters may measure the electrical consumption (kWh), electrical demand (kW), or both.
 3. PDL shall sample the meter data to continuously forecast the demand likely to be used during successive time intervals.
 4. If the PDL forecasted demand indicates that electricity usage is likely to exceed a user preset maximum allowable level, then PDL shall automatically shed electrical loads.
 5. Once the demand peak has passed, loads that have been shed shall be restored and returned to normal control.
- L. Temperature-compensated duty cycling
 1. User defined conditions shall be able to initiate a Duty Cycle Control Program.
 2. The Duty Cycle Control Program (DCCP) shall be configured to periodically stop and start loads according to various patterns.
 3. The loads shall be cycled such that there is a net reduction in both the electrical demands and the energy consumed.
- M. Automatic Daylight Savings Time Switchover. The system shall provide automatic time adjustment for switching to/from Daylight Savings Time.
- N. Night setback control. The system shall provide the ability to automatically adjust setpoints for night control.
- O. Enthalpy switchover (economizer). The Building Controller Software (BCS) shall control the position of the air handler relief, return, and outside air dampers. If the outside air dry bulb temperature falls below changeover setpoint the BCS will modulate the dampers to provide 100 percent outside air. The user will be able to quickly change over to an economizer system based on dry bulb temperature and will be able to override the economizer cycle and return to minimum outside air operation at any time.
- P. Control Loop Algorithm

1. Provide a PID (proportional-integral-derivative) closed-loop control algorithm with direct or reverse action and anti-windup. The algorithm shall calculate a time-varying analog value that is used to position an output or stage a series of outputs. The controlled variable, setpoint, and weighting parameters shall be accessible from the operator workstation.
- Q. Adaptive Loop Tuning
1. Building Controllers shall also provide high resolution sampling capability for verification of DDC control loop performance. Documented evidence of tuned control loop performance shall be provided on a monthly, seasonal, quarterly, annual period.
 2. For Model-Free Adaptive Control loops, evidence of tuned control loop performance shall be provided via graphical plots or trended data logs. Graphical plots shall minimally include depictions of setpoint, process variable (output), and control variable (e.g., temperature). Other parameters that may influence loop control shall also be included in the plot (e.g., fan on/off, mixed-air temp).
 3. For PID control loops, operator-initiated automatic and manual loop tuning algorithms shall be provided for all operator-selected PID control loops. Evidence of tuned control loop performance shall be provided via graphical plots or trended data logs for all loops.
 - a. In automatic mode, the controller shall perform a step response test with a minimum one-second resolution, evaluate the trend data, calculate the new PID gains and input these values into the selected LOOP statement.
 - b. Loop tuning shall be capable of being initiated either locally at the Building Controller, from a network workstation or remotely using dial-in modems. For all loop tuning functions, access shall be limited to authorized personnel through password protection.
- R. Logic programming: Provide a software routine that can build ladder logic to control using many conditional statements.
1. The logic programming syntax shall be able to combine ladder logic with other software features, such as combining status, scheduling, PDL and alarm conditions into one conditional decision.
 2. Logic programming shall be able to reference conditions in any other controller in the system.
- S. Staggered Start:
1. This application shall prevent all controlled equipment from simultaneously restarting after a power outage. The order in which equipment (or groups of equipment) is started, along with the time delay between starts, shall be user definable in an application and shall not require written scripts or ladder logic.
 2. Upon the resumption of power, each Building Controller shall analyze the status of all controlled equipment, compare it with normal occupancy scheduling and turn equipment on or off as necessary to resume normal operations.
- T. Totalization Features:
1. Run-Time Totalization. Building Controllers shall automatically accumulate and store run-time hours for all digital input and output points. A high runtime alarm shall be assigned, if required, by the operator.

2. Consumption totalization. Building Controllers shall automatically sample, calculate and store consumption totals on a daily, weekly or monthly basis for all analog and digital pulse input type points.
3. Event totalization. Building Controllers shall have the ability to count events such as the number of times a pump or fan system is cycled on and off. Event totalization shall be performed on a daily, weekly or monthly basis for all points. The event totalization feature shall be able to store the records associated with events before reset.

U. Data Collection:

1. A variety of historical data collection utilities shall be provided to manually or automatically sample, store, and display system data for all points.
2. Building Controllers shall store point history data for selected analog and digital inputs and outputs:
3. Any point, physical or calculated may be designated for trending. Any point, regardless of physical location in the network, may be collected and stored in each Building Controllers point group.
4. Two methods of collection shall be allowed: either by up to four pre-defined time intervals or upon a pre-defined change of value. Sample intervals of 1 minute to 7 days shall be provided.
5. Each Building Controller shall have a dedicated RAM-based buffer for trend data and shall be capable of storing a minimum of 10,000 data samples.
6. Trend data shall be stored at the Building Controllers and uploaded to the workstation when retrieval is desired. Uploads shall occur based upon either user-defined interval, manual command or when the trend buffers are full. All trend data shall be available for use in third-party personal computer applications.

2.7 BUILDING CONTROLLERS (B-BC)

- A. Provide all necessary hardware for a complete operating system as required. The Building Controller shall be able to operate as a standalone panel and shall not be dependent upon any higher level computer or another controller for operation.
- B. Basis of design is Siemens PX Modular and Compact Controllers (PXC).
- C. This level of controller shall be used for the following types of systems:
 1. Chiller plant systems
 2. Heating plant systems
 3. Cooling Towers
 4. Pumping systems
 5. VAV air handlers
 6. Air handlers
 7. Systems with over 24 input/output points
- D. Computing power and memory minimum:
 1. A 32-bit, stand-alone, multi-tasking, multi-user, real-time 100MHz digital control microprocessor module.
 2. Inputs shall be 16-bit minimum analog-to-digital resolution
 3. Outputs shall be 10-bit minimum digital-to-analog resolution
 4. Memory module (24 Megabyte, minimum) to accommodate all Primary Control Panel software requirements, including but not limited to, its own operating

- system and databases (see Controllers Software section), including control processes, energy management applications, alarm management applications, historical/trend data for points specified, maintenance support applications, custom processes, operator I/O, dial-up communications.
5. Real time clock and battery
 6. Data collection/ Data Trend module sized for 10,000 data samples.
 7. Flash Memory Firmware: Each Building Level Control Panel shall support firmware upgrades without the need to replace hardware.
- E. Onboard or Modular hardware and connections:
1. Primary Network communication module, if needed for primary network communications.
 2. Secondary Network communication module, if needed for secondary network communications.
 3. RJ45 port 10/100Mbaud
 4. RS485 ports for subnetworks and point expansion
 5. Man to Machine Interface port (MMI)
 6. USB Port
- F. Input and Output Points Hardware
1. Input/output point modules as required including spare capacity.
 2. Monitoring of the status of all hand-off-auto switches.
 3. Monitoring of all industry standard types of analog and digital inputs and outputs, without the addition of equipment to the primary control panel.
 4. Local status indication for each digital input and output for constant, up-to-date verification of all point conditions without the need for an operator I/O device. Each primary control panel shall perform diagnostics on all inputs and outputs and a failure of any input or output shall be indicated both locally and at the operator workstation.
 5. Graduated intensity LEDs or analog indication of value for each analog output.
- G. Code compliance
1. Approvals and standards: UL916; CE; FCC
 2. Provide UL864-UUKL where called for in the sequences of operations.
- H. Accessories:
1. Appropriate NEMA rated metal enclosure.
 2. Power supplies as required for all associated modules, sensors, actuators, etc.
- I. Keypad.
1. Where called for in the sequence of operation, or on the plans, a local keypad and display shall be provided for each controller. The keypad shall be provided for interrogating and editing data. An optional system security password shall be available to prevent unauthorized use of the keypad and display.
- J. The operator shall have the ability to manually override automatic or centrally executed commands at the primary control panels via local, point discrete, on-board hand/off/auto operator override switches. If on board switches are not available, provide separate control panels with HOA switches. Mount panel adjacent to primary control panel. Provide hand/off/auto switch for each digital output, including spares.

- K. Each Building Level Control Panel shall continuously perform self-diagnostics on all hardware modules and network communications. The System Level Control Panel shall provide both local and remote annunciation of any detected component failures, low battery conditions or repeated failure to establish communication with any system.
- L. Panel setup, point definitions and sequencing diagrams shall be backed up on EEPROM memory.
- M. Power loss. In the event of the loss of power, there shall be an orderly shutdown of all Building Controllers to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 30 days.
- N. Building Level control panels shall provide at least two serial data communication ports for operation of operator I/O devices such as industry standard printers, operator terminals, modems and portable laptop operator's terminals. Primary control panels shall allow temporary use of portable devices without interrupting the normal communications, operation of permanently connected modems, printers or terminals.
- O. Building Level Controllers shall have the capability to serve as a gateway between Modus subnetworks and the BAS System. Provide software, drives and programming.
- P. Isolation shall be provided at all primary control panel terminations, as well as all field point terminations to suppress induced voltage transients consistent with IEEE Standards 587-1980.
- Q. Spare Capacity: Provide enough inputs and outputs to handle the equipment shown to be "future" on drawings and 10% more of each point type. Provide all hardware modules, software modules, processors, power supplies, communication controllers, etc. required to ensure adding a point to the spare point location only requires the addition of the appropriate sensor/actuator and field wiring/tubing.
- R. Environment.
 - 1. Controller hardware shall be suitable for the anticipated ambient conditions.
 - 2. Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures and shall be rated for operation at 0°C to 49°C (32°F to 120°F).
 - 3. Controllers used in conditioned space shall be mounted in dust-proof enclosures and shall be rated for operation at 0°C to 49°C (32°F to 120°F).
- S. Immunity to power and noise.
 - 1. Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage.
 - 2. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 1 m (3 ft).
 - 3. Isolation shall be provided at all primary network terminations, as well as all field point terminations to suppress induced voltage transients consistent with:
 - a. RF-Conducted Immunity (RFCI) per ENV 50141 (IEC 1000-4-6) at 3V.
 - b. Electro Static Discharge (ESD) Immunity per EN 61000-4-2 (IEC 1000-4-2) at 8 kV air discharge, 4 kV contact.

- c. Electrical Fast Transient (EFT) per EN 61000-4-4 (IEC 1000-4-4) at 500V signal, 1 kV power.
- d. Output Circuit Transients per UL 864 (2,400V, 10A, 1.2 Joule max).
4. Isolation shall be provided at all Building Controller's AC input terminals to suppress induced voltage transients consistent with:
 - a. IEEE Standard 587 1980
 - b. UL 864 Supply Line Transients
 - c. Voltage Sags, Surge, and Dropout per EN 61000-4-11 (EN 1000-4-11)

2.8 ADVANCED APPLICATION CONTROLLERS

- A. Provide all necessary hardware for a complete operating system as required. The Advanced Application level control panel shall be able to operate as a standalone panel and shall not be dependent upon any higher level computer or another controller for operation.

2.9 APPLICATION SPECIFIC CONTROLLERS

- A. Each Application Level Control Panel shall operate as a stand-alone controller capable of performing its user selectable control routines independently of any other controller in the system. Each application specific controller shall be a microprocessor-based, multi-tasking, real-time digital control processor.
- B. Basis of design is Siemens BTEC controller.
- C. Provide a Application Specific Control Panel for each of the following types of equipment (if applicable):
 1. Constant Air Volume (CAV) boxes
 2. Chilled beams
 3. Duct mounted reheat coils
 4. Fan coil Units
 5. Fan Powered Variable Air Volume (VAV) Boxes
 6. Reheat Coils
 7. Supplemental AC units
 8. Variable Air Volume (VAV) Boxes
 9. Other terminal equipment
- D. Each Application Specific Controller shall, at a minimum, be provided with:
 1. Appropriate NEMA rated enclosure
 2. Floor Level network communications ability
 3. Power supplies as required for all associated modules, sensors, actuators, etc.
 4. Software as required for all sequences of operation, logic sequences and energy management routines.
 5. A portable operator terminal connection port
 6. Auxiliary enclosure for analog output transducers, isolation relays, etc. Auxiliary enclosure shall be part of primary enclosure or mounted adjacent primary enclosure
 7. Each controller measuring air volume shall include provisions for manual and automatic calibration of the differential pressure transducer in order to maintain stable control and insuring against drift over time

8. Each controller measuring air volume shall include a differential pressure transducer
 9. Approvals and standards: UL916; CE; FCC
- E. Each Application Specific Controller shall continuously perform self-diagnostics on all hardware and secondary network communications. The Application Specific Controller shall provide both local and remote annunciation of any detected component failures, low battery conditions, or repeated failure to establish communication to the system.
- F. Provide each Application Specific Controller with sufficient memory to accommodate point databases, operating programs, local alarming and local trending. All databases and programs shall be stored in non-volatile EEPROM, EPROM and PROM. The controllers shall be able to return to full normal operation without user intervention after a power failure of unlimited duration. Provide uninterruptible power supplies (UPSs) of sufficient capacities for all terminal controllers that do not meet this protection requirement. Operating programs shall be field-selectable for specific applications. In addition, specific applications may be modified to meet the user's exact control strategy requirements, allowing for additional system flexibility. Controllers that require factory changes of all applications are not acceptable.
- G. The Application Specific Controller shall be powered from a 24 VAC source provided by this contractor and shall function normally under an operating range of 18 to 28 VAC (-25% to +17%), allowing for power source fluctuations and voltage drops. Install plenum data line and sensor cable in accordance with local code and NEC. The controllers shall also function normally under ambient conditions of 32 to 122 F (0 to 50 C) and 10% to 95%RH (non-condensing). Provide each controller with a suitable cover or enclosure to protect the intelligence board assembly.
- 2.10 ROUTERS
- A. Provide a router for each subnetwork to connect the floor level network to the base building backbone level network.
- 2.11 BASE BUILDING BACKBONE PORTS
- A. On each floor, wing or major mechanical room provide an Ethernet RJ45 connection that allows connection to the IP network. An open port shall always be available and shall not require any part of the network to be disconnected. The location shall be accessible to the base building personnel and not in a location where the tenant can restrict the access.
- 2.12 CONTROL PANELS
- A. Controllers in mechanical rooms shall be mounted in NEMA 1 enclosures.
- B. Mount on walls at an approved location or provide a free standing rack.

- C. Panels shall be constructed of 16 gauge, furniture-quality steel, or extruded-aluminum alloy, totally enclosed, with hinged doors and keyed lock and with ANSI 61 gray polyester-powder painted finish, UL listed. Provide common keying for all panels.
- D. Provide power supplies for control voltage power.
- E. Dedicate 1 power supply to the DDC controller. Other devices shall be on a separate power supply, unless the power for the control device is derived from the controller terminations.
- F. Power supplies for controllers shall be a transformer with a fuse or circuit breaker. Power supplies for other devices can be plain transformers.
- G. All power supplies for 24V low voltage wiring shall be class 2 rated and less than 100VA. If low voltage devices require more amps, then provide multiple power supplies. If a single device requires more amps, then provide a dedicated power supply in a separate enclosure and run a separate, non-class 2 conduit to the device.
- H. Surge transient protection shall be incorporated in design of system to protect electrical components in all DDC Controllers and operator's workstations.
- I. All devices in a panel shall be permanently mounted, including network switches, modems, media converters, etc.
- J. Provide a pocket to hold documentation.

2.13 GENERAL SPECIFICATIONS FOR DEVICES

- A. Provide mounting hardware for all devices, including actuator linkages, wells, installation kits for insertion devices, wall boxes and fudge plates, brackets, etc.
- B. If a special tool is required to mount a device, provide that tool.

2.14 SENSORS

- A. Terminal Unit Space Thermostats
 - 1. Each controller performing space temperature control shall be provided with a matching room temperature sensor.
 - a. Plain Space Temperature Sensors – Wired: Where called for in the sequences or on the drawings, provide sensors with plain covers.
 - b. The sensing element for the space temperature sensor shall be thermistor type providing the following.
 - 1) Element Accuracy: + /- 1.0°F
 - 2) Operating Range: 55 to 95°F
 - 3) Set Point Adjustment Range: 55 to 95°F
 - 4) Calibration Adjustments: None required
 - 5) Installation: Up to 100 ft. from controller
 - 6) Auxiliary Communications Port: as required
 - 7) Local LCD Temperature Display: as required
 - 8) Setpoint Adjustment Dial as required
 - 9) Occupancy Override Switch as required

- c. Auxiliary Communication Port. Each room temperature sensor shall include a terminal jack integral to the sensor assembly. The terminal jack shall be used to connect a portable operator's terminal to control and monitor all hardware and software points associated with the controller. RS-232 communications port shall allow the operator to query and modify operating parameters of the local room terminal unit from the portable operator's terminal.
2. Digital Display temperature sensor specifications – Wired:
 - a. As called for in the sequences of operations or on the drawings, provide temperature sensors with digital displays.
 - b. The sensing element for the space temperature sensor must be IC-based and provide the following.
 - 1) Digitally communicating with the Application Specific Controller.
 - 2) Mountable to and fully covering a 2 x 4 electrical junction box without the need for an adapter wall plate.
 - 3) IC Element Accuracy: +/- 0.9°F
 - 4) Operating Range: 55 to 95°F
 - 5) Setpoint Adjustment Range: User limiting, selectable range between 55 and 95°F
 - 6) Display of temperature setpoint with numerical temperature values
 - 7) Display of temperature setpoint graphically, with a visual Hotter/Colder setpoint indication
 - 8) Calibration: Single point, field adjustable at the space sensor to +/- 5°F
 - 9) Installation: Up to 100 ft. from controller
 - 10) Auxiliary Communications Port: included
 - 11) Local OLED Temperature Display: included
 - 12) Display of Temperature to one decimal place
 - 13) Temperature Setpoint Adjustment included
 - 14) Occupancy Override Function included
 - c. Auxiliary Communication Port. Each room temperature sensor shall include a terminal jack integral to the sensor assembly. The terminal jack shall be used to connect a portable operator's terminal to control and monitor all hardware and software points associated with the controller. RS-232 communications port shall allow the operator to query and modify operating parameters of the local room terminal unit from the portable operator's terminal.
 3. Provide the following options as they are called for in the sequences or on the drawings:
 - a. Setpoint Adjustment. The setpoint adjustment function shall allow for modification of the temperature by the building operators. Setpoint adjustment may be locked out, overridden, or limited as to time or temperature through software by an authorized operator at any central workstation, Building Controller, room sensor two-line display, or via the portable operator's terminal.
 - b. Override Switch. An override button shall initiate override of the night setback mode to normal (day) operation when activated by the occupant and enabled by building operators. The override shall be limited to two (2) hours (adjustable.) The override function may be locked out, overridden, or limited through software by an authorized operator at the operator

interface, Building Controller, room sensor two-line display or via the portable operator's terminal.

- c. Space Combination Temperature and Humidity Sensors. Each controller performing space temperature control shall be provided with a matching room temperature sensor, which also includes the ability to measure humidity for either monitoring or control purposes. The combination temperature and humidity sensors shall have the same appearance as the space temperature sensors. Humidity elements shall measure relative humidity with a +/- 2% accuracy over the range of 10 to 90% relative humidity. Humidity element shall be an IC (integrated circuit) sensing element. Humidity sensing elements shall be removable and field replaceable if needed.

B. Temperature Sensors

1. All temperature sensors shall meet the following specifications:
 - a. Accuracy: Plus or minus 0.2 percent at calibration point.
 - b. Wire: Twisted, shielded-pair cable.
 - c. Vibration and corrosion resistant
2. Space temperature sensors shall meet the following specifications:
 - a. 10k ohm type 2 thermistors
3. Insertion Elements in Ducts shall meet the following specifications:
 - a. Single point 10k ohm thermistor
 - b. Use where not affected by temperature stratification
 - c. The sensor shall reach more than 1/3 the distance from the duct wall
 - d. Junction box for wire splices
4. Averaging Elements in Ducts shall meet the following specifications:
 - a. 72 inches (183 cm) long
 - b. Flexible
 - c. Use where prone to temperature stratification, in front of coils, or where ducts are larger than 9 sq. ft.
 - d. Junction box for wire splices
5. Insertion Elements for Liquids shall meet the following specifications:
 - a. Platinum RTD with 4-20mA transmitter
 - b. Threaded mounting with matching well
 - c. Brass well with minimum insertion length of 2-1/2 inches for pipes up to 4" diameter
 - d. Brass well with insertion length of 6 inches for pipes up to 10" diameter
 - e. Junction box for wire splices
6. Outside-Air Sensors Platinum RTD with 4-20mA transmitter:
 - a. Watertight enclosure, shielded from direct sunlight
 - b. Circulation fan
 - c. Watertight conduit fitting

C. Where called for in the sequences of operations, provide the following feature on space sensors and thermostats:

1. Security Sensors: Stainless-steel cover plate with insulated back and security screws
2. Space sensors with setpoint adjust: Plain white plastic cover with slide potentiometer to signal a setpoint adjustment to the DDC
3. Space Sensors with LCD display:
 - a. Operator buttons for adjusting setpoints, setting fans speeds and overriding unit to on/off

- b. Graphical LCD icons for signaling heating/cooling mode, fans speed, schedule mode, actual temperature and current setpoint

- D. Humidity Sensors shall meet the following specifications:
 - 1. Bulk polymer sensor element
 - 2. Accuracy: 2 percent full range with linear output
 - 3. Room Sensors: With locking cover matching room thermostats, span of 0 to 100 percent relative humidity
 - 4. Duct and Outside-Air Sensors: With element guard and mounting plate, range of 0 to 100 percent relative humidity

- E. Air Static Pressure Transmitter shall meet the following specifications:
 - 1. Non-directional sensor with suitable range for expected input, and temperature compensated.
 - 2. Accuracy: 2 percent of full scale with repeatability of 0.5 percent.
 - 3. Output: 4 to 20 mA.
 - 4. Building Static-Pressure Range: 0 to 0.25 inches wg.
 - 5. Duct Static-Pressure Range: 0 to 5 inches wg.

- F. Pressure Transmitters: Direct acting for gas, liquid, or steam service; range suitable for system; proportional output 4 to 20 mA.

- G. Equipment operation sensors as follows:
 - 1. Status Inputs for Fans: Differential-pressure switch with adjustable range of 0 to 5 inches wg.
 - 2. Status Inputs for Pumps: Differential-pressure switch piped across pump with adjustable pressure-differential range of 8 to 60 psig.
 - 3. Status Inputs for direct drive electric motors: Current-sensing relay with current transformers, adjustable and sized for 175 percent of rated motor current.
 - 4. Status inputs for belt drive electric motors: Current sensing transmitter with linear 4-20mA output

- H. Electronic Valve/Damper Position indication: Visual scale indicating percent of travel and 0 to 10 V dc, feedback signal.

- I. Water-Flow Switches: Pressure-flow switches of bellows-actuated mercury or snap-acting type, with appropriate scale range and differential adjustment, with stainless-steel or bronze paddle. For chilled-water applications, provide vapor proof type.

- J. Air Differential Pressure Switches: Diaphragm type air differential pressure switches with die cast aluminum housing, adjustable setpoint, minimum 5 amp switch rating at 120VAC, SPDT switches, and the switch pressure range shall be suited for the application. Provide Dwyer or equal. These switches shall be utilized for filter status.

- K. Leak detectors: Provide spot leak detectors that can be secured to the floor or secured to a drain pan. The detection shall use a microchip controlled energized probes. The detector shall operate on 24V or less. Provide a way to adjust the height of the leak probes. The SPDT contacts shall be inside a watertight enclosure.

2.15 ELECTRO-MECHANICAL THERMOSTATS

- A. Fire-Protection Thermostats: UL listed with fixed or adjustable settings to operate at not less than 75 deg F above normal maximum operating temperature, with the following:
 - 1. Reset: Automatic with control circuit arranged to require manual reset at central control panel, with pilot light and reset switch on panel labeled to indicate operation.
- B. Electric Low-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual- or automatic-reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or below set point. Setpoint shall be adjustable.
 - 1. Bulb Length: Minimum 20 feet.
 - 2. Quantity: One thermostat for every 20 sq. ft. of coil surface.
- C. Electric space thermostats: Provide a charged element type stat with snap acting SPDT switch. The switch shall be rated for 16A or 1HP at 120V.
- D. Aquastat: Provide a charged element type stat with snap acting SPDT switch. The switch shall be rated for 16A or 1HP at 120V.

2.16 SMOKE DETECTORS

- A. Provide a smoke detector for each unit above 2000 cfm. Turn it over to the mechanical contractor for installation. Wire it to stop the fan upon sensing smoke.

2.17 AUTOMATIC CONTROL VALVES

- A. General:
 - 1. All automatic control valves shall be fully proportioning, unless specified otherwise. The valves shall be quiet in operation and fail-safe in either normally open or normally closed position in the event of control air failure. All valves shall be capable of operating at varying rates of speed to correspond to the exact dictates of the controllers and variable load requirements. The valves shall be capable of operating in sequence with other valves and/or dampers when required by the sequence of operation. All control valves shall be sized by the control vendor and shall be guaranteed to accommodate the flow rates as scheduled. All control valves shall be suitable for the pressure conditions and shall close against the differential pressures involved. Body pressure rating and connection type construction shall conform to fitting and valve schedules. Control valve operators shall be sized to close against a differential pressure equal to the design pump heads plus 10 percent.
 - 2. Cold water, hot water and steam valves, throttling type, and bypass valves shall have equal percentage flow characteristics.
 - 3. Unless otherwise specified, control valves 2 inches and smaller shall have cast iron or bronze bodies with screwed NPT connections.
 - 4. Valves between 2-1/2 inch and 4 inch shall have cast iron bodies with flanged connections.
 - 5. All automatic control valves installed exposed to the elements shall be provided with electric actuators with operating characteristics and accessories as

described in herein. Coordinate with electrical contractor for power availability and point of connection.

6. All automatic control valves controlled by the BAS shall be furnished by the controls contractor unless noted otherwise in these documents.
 7. All automatic control valves shall be installed by the mechanical trade.
 8. The controls contractor shall provide wiring as follows:
 - a. All line voltage power for electric valve actuators shall be wired by the controls contractor from the nearest available power panel. Coordinate with electrical trade.
 - b. All wiring between the central control system (ATC/BMS) and the valve actuator shall be wired by the controls contractor.
 - c. All wiring between the valve actuator and their associated thermostats, pressure switches, control devices, etc. shall be wired by the controls contractor.
 - d. All wiring shall comply with code requirements. Segregate high and low voltage wiring & circuits and segregate the FAS and controls (BMS) terminals.
- B. Hot Water / Condenser Water / Control Valves
1. Single-seated.
 2. Fully proportioning with modulating plug or V-port inner valves.
 3. Body pressure rating and connection type construction shall conform to fitting and valve schedules. The ANSI rating of the valve shall match the ANSI rating of the piping in which the valve is installed. Minimum ANSI rating shall be ANSI 125.
 4. Stainless steel stems and trim.
 5. Spring loaded Teflon packing
 6. Quiet in operation.
 7. Fail-safe in either normally open or normally closed position in the event of power failure.
 8. Capable of operating in sequence with other valves and/or dampers when required by the sequence of operation.
 9. Capable of operating at varying rates of speed to correspond to the exact dictates of the controller and variable load requirements.
- C. Differential Pressure Control Valves :
1. Provide for all water systems where modulating water flow conditions are required to prevent excessive pump pressure build-up. Provide a valve for each closed loop water system. Valve to be globe type. Provide valves 2" and smaller with screwed end bodies and provide valves 2-1/2" and larger with flanged ends.
- D. Butterfly Valves
1. Furnish automatic butterfly valves for isolation requirements as shown on the drawings or required herein.
 2. Butterfly valves shall have body ratings in accordance with the piping specifications.
 3. Valves that are in high static locations or where flanges are ANSI300 per the piping design shall be high performance, fully lugged with carbon steel body ANSI 300 as required by pipe specifications.
 4. Valves that are in locations where ANSI150 flanges are allowed shall be ANSI 150 valves.
 5. Valves shall be bubble tight with 316 stainless steel disc, stainless steel shaft and reinforced Teflon seat.

6. Actuators shall be fail in place with factory mounted open and closed position limit switches mounted.
7. Provide fail in place, electric actuators with waterproof enclosure and crankcase heater for actuator and accessories mounted outside.
8. Provide manual override hand wheels for each valve.
9. Butterfly valves will only be approved for cooling tower bypass and all two-position (open or close) applications.
10. Valves must have full lug type body connections.

2.18 ELECTRONIC ACTUATOR SPECIFICATION

A. ELECTRONIC VALVE ACTUATORS

1. Actuator shall be fully modulating, floating (tri-state), two position, and/or spring return as indicated in the control sequences. Specified fail safe actuators shall require mechanical spring return.
2. Modulating valves shall be positive positioning, responding to a 2-10VDC or 4-20mA signal. There shall be a visual valve position indicator.
3. The actuator shall have the capability of adding auxiliary switches or feedback potentiometer if specified.
4. Actuator shall provide minimum torque required for proper valve close-off. The actuator shall be designed with a current limiting motor protection. A release button (clutch) or handle on the actuator shall be provided to allow for manual override (except when actuator is spring return type).
5. Actuators shall be UL listed.

B. ELECTRONIC DAMPER ACTUATORS

1. Actuator shall be direct coupled (over the shaft), enabling it to be mounted directly to the damper shaft without the need for connecting linkage. The actuator-to-shaft clamp shall use a "V" bolt and "V" shaped, toothed cradle to attach to the damper shaft for maximum holding strength. Single bolt or set screw type fasteners are not acceptable.
2. Actuator shall have electronic overload or digital rotation sensing circuitry to prevent damage to the actuator throughout the rotation of the actuator. End switches to deactivate the actuator at the end of rotation or magnetic clutch are not acceptable.
3. For power-failure/safety applications, a mechanical, spring return mechanism shall be used.
4. Actuators with spring return mechanisms shall be capable of either clockwise or counterclockwise spring return operation by simply changing the mounting orientation.
5. Proportional actuators shall accept a 2-10VDC, 4-20mA signal, or be of the 2 point floating type and provide a 2-10VDC actuator position feedback signal.
6. All actuators shall have an external manual gear release (clutch) or manual crank to aid in installation and for allowing manual positioning when the actuator is not powered.
7. All actuators shall have an external direction of rotation switch to aid in installation and to allow proper control response.
8. Actuators shall be provided with a factory-mounted 3-foot electrical cable and conduit fitting to provide easy hook-up to an electrical junction box.
9. Actuators shall be listed under Underwriters Laboratories Standard 873 and Canadian Standards Association. They must be manufactured under ISO 9001.

2.22 AIRFLOW CONTROL DEVICE – GENERAL

- A. The airflow control device shall be a Venturi valve by Phoenix Controls.
- B. The valve assembly manufacturer's Quality Management System shall be registered to ISO 9001:2000.
- C. The airflow control device shall be pressure independent over its specified differential static pressure operating range. An integral pressure independent assembly shall respond and maintain specific airflow within one second of a change in duct static pressure irrespective of the magnitude of pressure and/or flow change or quantity of airflow controllers on a manifold system.
- D. The airflow control device shall maintain accuracy within $\pm 5\%$ of signal over an airflow turndown range of no less than:

Pressure Drop Range	Airflow	Turndown	Valve Type
0.6- 3.0-inch WC	Devices up to 1,000 CFM (472 l/s)	20 to 1	Standard
	Devices up to 1,500 CFM (708 l/s)	16 to 1	Standard
	Devices up to 2,500 CFM (1,180 l/s)	12 to 1	Standard
	Devices up to 850 CFM (401 l/s)	17 to 1	Shutoff
	Devices up to 1,300 CFM (614 l/s)	14 to 1	Shutoff
0.3- 3.0-inch WC	Devices up to 550 CFM (260 l/s)	11 to 1	Standard
	Devices up to 1,050 CFM (496 l/s)	11 to 1	Standard

- E. No minimum entrance or exit duct diameters shall be required to ensure accuracy and/or pressure independence.
- F. The airflow control device shall be constructed of one of the following three types:
 - 1. Class A: The airflow control device for non-corrosive airstreams, such as supply and general exhaust, shall be constructed of 16-gauge aluminum. The device's shaft and shaft support brackets shall be made of 316 stainless steel. The pivot arm and internal mounting link shall be made of aluminum. The pressure independent springs shall be a spring-grade stainless steel. All shaft bearing surfaces shall be made of a Teflon, polyester or PPS (polyphenylene sulfide) composite.

2. Sound attenuating devices used in conjunction with general exhaust or supply airflow control devices shall be constructed using 24 gauge galvanized steel or other suitable material used in standard duct construction. No sound absorptive materials of any kind shall be used.

G. Actuation

1. For electrically actuated VAV operation, a UL 916 listed electronic actuator shall be factory mounted to the valve. Loss of main power shall cause the valve to position itself in an appropriate failsafe state. Options for these failsafe states include: normally open-maximum position, normally closed-minimum position and last position. This position shall be maintained constantly without external influence, regardless of external conditions on the valve (within product specifications).
2. The shutoff airflow control device shall have shutoff and casing leakage of no more than:

Static Pressure Across Valve in Shutoff	Airflow	Shutoff Leakage	Casing Leakage
5.0-inch WC	Shutoff devices up to 850 CFM (472 l/s)	6 CFM	0.12 CFM/ ft ²
	Shutoff devices up to 1,300 CFM (708 l/s)	6 CFM	0.12 CFM/ ft ²
	Low leakage shutoff devices up to 850 CFM (472 l/s)	0.005 CFM	0.010 CFM/ ft ²
	Low leakage shutoff devices up to 1,300 CFM (708 l/s)	0.010 CFM	0.010 CFM/ ft ²

H. The controllers for the airflow control devices shall be microprocessor based furnished by Phoenix with valves and operate using peer-to-peer control architecture. The room-level airflow control devices shall function as a standalone network.

I. The room-level control network shall utilize a LonTalk communications protocol.

J. There shall be no reliance on external or building-level control devices to perform room-level control functions. Each critical airflow control system shall have the capa-

- bility of performing pressurization control, temperature control, humidity control, and implement occupancy and emergency mode control schemes.
- K. The critical airflow control systems shall have the option of digital integration with the BMS.
- L. Certification
1. Each airflow control device shall be factory calibrated to the job specific airflows as detailed on the plans and specifications using NIST traceable air stations and instrumentation having a combined accuracy of no more than $\pm 1\%$ of signal over the entire range of measurement. Electronic airflow control devices shall be further calibrated and their accuracy verified to $\pm 5\%$ of signal at a minimum of 48 different airflows across the full operating range of the device.
 2. Each airflow control device shall be marked with device-specific factory calibration data. At a minimum, it should include the tag number, serial number, model number, eight-point characterization information (for electronic devices), and quality control inspection numbers. All information shall be stored by the manufacturer for use with as-built documentation.
- M. Airflow control devices that are not Venturi valves and airflow measuring devices (e.g., pitot tube, flow cross, air bar, orifice ring, vortex shedder, etc.) shall only be acceptable, provided these meet all the performance and construction characteristics as stated throughout this specification and:
1. The airflow control device employs transducers manufactured by Rosemount, Bailey, Bristol, or Foxboro. Accuracy shall be no less than $\pm 0.15\%$ of span (to equal $\pm 5\%$ of signal with a 15 to one turndown) over the appropriate full-scale range, including the combined effects of nonlinearity, hysteresis, repeatability, and drift over a one-year period, and temperature effect. 316L stainless steel materials shall be provided for all exhaust applications. The use of 304 stainless steel materials shall be provided for all make-up air applications.
 2. Airflow sensors shall be of a multi-point averaging type, 304 stainless steel for all supply and general exhaust applications, 316L stainless steel for all fume hood, canopy, snorkel, and biosafety cabinet applications. Single point sensors are not acceptable.
 3. Suppliers of airflow control devices or airflow measuring devices requiring minimum duct diameters shall provide revised duct layouts showing the required straight duct runs upstream and downstream of these devices. Coordination drawings reflecting these changes shall be submitted by the supplier of the laboratory airflow control system. In addition, suppliers shall include static pressure loss calculations as part of their submittals. All costs to modify the ductwork, increase fan sizes and horsepower and all associated electrical changes shall be borne by the laboratory airflow control supplier.

2.23 EXHAUST AND SUPPLY TRACKING PAIR DEVICE CONTROLLER

- A. One controller shall be supplied for both the supply airflow control device and the corresponding exhaust air control device. The controller shall be a microprocessor-based design and use closed-loop control to linearly regulate airflow based on a digital control signal. The device shall generate a digital feedback signal that represents its airflow.
- B. In flow tracking applications, where an exhaust device is tracking a supply device, flow data for each device shall be downloaded to the controller in the factory.
- C. The airflow control device shall store its control algorithms in non-volatile, rewritable memory. The device shall be able to stand alone or to be networked with other room-level digital airflow control devices through an industry standard protocol.
- D. Room-level flow tracking control functions shall be embedded in and executed by one controller mounted on one of the airflow devices.
- E. The room-level control network shall communicate by using the LonTalk® protocol. The controller must be a LONMARK certified device utilizing the Space Comfort Controller, Variable Air Volume (SCC-VAV Object type 8502) profile.
- F. The airflow control device shall use 24 Vac power $\pm 15\%$, the industry standard.
- G. The airflow control device shall be able to connect a notebook PC commissioning tool. Every node on the local network shall be accessible.
- H. The airflow control device shall have integral input/output for the following functions: temperature control, humidity control, occupancy control, emergency control, shut-off control, and non-network sensor switches and control devices. At a minimum, the airflow controller shall have:
 - 1. Base models shall have three universal inputs capable of accepting 0 to 10 Vdc, 4 to 20 mA, 0 to 65 K ohms, or Type 2 or Type 3, 10 K ohm @ 25 degree C; thermistor temperature sensors available for space temperature, setpoint lever adjust and discharge air temperature.
 - 2. Expanded models shall have five universal inputs capable of accepting 0 to 10 Vdc, 4 to 20 mA, 0 to 65 K ohms, or Type 2 or Type 3, 10 K ohm @ 25 degree C, thermistor temperature sensors available for space temperature, setpoint lever adjust and discharge air temperature, humidity control (UI 4 and 5) and pressure monitoring (UI 4 and 5).
 - 3. One digital input capable of accepting a dry contact or logic-level signal input, which may be used for occupancy override via a local room-level sensor.
 - 4. All inputs shall have an accuracy of $\pm 1\%$ F.S.
 - 5. All models shall have two analog outputs capable of developing either a 0 to 10 Vdc or 4 to 20 mA linear control signal, to be available for duct reheat and ancillary room heat (i.e., fin tube radiation, radiant heat panels, each with its own independent PID control loops).

6. All models shall one floating point Triac® output available for proportional reheat coil valve operation. This output shall have a rating of 6 VA Max at 24 VAC.
7. All models shall have one Form C (SPDT) relay output capable of driving up to 1 A @ 24 Vac/Vdc to be available for local audio/visual alarms.
8. All outputs shall have the following accuracies:
 - a. 0 to 10 Vdc- ± 1% F.S. into 10 K ohms minimum
 - b. 4 to 20 mA- ±1% F.S. into 500 ohms, +0 ohms/ -50 ohms
- I. The airflow control device shall meet the following agency compliance requirements: FCC Part 15 Subpart J Class A, CE and CSA.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. The project plans shall be thoroughly examined for control device and equipment locations. Any discrepancies, conflicts, or omissions shall be reported to the architect/engineer for resolution before rough-in work is started.
- B. The contractor shall inspect the site to verify that equipment may be installed as shown. Any discrepancies, conflicts, or omissions shall be reported to the engineer for resolution before rough-in work is started.
- C. The contractor shall examine the drawings and specifications for other parts of the work. If head room or space conditions appear inadequate—or if any discrepancies occur between the plans and the contractor's work and the plans and the work of others—the contractor shall report these discrepancies to the engineer and shall obtain written instructions for any changes necessary to accommodate the contractor's work with the work of others.

3.2 INSTALLATION

- A. Provide all relays, switches, sources of emergency and UPS battery back-up electricity and all other auxiliaries, accessories and connections necessary to make a complete operable system in accordance with the sequences specified. All field wiring shall be by this contractor.
- B. Install controls so that adjustments and calibrations can be readily made. Controls are to be installed by the control equipment manufacturer.
- C. Mount surface-mounted control devices on brackets to clear the final finished surface on insulation.
- D. Install equipment level and plumb.
- E. Install control valves horizontally with the power unit up.

- F. Unless otherwise noted, install wall mounted thermostats and humidistat 60" above the floor measured to the center line of the instrument, or as otherwise directed by the Architect.
- G. Install averaging elements in ducts and plenums in horizontal crossing or zigzag pattern.
- H. Install outdoor sensors in perforated tube and sunshield.
- I. Install damper motors on outside of duct in protected areas, not in locations exposed to outdoor temperatures.
- J. Install labels and nameplates on each control panel listing the name of the panel referenced in the graphics and a list of equipment numbers served by that panel.
- K. Furnish hydronic instrument wells, valves, and other accessories to the mechanical contractor for installation.
- L. Furnish automatic dampers to mechanical contractor for installation.

3.3 ELECTRICAL WIRING SCOPE

- A. This contractor shall be responsible for power that is not shown on the electrical drawings, to controls furnished by this contractor. If power circuits are shown on the electrical drawings, this contractor shall continue the power run to the control device. If power circuits are not shown, this contractor shall coordinate with the electrical contractor to provide breakers at distribution panels for power to controls. This contractor is then responsible for power from the distribution panel.
 - 1. Coordinate panel locations. If enclosures for panels are shown on the electrical drawings, furnish the enclosures according to the electrician's installation schedule.
- B. This contractor shall not be responsible for power to control panels and control devices that are furnished by others, unless it is part of the control interlock wiring.
- C. Refer to Coordination section for what devices this contractor is responsible to mount and which are turned over to others to mount.
- D. This contractor shall be responsible for wiring of any control device that is furnished as part of this section of specification.
- E. Wiring for controls furnished by others:
 - 1. Provide control wiring for HVAC controls furnished by others. Wiring may include, but not limited to, the following items:
 - a. Thermostats
 - b. Condensers
 - c. Chiller control devices shipped loose
 - d. Leak detectors
 - e. Humidifier controls
 - f. Refrigerant leak monitoring systems
 - g. Exhaust or Purge fans
 - h. Manual switches for HVAC equipment (not shown on electrical drawings)
 - i. Emergency ventilation switches (not shown on electrical drawings)

- j. Emergency shutdown switches (not shown on electrical drawings)
2. Provide control wiring for the following non-HVAC controls furnished by others if they are called for in this project:
 - a. Electrical vault fans
 - b. Emergency generator dampers
 - c. Water treatment
 - d. Interlock to fire suppression system
 - e. Leak detection system
 - f. Fuel oil monitoring system
 - g. Fuel oil fill system

F. Interlock wiring shall be run in separate conduits from BAS associated wiring.

G. Provide network wiring for equipment that is called to be integrated to the BAS.

3.4 ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. All low voltage control wiring shall be class 2. Control wiring that is not class 2 shall be run in separate conduits from class 2 wiring.

B. Floor level network wiring between terminal units can be combined with thermostat and other low voltage wiring in the same conduit. All other network wiring shall be in dedicated conduits.

C. Install raceways, boxes, and cabinets according to Division 26 Section "Raceways and Boxes."

D. Install building wire and cable according to Division 26 Section "Conductors and Cables."

E. Installation shall meet the following requirements:

1. Conceal cable and conduit, except in mechanical rooms and areas where other conduit and piping are exposed.
2. Install exposed cable in raceway or conduit.
3. Install concealed cable using plenum rated cable.
4. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
7. All wiring in lab areas shall be in conduit.
8. All unsupported risers shall be rigid steel conduit. Supported risers shall be EMT.

F. Concealed control conduit and wiring shall be provided in all spaces except in the Mechanical Equipment Rooms and in unfinished spaces. Install in parallel banks with all changes in directions made at 90 degree angles.

G. Install conduit adjacent to machine to allow service and maintenance.

- H. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.
- I. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.
- J. Ground equipment.

3.5 COMMUNICATION WIRING

- A. All cabling shall be installed in a neat and workmanlike manner. Follow manufacturer's installation recommendations for all communication cabling.
- B. Do not install communication wiring in raceway and enclosures containing Class 1 wiring.
- C. Maximum pulling, tension, and bend radius for cable installation, as specified by the cable manufacturer, shall not be exceeded during installation.
- D. Contractor shall verify the integrity of the entire network following the cable installation. Use appropriate test measures for each particular cable.
- E. Cable bundling:
 - 1. RS485 cabling run open air in accessible areas can be bundled with other class 2 low voltage cabling.
 - 2. RS485 cabling run between terminal units in conduits above ceilings or under floors or in inaccessible areas can be bundled with other class 2 low voltage cabling.
 - 3. RS485 cabling run between floors shall be in a communication only conduit.
 - 4. RS485 conduit run long distances between utility rooms or between buildings shall be in a communication only conduit.
 - 5. Ethernet cabling shall be in a communication only conduit.
 - 6. Ethernet and RS485 can be run together.
 - 7. Fiber optics can be run with Ethernet and RS485 cabling as long as the conduit is bent to fiber optic standards and junction boxes are sized for fiber optic use.
- F. FLN or BACnet BACnet MS/TP Cabling
 - 1. RS485 cabling shall be used for BACnet MS/TP networks.
 - 2. RS485 shall use low capacitance, 20-24 gauge, twisted shielded pair.
 - 3. The shields shall be tied together at each device.
 - 4. The shield shall be grounded at one end only and capped at the other end.
 - 5. Provide end of line (EOL) termination devices at each end of the RS485 network or subnetwork run, to match the impedance of the cable, 100 to 120ohm.
- G. Ethernet Cabling
 - 1. Ethernet shall not be run with any Class 1 or low voltage Class 2 wiring.
 - 2. CAT6, unshielded twisted pair (UTP) cable shall be used for BAS Ethernet.
 - 3. Solid wire shall be used for long runs, between mechanical rooms and between floors. Stranded cable can be used for patch cables and between panels in the same mechanical room up to 50 feet away.

4. When the BAS Ethernet connects to an Owner's network switch, document the port number on the BAS As-builts.
- H. When a cable enters or exits a building, a lightning arrestor must be installed between the lines and ground. The lightning arrestor shall be installed according to the manufacturer's instructions.
- I. All runs of communication wiring shall be unspliced length when that length is commercially available.
- J. All communication wiring shall be labeled to indicate origination and destination data.
- K. Grounding of coaxial cable shall be in accordance with NEC regulations article on "Communications Circuits, Cable, and Protector Grounding."

3.6 Fiber Optic Cable System:

- A. Maximum pulling tensions as specified by the cable manufacturer shall not be exceeded during installation. Post-installation residual cable tension shall be within cable manufacturer's specifications.
- B. All cabling and associated components shall be installed in accordance with manufacturers' instructions. Minimum cable and unjacketed fiber bend radii, as specified by cable manufacturer, shall be maintained.
- C. All terminations shall to be made into a patch panel, designed for such use. Free air terminations with patch panels are prohibited.

3.7 IDENTIFICATION

- A. Permanent warning labels shall be affixed to all equipment that can be automatically started by the DDC system.
 1. Labels shall use white lettering (12-point type or larger) on a red background.
 2. Warning labels shall read as follows: **C A U T I O N This equipment is operating under automatic control and may start or stop at any time without warning. Switch disconnect to "Off" position before servicing.**
- B. Permanent warning labels shall be affixed to all motor starters and all control panels that are connected to multiple power sources utilizing separate disconnects.
 1. Labels shall use white lettering (12-point type or larger) on a red background.
 2. Warning labels shall read as follows: **C A U T I O N This equipment is fed from more than one power source with separate disconnects. Disconnect all power sources before servicing.**
- C. Control Equipment and Device labeling:
 1. Labels and tags shall match the unique identifiers shown on the as-built drawings.
 2. All Enclosures shall be labeled to match the as-built drawing by either control panel name or the names of the DDC controllers inside.
 3. All sensors and actuators not in occupied areas shall be tagged.
 4. Airflow measurement arrays shall be tagged to show flow rate range for signal output range, duct size, and pitot tube AFMS flow coefficient.

5. Duct static pressure taps shall be tagged at the location of the pressure tap.
 6. Each device inside enclosures shall be tagged.
 7. Terminal equipment need only have a tag for the unique terminal number, not for each device. Match the unique number on:
 - a. First, the design drawings, or
 - b. Second, the control as-builts, or
 - c. Third, the DDC addressing scheme
 8. Tags on the terminal units shall be displayed on the Operator Workstation Graphics.
- D. Tags shall be mechanically printed on permanent adhesive backed labeling strips, 12 point height minimum.
- E. Manufacturers' nameplates and UL or CSA labels are to be visible and legible after equipment is installed.
- F. Identification of Wires
1. Tag each wire with a common identifier on each end of the wire, such as in the control panel and at the device termination.
 2. Tag each network wire with a common identifier on each end.
 3. Tag each 120V power source with the panel and breaker number it is fed by.
- G. Identification of Conduits:
1. Identify the low voltage conduit runs as BAS conduit, power feeds not included.
 2. Identify each electric box, junction box, utility box and wiring tray with a blue paint mark or blue permanent adhesive sticker.
 3. For conduit runs that run more than 8 ft between junction boxes in 1 room, place a blue identifier at least every 8 feet.
 4. Place a blue identifier on each side of where a conduit passed through a wall or other inaccessible path.
 5. Identify all BAS communication conduits the same as above.

3.8 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.
1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove malfunctioning units, replace with new units, and retest.
 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment, and retest.
 3. Calibration test controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
- B. Engage a factory-authorized service representative to perform startup service.
- C. Replace damaged or malfunctioning controls and equipment.
1. Start, test, and adjust control systems.

2. Demonstrate compliance with requirements, including calibration and testing, and control sequences.
3. Adjust, calibrate, and fine tune circuits and equipment to achieve sequence of operation specified.

3.9 SYSTEM CHECKOUT AND STARTUP

- A. Inspect each termination in the MER control panels and devices to make sure all wires are connected according to the wiring diagrams and all termination are tight.
- B. After the controls devices and panels are installed and power is available to the controls, perform a static checkout of all the points, including the following:
 1. Inspect the setup and reading on each temperature sensor against a thermometer to verify its accuracy.
 2. Inspect the setup and reading on each humidity sensor against a hygrometer to verify its accuracy.
 3. Inspect the reading on each CO2 sensor using a calibration kit to verify the sensor range accuracy matches the DDC setup.
 4. Inspect the reading of each status switch to verify the DDC reads the open and close correctly.
 5. Command each relay to open and close to verify its operation.
 6. Command each 2-position damper actuator to open and close to verify operation.
 7. Command each 2-position valve to open and close to verify operation.
 8. Ramp each modulating actuator to 0%, 25%, 50%, 75% and 100% to verify its operation.
 9. Ramp each modulating output signal, such as a VFD speed, to verify its operation.
 10. Test each safety device with a real life simulation, for instance check freezestats with ice water, water detectors with water, etc.
- C. Document that each point was verified and operating correctly. Correct each failed point before proceeding to the dynamic startup.
- D. Verify that each DDC controller communicates on its respective network correctly.
- E. After all of the points are verified, and power is available to the mechanical system, coordinate a startup of each system with the mechanical contractor. Include the following tests:
 1. Start systems from DDC.
 2. Verify that each setpoint can be met by the system.
 3. Change setpoints and verify system response.
 4. Change sensor readings to verify system response.
 5. Test safety shutdowns.
 6. Verify time delays.
 7. Verify mode changes.
 8. Adjust filter switches and current switches for proper reactions.
 9. Adjust proportional bands and integration times to stabilize control loops.
- F. Perform all program changes and debugging of the system for a fully operational system.

- G. Verify that all graphics at the operator workstations correspond to the systems as installed. Verify that the points on the screens appear and react properly. Verify that all adjustable setpoints and manual commands operate from the operator workstations.
- H. After the sequence of operation is verified, setup the trends that are listed in the sequence of operations for logging and archiving for the commissioning procedure.

3.10 SYSTEM COMMISSIONING, DEMONSTRATION AND TURNOVER

- A. The BAS Contractor shall prepare and submit for approval a complete acceptance test procedure including submittal data relevant to point index, functions, sequence, interlocks, and associated parameters, and other pertinent information for the operating system. Prior to acceptance of the BAS by the Owner and Engineer, the BAS contractor shall completely test the BAS using the approved test procedure.
- B. After the BAS contractor has completed the tests and certified the BAS is 100% complete, the Engineer shall be requested, in writing, to approve the satisfactory operation of the system, sub-systems and accessories. The BAS contractor shall submit Maintenance and Operating manuals at this time for approval. An acceptance test in the presence of the Engineer and Owner's representative shall be performed. The Owner will then shake down the system for a fixed period of time (30 days).
- C. The BAS contractor shall fix punch list items within 30 days of acceptance.
- D. When the system performance is deemed satisfactory in whole or in part by these observers, the system parts will be accepted for beneficial use and placed under warranty.

3.11 PROJECT RECORD DOCUMENTS

- A. Project Record Documents: Submit three (3) copies of record (as-built) documents upon completion of installation. Submittal shall consist of:
 - 1. Project Record Drawings. As-built versions of the submittal shop drawings provided as AutoCAD compatible files in electronic format and as 11 x 17 inch prints.
 - 2. Testing and Commissioning Reports and Checklists. Completed versions of reports, checklists, and trend logs used to meet requirements in the Control System Demonstration and Acceptance section of this specification.
 - 3. Operation and Maintenance (O & M) Manual.
 - a. As-built versions of the submittal product data.
 - b. Names, addresses, and 24-hour telephone numbers of installing contractors and service representatives for equipment and control systems.
 - c. Operator's Manual with procedures for operating control systems, logging on and off, handling alarms, producing point reports, trending data, overriding computer control, and changing setpoints and variables.
 - d. Programming manual or set of manuals with description of programming language and of statements for algorithms and calculations used, of point database creation and modification, of program creation and modification, and of editor use.

- e. Engineering, installation, and maintenance manual or set of manuals that explains how to design and install new points, panels, and other hardware; how to perform preventive maintenance and calibration; how to debug hardware problems; and how to repair or replace hardware.
 - f. Documentation of all programs created using custom programming language, including setpoints, tuning parameters, and object database.
 - g. Graphic files, programs, and database on electronic media.
 - h. List of recommended spare parts with part numbers and suppliers.
 - i. Complete original-issue documentation, installation, and maintenance information for furnished third-party hardware, including computer equipment and sensors.
 - j. Complete original original-issue copies of furnished software, including operating systems, custom programming language, operator workstation software, and graphics software.
 - k. Licenses, guarantees, and warranty documents for equipment and systems.
- B. Operating manual to serve as training and reference manual for all aspects of day-to-day operation of the system. As a minimum include the following:
- 1. Sequence of operation for automatic and manual operating modes for all building systems. The sequences shall cross-reference the system point names.
 - 2. Description of manual override operation of all control points in system.
 - 3. BMS system manufacturers complete operating manuals.
- C. Provide maintenance manual to serve as training and reference manual for all aspects of day-to-day maintenance and major system repairs. As a minimum include the following:
- 1. Complete as-built installation drawings for each building system.
 - 2. Overall system electrical power supply schematic indicating source of electrical power for each system component. Indicate all battery backup provisions.
 - 3. Photographs and/or drawings showing installation details and locations of equipment.
 - 4. Routine preventive maintenance procedures, corrective diagnostics troubleshooting procedures, and calibration procedures.
 - 5. Parts list with manufacturer's catalog numbers and ordering information.
 - 6. Lists of ordinary and special tools, operating materials supplies and test equipment recommended for operation and servicing.
 - 7. Manufacturer's operation, set-up, maintenance and catalog literature for each piece of equipment.
 - 8. Maintenance and repair instructions.
 - 9. Recommended spare parts.
- D. Provide Programming Manual to serve as training and reference manual for all aspects of system programming. As a minimum include the following:
- 1. Complete programming manuals, and reference guides.
 - 2. Details of any custom software packages and compilers supplied with system.
 - 3. Information and access required for independent programming of system.

3.12 TRAINING

- A. During System commissioning and at such time as acceptable performance of the Building Automation System hardware and software has been established, the BAS

contractor shall provide on-site operator instruction to the owner's operating personnel. Operator instruction during normal working hours shall be performed by a competent building automation contractor representative familiar with the Building Automation System's software, hardware and accessories.

- B. At a time mutually agreed upon, during System commissioning as stated above, the BAS contractor shall give 16-hours of onsite training on the operation of all BAS equipment. Describe its intended use with respect to the programmed functions specified. Operator orientation of the automation system shall include, but not be limited to:
1. Explanation of drawings and operator's maintenance manuals.
 2. Walk-through of the job to locate all control components.
 3. Operator workstation and peripherals.
 4. DDC Controller and ASC operation/sequence.
 5. Operator control functions including scheduling, alarming, and trending.
 6. Explanation of adjustment, calibration and replacement procedures.
- C. Additional 8-hours of training shall be given after the 30 day shakedown period.
- D. Since the Owner may require personnel to have more comprehensive understanding of the hardware and software, additional training must be available from the Contractor. If the Owner requires such training, it will be contracted at a later date. Provide description of available local and factory customer training. Provide costs associated with performing training at an off-site classroom facility and detail what is included in the manufacturer's standard pricing such as transportation, meals, etc.

END OF SECTION

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SECTION 230993 – SEQUENCES OF OPERATION

1. POWER FAILURE

Items noted below have been connected to the emergency generator system and shall remain functional during a power outage. When power has been restored to normal for a minimum of two minutes, the mechanical equipment shall restart at 30-second intervals (adjustable) in a predetermined sequence.

- Booster Fan F-1
- Fan Filter Unit FFU-1, FFU-2, FFU-3, FFU-4, FFU-5, FFU-6
- VAV boxes VR-#

2. SCHEDULE

Although specific set points, time periods and reset values are listed in the sequence of operation, all values shall be changeable through the Facility Management System console or portable operators' terminal. The initial occupied/unoccupied schedules shall be as designated by the owners representative.

3. PHARMACY COMPOUNDING ROOM

The fan filter units serving the Ante room and Non-Hazardous Compounding room shall run continuously. The fan filter units are equipped with a Bacnet controller. The BAS shall monitor and display all available points to the user interface including: airflow, filter pressure drop, and fan speed. The fan status and pressure drop across the HEPA filter shall be monitored and alarmed by the BMS system.

Displays for (2) room digital pressure monitors (TSI Pressura model RPM20 or equal) are installed next to the door entering the Ante room compounding area as shown on the plans. A room sensor and reference sensor provide direct measurement between the pharmacy work room and Ante room. A separate sensor provides measurement between the Ante room and Non-Hazardous Compounding room. The differential pressure monitor shall have an audible and visual alarm, key switch to disable the monitor, and a door switch input. An adjustable alarm delay prevents nuisance alarms caused by opening the door. The monitor displays the room pressurization.

A constant volume VAV box supplies constant airflow to the return air inlet of the fan filter units. The zone reheat coil valve modulates to maintain the space temperature setpoint.

An inline booster fan F-1 operates continuously to maintain constant return air pressure for the compounding return grilles. The fan is equipped with an EC motor and the speed shall be controlled to maintain a constant duct static pressure setpoint as measured by the BAS near the fan inlet. The ATC contractor shall furnish and install the pressure sensor and monitor fan status, inlet pressure, fan command, and all other available points.

The ATC contractor shall work with the TAB contractor during balancing to determine the fan speed required to maintain +0.02" w.g. pressure at each of the compounding spaces.

4. COMPOUNDING ROOM TRENDING REQUIREMENTS

The BAS shall monitor and trend the space temperature, space humidity, space pressurization, and average daily temperature & humidity. Measuring points shall be taken at a frequency of 10 minute intervals (adjustable) and shall maintain the measurement history for one month of data (adjustable). Coordinate page layout and reporting requirements with owner's representative.

5. VAV BOX WITH HOT WATER REHEAT

The variable volume (VAV) terminal unit is controlled independent of system pressure fluctuations by an application specific DDC controller using electric actuation. The VAV terminal unit is controlled within user defined maximum and minimum supply air volume settings. The controller monitors the room temperature sensor and air velocity sensor and modulates the supply air damper in sequence with the reheat valve to maintain the room temperature at set point. The space served by the VAV terminal unit is controlled as follows:

When the zone temperature is between the effective heating setpoint and the effective cooling setpoint (inside the bias), the VAV controller will be Satisfied and the airflow setpoint will be at minimum. The VAV air damper will modulate to maintain the airflow setpoint and there will be no mechanical heating.

On a rise in zone temperature above the effective cooling setpoint, the VAV controller will switch to Primary Cooling mode and the airflow setpoint will modulate up to the maximum cooling airflow setpoint. The VAV air damper will modulate to maintain the airflow setpoint and there will be no mechanical heating.

On a drop in zone temperature below the effective heating setpoint, the VAV controller will switch to the Box Heating mode:

- The first stage of heating (PID between 0% and 50%) will modulate the discharge air temperature setpoint up to a maximum of 14 deg F above the zone temperature.
 - When the heating PID is between 0% and 50%, the airflow setpoint will be at its minimum specified airflow. The VAV air damper will modulate to maintain the airflow setpoint. Rooms with perimeter radiant heating will open the heating valve to the radiator before opening the VAV re-heat valve.
 - The discharge air temperature setpoint will reset from the air handler supply air temperature setpoint to 14 deg F above the current zone temperature.
- When the heating PID is between 50% and 100% , the airflow setpoint will modulate from the minimum to the maximum heating airflow setpoint. The VAV air damper will modulate to maintain the airflow setpoint. The reheat valve will modulate to maintain the discharge air temperature setpoint at 14 deg F above the current zone temperature.

END OF SECTION

SECTION 232113 - HYDRONIC 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 pipe and fitting materials and joining methods for the following:
 - 1. Hot-water heating piping.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of the following:
 - 1. Steel pipe and fittings.
 - 2. Copper pipe, tubing and fittings.
 - 3. Dielectric fittings.
- B. Delegated-Design Submittal:
 - 1. Design calculations and detailed fabrication and assembly of pipe anchors and alignment guides, hangers and supports for multiple pipes, expansion joints and loops, and attachments of the same to the building structure.
 - 2. Locations of pipe anchors and alignment guides and expansion joints and loops.
 - 3. Locations of and details for penetrations, including sleeves and sleeve seals for exterior walls, floors, basement, and foundation walls.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Piping layout, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Suspended ceiling components.
 - 2. Other building services.
 - 3. Structural members.
- B. Qualification Data: For Installer.
- C. Welding certificates.

- D. Field quality-control reports: Written reports as specified in Part 3 of this section including:
1. Test procedures used.
 2. Test results showing compliance with specified requirements.
 3. Failed test results with corrective action taken to achieve compliance with specified requirements.

1.5 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
1. Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.
 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

1.6 COORDINATION

- A. Coordinate layout and installation of hydronic piping and suspension system components with other construction, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.
- B. Coordinate pipe sleeve installations for foundation wall penetrations.
- C. Coordinate piping installation with roof curbs, equipment supports, and roof penetrations. Roof specialties are specified in Division 7 Sections.
- D. Coordinate pipe fitting pressure classes with products specified in related sections.
- E. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into base. Concrete, reinforcement, and formwork requirements are specified in Division 3 Sections.
- F. Coordinate installation of pipe sleeves for penetrations through exterior walls and floor assemblies. Coordinate with requirements for firestopping specified in Division 7 Section "Through-Penetration Firestop Systems" for fire and smoke wall and floor assemblies.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

- A. **Drawn-Temper Copper Tubing: ASTM B 88, Type L.**

2.2 STEEL PIPE AND FITTINGS

- A. Steel Pipe: ASTM A 53, black steel with plain ends; welded and seamless, Grade B, and wall thickness as indicated in "Piping Applications" Article.
- B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250 as indicated in "Piping Applications" Article.
- C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300 as indicated in "Piping Applications" Article.
- D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in "Piping Applications" Article.
- E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced as indicated in "Piping Applications" Article.
- F. Wrought-Steel Fittings: ASTM A 234, wall thickness to match adjoining pipe.
- G. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
 - 1. Material Group: 1.1.
 - 2. End Connections: Butt welding.
 - 3. Facings: Raised face.
- H. Forged Steel "Olet" Type Fittings, Welding, Socket-Welding and Threaded: ASME B16.11 and ASTM A105.
 - 1. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- I. Steel Pipe Nipples: ASTM A 733, made of same materials and wall thicknesses as pipe in which they are installed.

2.3 JOINING MATERIALS

- A. 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 (3.2-mm) maximum thickness unless otherwise 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.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

- D. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.
- E. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 DIELECTRIC FITTINGS

- A. General: Assembly or fitting with insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.
 - 1. Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc. Capitol Manufacturing Co.
 - c. Capitol Manufacturing Company.
 - d. Central Plastics Company.
 - e. Elster Perfection.
 - f. Grinnell Mechanical Products.
 - g. Matco-Norca.
 - h. Pipeline Seal and Insulator, Inc.
 - i. Precision Plumbing Products, Inc.
 - j. Victaulic Company.
 - k. Watts Regulator Co.
 - l. Zurn Industries, LLC.
- B. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld-neck end types and matching piping system materials.
- C. Insulating Material: Suitable for system fluid, pressure, and temperature.
- D. **End Connections:** Threaded, or flanged.
- E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and **300-psig** minimum working pressure at **225 deg F**.
- F. Dielectric Nipples or Waterways: Electroplated steel with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and **300-psig** minimum working pressure at **225 deg F**.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Hot-water heating piping, aboveground, NPS 2 and smaller shall be **[any of]** the following:
 - 1. **Type L** drawn-temper copper tubing, wrought-copper fittings, and **soldered** joints.
 - 2. **Schedule 40**, Grade B, Type 96 steel pipe; **Class 125, cast-iron** fittings; cast-iron flanges and flange fittings; and threaded joints.

- B. Hot-water heating piping, aboveground, NPS 2-1/2 and larger, shall be **any of** the following:
 - 1. **Type L**, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
 - 2. **Schedule 40** steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
- C. Blowdown-Drain Piping: Same materials and joining methods as for piping specified for the service in which blowdown drain is installed.
- D. Air-Vent Piping:
 - 1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to piping manufacturer's written instructions.
 - 2. Outlet: Type K, annealed-temper copper tubing with soldered or flared joints.
- E. Safety-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed with metal-to-plastic transition fittings for plastic piping systems according to piping manufacturer's written instructions.

3.2 PIPING INSTALLATIONS

A. PRE-WORK / PRE-REQUISITES

- 1. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- 2. The Contractor shall study the architectural, structural, mechanical, electrical and other drawings to eliminate conflict of piping with other structure lighting or other services.

B. CONDITION

- 1. All installed pipe lines shall be free from dents, scars, and burrs, with ends reamed smooth.
- 2. All piping shall be clean and free from acids and loose dirt when installed and shall be kept clean during the completion of the installation.
- 3. Install piping free of sags and bends.
- 4. All installed pipe lines shall remain straight against strains tending to cause distortion during system operation. The contractor shall make proper allowance for pipe line expansion and contraction so that no unsightly distortion, noise, damage or improper operation results therefrom.

C. SELECTION

1. Select system components with pressure rating equal to or greater than system operating pressure.
2. No street type fittings shall be used.
3. No short nipples shall be used except at drain valves.
4. Plugs of rags, wools, cottons, waste, or similar materials may not be used for plugging.

D. ROUTING/ARRANGEMENT

1. Piping installations shall be neatly organized.
2. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
3. Install groups of pipes parallel to each other.
4. Install piping spaced to permit application of insulation.
5. Install piping parallel and spaced to permit the servicing of valves.
6. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls or axis of the building.
7. Diagonal runs are prohibited unless specifically indicated otherwise.
8. Install fittings for all changes in direction.
9. No piping shall be run above any electrical panels, electrical equipment or access clearances for electrical for electrical panels or equipment. No piping shall be allowed to run through any electrical rooms.
10. Piping shall be arranged, placed and installed to facilitate equipment maintenance and shall be so arranged to not interfere with the installation of the air-conditioning equipment, ducts, or the removal of other equipment or devices. All specialties shall be so placed to permit easy operation and access.
11. All piping shall be so installed to insure noiseless circulation.
12. Install fittings for all branch connections.
13. Unless otherwise indicated, install branch connections to mains using tee fittings or forged steel branch fittings in main pipe, with the branch connected to the bottom of the main pipe.
14. For up-feed risers, connect the branch to the top of the main pipe.
15. Forged branch fittings shall be installed per the manufacturer's recommendations.

E. ACCESS / ARRANGEMENT

1. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal. All piping shall be so arranged to not block access to manholes, access openings, etc.
2. Install piping at indicated slopes. If not indicated, install piping at a uniform grade of 0.2 percent where possible, upward in direction of flow. Traps are to be avoided where-ever possible.
3. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
4. When insulated pipes are supported by a roller hanger they shall be protected from damage by suitable pipe covering protection saddles. Saddles shall support pipe on roller and shall be packed with insulation.
5. Install valves according to Section 230523 "General-Duty Valves for HVAC Piping."
6. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, at each coil on all sides of automatic valves where valves do not have union connections, elsewhere as indicated, and wherever necessary to prevent undue difficulty in making repairs or replacement. Unions are not required at flanged connections.
7. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated. Install flanges on valves, apparatus, and equipment having 2 ½ inch NPS and larger connections. Flanges or unions as applicable for the type of piping specified, shall be provided in the piping at connections to all items of equipment.
8. Install shutoff valve immediately upstream of each dielectric fitting. Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.
9. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
10. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
11. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."
12. Install strainers on supply side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS ¾) nipple and ball valve in blow-down connection of strainers NPS 2) and larger. Match size of strainer blow-off connection for strainers smaller than NPS 2).

F. DRAINAGE

1. Drain valves shall be installed at all low points in all piping systems to allow for complete drainage of piping systems.

2. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
3. All piping systems shall be installed so that they can be easily drained by means of drainage of low points of all piping without disconnecting pipe.
4. If not specifically indicated on the drawings, the frequency of draining shall determine whether drain caps, plugs, cocks, or valves are to be used.

G. IDENTIFICATION

1. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for identifying piping.

3.3 DIELECTRIC FITTING INSTALLATION

A. Make connections according to the following, unless otherwise indicated:

1. **Install dielectric nipples or waterways** in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install **waterways**, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Install Dielectric Fittings into Hydronic Piping Systems: Install dielectric nipples, waterways or couplings to connect piping materials of dissimilar metals.
4. **End Connections: Threaded, or flanged.**

3.4 HANGERS AND SUPPORTS

- A. Comply with requirements in Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for hanger, support, and anchor devices. Comply with the following requirements for maximum spacing of supports.
- B. Comply with requirements in Section 230548 "Vibration and Seismic Controls for HVAC" for seismic restraints.
- C. Steel roof deck shall not be used to support loads from piping, ductwork or equipment, unless noted otherwise. Hanger loads less than 50 lbs. may be hung from the steel roof deck in cases when hanging from the steel roof deck cannot be avoided; the attachment method must distribute the load across the deck as approved by the Structural Engineer.
- D. Install the following pipe attachments:
 1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
 2. Adjustable roller hangers and spring hangers for individual horizontal piping 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. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
 6. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.
- E. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
1. NPS 3/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
 2. NPS 1: Maximum span, 7 feet; minimum rod size, 3/8 inch.
 3. NPS 1-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
 4. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
 5. NPS 2-1/2: Maximum span, 11 feet; minimum rod size, 1/2 inch.
 6. NPS 3 and Larger: Maximum span, 12 feet; minimum rod size, 1/2 inch.
- F. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:
1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
 2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
 3. NPS 1-1/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
 4. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
 5. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
 6. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
 7. NPS 3 and Larger: Maximum span, 10 feet; minimum rod size, 3/8 inch.
 8. Space all sizes of fiberglass composite reinforced PP pipe according to the manufacturer's written instructions.
- G. Install supports for vertical PP piping every 60 inches for NPS 1 and smaller, and every 72 inches for NPS 1-1/4 and larger.
- H. Fiberglass Piping Hanger Spacing: Space hangers according to pipe manufacturer's written instructions for service conditions. Avoid point loading. Space and install hangers with the fewest practical rigid anchor points.
- I. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.
- J. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.
- 3.5 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: 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.
- D. 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.
- E. 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.
- F. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
- G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.6 TERMINAL EQUIPMENT CONNECTIONS

- A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.
- B. Install control valves in accessible locations close to connected equipment.

3.7 FIELD QUALITY CONTROL

- A. Prepare hydronic piping according to ASME B31.9 and as follows:
 - 1. Leave joints, including welds, uninsulated and exposed for examination during test.
 - 2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
 - 3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
 - 4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
 - 5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.
- B. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
 2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
 3. Isolate expansion tanks and determine that hydronic system is full of water.
 4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times the "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
 5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
 6. Prepare written report of testing.
- C. Perform the following before operating the system:
1. Open manual valves fully.
 2. Inspect pumps for proper rotation.
 3. Set makeup pressure-reducing valves for required system pressure.
 4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
 5. Set temperature controls so all coils are calling for full flow.
 6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
 7. Verify lubrication of motors and bearings.

END OF SECTION

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SECTION 232116 - HYDRONIC 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. Section includes special-duty valves and specialties for the following:
 - 1. Hot-water heating piping.
 - 2. Makeup-water piping.
 - 3. Condensate-drain piping.
 - 4. Air-vent piping.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of the following:
 - 1. Valves: Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
 - 2. Air-control devices.
 - 3. Hydronic specialties.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air-control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
 - 1. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

PART 2 - PRODUCTS

2.1 VALVES

- A. **Globe, Check, Ball, and Butterfly Valves:** Comply with requirements specified in Section 230523 "General-Duty Valves for HVAC Piping. Gate valves are not allowed on this project.
- B. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Section 230900 "Instrumentation and Control for HVAC.
- C. Refer to Part 3 "Valve Applications" Article for applications of each valve.
- D. Bronze, Calibrated-Orifice or Venturi, Balancing Valves, NPS 2 and smaller:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong Pumps, Inc.
 - b. Bell & Gossett Domestic Pump.
 - c. Flow Design Inc.
 - d. Gerand Engineering Co.
 - e. Griswold Controls.
 - f. Taco.
 - g. Tour & Andersson; available through Victaulic Company.
 - h. Nexus Valve, Inc.
 2. Body: Bronze, ball or plug type with calibrated orifice or venturi.
 3. Ball: Brass or stainless steel.
 4. Plug: Resin.
 5. Seat: PTFE.
 6. End Connections: Threaded or socket.
 7. Pressure Gage Connections: Integral seals for portable differential pressure meter.
 8. Handle Style: Lever, with memory stop to retain set position.
 9. CWP Rating: Minimum **125 psig**.
 10. Maximum Operating Temperature: **250 deg F**.
- E. Cast-Iron or Steel, Calibrated-Orifice or Venturi, Balancing Valves, NPS 2 ½ and larger:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Amtrol, Inc.
 - b. Armstrong Pumps, Inc.
 - c. Bell & Gossett Domestic Pump.
 - d. Flow Design Inc.
 - e. Gerand Engineering Co.
 - f. Grinnell.
 - g. Griswold Controls.
 - h. Taco.
 - i. Tour & Andersson; available through Victaulic Company.

- j. Spence Engineering Company Inc.
 - k. Watts Regulator Co.
 - l. Nexus Valve, Inc.
2. Body: Cast-iron or steel body, ball, plug, or globe pattern with calibrated orifice or venturi.
 3. Ball: Brass or stainless steel.
 4. Stem Seals: EPDM O-rings.
 5. Disc: Glass and carbon-filled PTFE.
 6. Seat: PTFE.
 7. End Connections: Flanged or grooved.
 8. Pressure Gage Connections: Integral seals for portable differential pressure meter.
 9. Handle Style: Lever, with memory stop to retain set position.
 10. CWP Rating: Minimum **125 psig**.
 11. Maximum Operating Temperature: **250 deg F**.
- F. Automatic Flow-Control Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong Pumps, Inc.
 - b. Bell & Gossett Domestic Pump.
 - c. Flow Design Inc.
 - d. Griswold Controls.
 - e. Taco
 - f. Nexus Valve, Inc.
 2. Body: Brass or ferrous metal.
 3. Piston and Spring Assembly: Tamper proof, self-cleaning, and removable, for inspections and replacement.
 - a. **Corrosion resistant.**
 4. Combination Assemblies: Include bronze or brass-alloy ball valve.
 5. Identification Tag: Attached by chain and marked with zone identification, valve number, and flow rate.
 6. Size: Same as pipe in which installed.
 7. Performance: Maintain constant flow, plus or minus 5 percent over system pressure fluctuations:
 - a. **Minimum CWP Rating: 175 psig.**
 8. **Maximum Operating Temperature: 200 deg F.**
 9. Fitted with pressure and temperature test valves.
 10. Equipped with a readout kit including flow meter, probes, hoses, flow charts, and carrying case.

2.2 AIR-CONTROL DEVICES

- A. Manual Air Vents:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Amtrol, Inc.
 - b. Armstrong Pumps, Inc.
 - c. Bell & Gossett Domestic Pump.
 - d. Taco, Inc.
2. Body: Bronze.
3. Internal Parts: Nonferrous.
4. Operator: Screwdriver or thumbscrew.
5. Manually operated with ball valve in the down position.
6. Inlet Connection: **NPS 1/2**.
7. Discharge Connection: **NPS 1/8**.
8. CWP Rating: **150 psig**.
9. Maximum Operating Temperature: **225 deg F**.

B. Automatic Air Vents:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Amtrol, Inc.
 - b. Bell & Gossett Domestic Pump.
 - c. Hoffman Specialty ITT; Fluid Handling Div.
 - d. Spirax-Sarco.
 - e. Spirovent.
 - f. Taco, Inc.
 - g. Honeywell-Baukman.
2. Body: Bronze or cast iron.
3. Internal Parts: Nonferrous.
4. Operator: Noncorrosive metal float.
5. Inlet Connection: **NPS 1/2**.
6. Discharge Connection: **NPS 1/4**.
7. CWP Rating: **150 psig**.
8. Maximum Operating Temperature: **240 deg F**.

2.3 HYDRONIC PIPING SPECIALTIES

A. Y-Pattern Strainers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong Machine Works.
 - b. Hoffman Specialty ITT; Fluid Handling Div.
 - c. Metraflex Co.
 - d. Mueller
 - e. Spirax Sarco.
 - f. Trane Co.
 - g. Tour & Andersson; available through Victaulic Company.

- h. Watts Regulator Co.
 - i. Nexus Valve
2. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
 3. End Connections: Threaded ends for **NPS 2** and smaller; flanged ends for **NPS 2-1/2** and larger.
 4. Strainer Screen: Stainless-steel, or perforated stainless-steel basket:
 - a. **20**-mesh strainer.
 5. CWP Rating: **125 psig**.
- B. Diverting Fittings:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Amtrol, Inc.
 - b. Armstrong Pumps, Inc.
 - c. Bell & Gossett Domestic Pump.
 - d. Taco, Inc.
 2. Body: Cast Iron or Wrought Copper
 3. Ends: Threaded or Soldered
 4. Flow Direction: Indicated on fitting.
 5. CWP Rating: **125 psig**.
 6. Maximum Operating Temperature: **250 deg F**.

PART 3 - EXECUTION

3.1 VALVE APPLICATIONS

- A. Install shutoff-duty valves at each branch connection to supply mains and at supply connection to each piece of equipment.
- B. **Install calibrated-orifice**, balancing valves at each branch connection to return main.
- C. Install calibrated-orifice, balancing valves in the return pipe of each heating or cooling terminal.
- D. Install check valves at each pump discharge and elsewhere as required to control flow direction.
- E. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.
- F. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.

3.2 HYDRONIC SPECIALTIES INSTALLATION

- A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.
- B. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Install manual vents at heat-transfer coils and elsewhere as required for air venting.

END OF SECTION

SECTION 232513 - WATER TREATMENT FOR CLOSED-LOOP HYDRONIC SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes the following water treatment for closed-loop hydronic systems:
 - 1. Chemicals.

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.
- B. RO: Reverse osmosis.
- C. TSS: Total suspended solids are solid materials, including organic and inorganic, that are suspended in the water. These solids may include silt, plankton, and industrial wastes.

1.4 ACTION SUBMITTALS

- A. Product Data: Include rated capacities, operating characteristics, and furnished specialties and accessories for the following products:
 - 1. Bypass feeders.
 - 2. Water meters.
 - 3. Chemical solution tanks.
 - 4. Chemical material safety data sheets.
- B. Shop Drawings: Pretreatment and chemical treatment equipment showing tanks, maintenance space required, and piping connections to hydronic systems.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Include diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- B. Water Analysis Provider Qualifications: Verification of experience and capability of HVAC water-treatment service provider.
- C. Field quality-control reports.
- D. Other Informational Submittals:
1. Water-Treatment Program: Written sequence of operation on an annual basis for the application equipment required to achieve water quality defined in "Performance Requirements" Article.
 2. Water Analysis: Illustrate water quality available at Project site.
- 1.6 CLOSEOUT SUBMITTALS
- A. Operation and Maintenance Data: For sensors, injection pumps, and controllers to include in emergency, operation, and maintenance manuals.
- 1.7 QUALITY ASSURANCE
- A. HVAC Water-Treatment Service Provider Qualifications: An experienced HVAC water-treatment service provider capable of analyzing water qualities, installing water-treatment equipment, and applying water treatment as specified in this Section.
- 1.8 MAINTENANCE SERVICE
- A. Scope of Maintenance Service: Provide chemicals and service program to maintain water conditions required above to inhibit corrosion and scale formation for hydronic piping and equipment. Services and chemicals shall be provided for a period of one year from date of Substantial Completion and shall include the following:
1. Initial water analysis and HVAC water-treatment recommendations.
 2. Startup assistance for Contractor to flush the systems, clean with detergents, and initially fill systems with required chemical treatment prior to operation.
 3. Customer report charts and log sheets.
 4. Laboratory technical analysis.
 5. Analyses and reports of all chemical items concerning safety and compliance with government regulations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, **provide products by the following:**
 - 1. WEST

2.2 PERFORMANCE REQUIREMENTS

- A. Water quality for hydronic systems shall minimize corrosion, scale buildup, and biological growth for optimum efficiency of hydronic equipment without creating a hazard to operating personnel or the environment.
- B. Base HVAC water treatment on quality of water available at Project site, hydronic system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction.
- C. Closed hydronic systems, including:
 - 1. Hot-water heating
- D. Closed hydronic systems, shall have the following water qualities:
 - 1. pH: Maintain a value within the combined recommendations of the various equipment manufacturers.
 - 2. Nitrite: Maintain a value within **800 to 1000** ppm.
 - 3. Microbiological Limits:
 - a. Total Aerobic Plate Count: Maintain a maximum value of **zero** organisms/mL.

2.3 CHEMICALS

- A. Chemicals shall be as recommended by water-treatment system manufacturer that are compatible with piping system components and connected equipment and that can attain water quality specified in "Performance Requirements" Article.

PART 3 - EXECUTION

3.1 WATER ANALYSIS

- A. Perform an analysis of supply water to determine quality of water available at Project site.

3.2 INSTALLATION

- A. Install chemical application equipment on concrete bases, level and plumb. Maintain manufacturer's recommended clearances. Arrange units so controls and devices that require servicing are accessible. Anchor chemical tanks and floor-mounting accessories to substrate.
- B. Install seismic restraints for equipment and floor-mounting accessories and anchor to building structure. Comply with requirements in Section 230548 "Vibration and Seismic Controls for HVAC" for seismic restraints.
- C. Install water testing equipment on wall near water chemical application equipment.
- D. Install glycol feed system per manufacturers recommendations.
- E. Install interconnecting control wiring for chemical treatment controls and sensors.
- F. Mount sensors and injectors in piping circuits.

3.3 CONNECTIONS

- A. Where installing piping adjacent to equipment, allow space for service and maintenance.
- B. Make piping connections between HVAC water-treatment equipment and dissimilar-metal piping with dielectric fittings. Comply with requirements in Section 232116 "Hydronic Piping Specialties."
- C. Install shutoff valves on HVAC water-treatment equipment inlet and outlet. Metal general-duty valves are specified in Section 230523 "General-Duty Valves for HVAC Piping."
- D. Comply with requirements in Section 221119 "Domestic Water Piping Specialties" for backflow preventers required in makeup-water connections to potable-water systems.
- E. Confirm applicable electrical requirements in electrical Sections for connecting electrical equipment.
- F. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- G. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

- B. Perform the following tests and inspections **with the assistance of a factory-authorized service representative**:
1. Inspect field-assembled components and equipment installation, including piping and electrical connections.
 2. Inspect piping and equipment to determine that systems and equipment have been cleaned, flushed, and filled with water, and are fully operational before introducing chemicals for water-treatment system.
 3. Place HVAC water-treatment system into operation and calibrate controls during the preliminary phase of hydronic systems' startup procedures.
 4. Do not enclose, cover, or put piping into operation until it is tested and satisfactory test results are achieved.
 5. Test for leaks and defects. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 6. Leave uncovered and unconcealed new, altered, extended, and replaced water piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.
 7. 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 test pressure to stand for four hours. Leaks and loss in test pressure constitute defects.
 8. Repair leaks and defects with new materials and retest piping until no leaks exist.
- C. Equipment will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.
- E. At quarterly intervals following Substantial Completion, perform separate water analyses on hydronic systems to show that automatic chemical-feed systems are maintaining water quality within performance requirements specified in this Section. Submit written reports of water analysis advising Owner of changes necessary to adhere to "Performance Requirements" Article.
- F. Comply with ASTM D 3370 and with the following standards:
1. Silica: ASTM D 859.
 2. Acidity and Alkalinity: ASTM D 1067.
 3. Iron: ASTM D 1068.
 4. Water Hardness: ASTM D 1126.

3.5 DEMONSTRATION

- A. **Engage a factory-authorized service representative to train** Owner's maintenance personnel to adjust, operate, and maintain HVAC water-treatment systems and equipment.

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SECTION 233113 - METAL DUCTS

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. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Sheet metal materials.
4. Duct liner.
5. Sealants and gaskets.
6. Hangers and supports.

- B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.
3. Section 230713 "Duct Insulation" for duct insulation and fire wrap.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.
- B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.

- B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
- 12. Hangers and supports, including methods for duct and building attachment and vibration isolation.**
13. Duct fabrication shall not begin until shop drawings have been submitted and reviewed by the mechanical engineer.

C. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.
- 5. Design Calculations: Calculations for selecting hangers and supports.**

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
 2. Suspended ceiling components.
 3. Structural members to which duct will be attached.
 4. Size and location of initial access modules for acoustical tile.
 5. Penetrations of smoke barriers and fire-rated construction.
 6. Items penetrating finished ceiling including, but not limited to the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
 - f. Perimeter moldings.
- B. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to **AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.**
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
 - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
 - 3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."
- D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Duct dimensions shown on drawings are inside clear dimensions.
- E. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SINGLE-WALL ROUND DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

- B. Duct dimensions shown on drawings are inside clear dimensions.
- C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 1. Transverse Joints in Ducts Larger Than **60 inches** in Diameter: Flanged.
- D. Longitudinal Seams: Not allowed.
- E. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SHEET METAL MATERIALS

- A. General Material Requirements: 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.
 - 1. Galvanized Coating Designation: **G90**.
 - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Reinforcement Shapes and Plates: ASTM A 36, steel plates, shapes, and bars; black and galvanized.
 - 1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- D. 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**.

2.4 DUCT LINER

- A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed Corporation; Insulation Group.
 - b. Johns Manville.
 - c. Knauf Insulation.

- d. Owens Corning.
 2. Maximum Thermal Conductivity:
 - a. Type I, Flexible: **0.27 Btu x in./h x sq. ft. x deg F** at **75 deg F** mean temperature.
 - b. Type II, Rigid: **0.23 Btu x in./h x sq. ft. x deg F** at **75 deg F** mean temperature.
 3. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
 4. Water-Based Liner Adhesive:
 - a. Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
 - b. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Insulation Pins and Washers:
1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, , length to suit depth of insulation indicated with integral **1-1/2-inch** galvanized carbon-steel washer.
 - a. **0.135-inch**-diameter shank.
 2. Insulation-Retaining Washers: With beveled edge sized as required to hold insulation securely in place but not less than **1-1/2 inches** in diameter.
 - a. Self-locking washers formed from **0.016-inch-thick aluminum**.
- C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."
1. 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.
 2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
 3. Butt transverse joints without gaps, and coat joint with adhesive.
 4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
 5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
 6. 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.
 7. 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:
 - a. Fan discharges.
 - b. Intervals of lined duct preceding unlined duct.

8. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.
 - a. Sheet Metal Inner Duct Perforations: **3/32-inch** diameter, with an overall open area of 23 percent.
9. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated build-outs (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.5 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Two-Part Tape Sealing System:
 1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
 2. Tape Width: **4 inches**.
 3. Sealant: Modified styrene acrylic.
 4. Water resistant.
 5. Mold and mildew resistant.
 6. Maximum Static-Pressure Class: **10-inch wg**, positive and negative.
 7. Service: Indoor and outdoor.
 8. Service Temperature: **Minus 40 to plus 200 deg F**.
 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
 10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Water-Based Joint and Seam Sealant:
 1. Application Method: Brush on.
 2. Solids Content: Minimum 65 percent.
 3. Shore A Hardness: Minimum 20.
 4. Water resistant.
 5. Mold and mildew resistant.
 6. VOC: Maximum 75 g/L (less water).
 7. Maximum Static-Pressure Class: **10-inch wg**, positive and negative.
 8. Service: Indoor or outdoor.
 9. Substrate: Compatible with galvanized sheet steel, stainless steel, or aluminum sheets.
- D. Solvent-Based Joint and Seam Sealant:
 1. Application Method: Brush on.
 2. Base: Synthetic rubber resin.

3. Solvent: Toluene and heptane.
 4. Solids Content: Minimum 60 percent.
 5. Shore A Hardness: Minimum 60.
 6. Water resistant.
 7. Mold and mildew resistant.
 8. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 9. VOC: Maximum 395 g/L.
 10. Maximum Static-Pressure Class: **10-inch wg**, positive or negative.
 11. Service: Indoor or outdoor.
 12. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- E. Flanged Joint Sealant: Comply with ASTM C 920.
1. General: Single-component, acid-curing, silicone, elastomeric.
 2. Type: S.
 3. Grade: NS.
 4. Class: 25.
 5. Use: O.
 6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- F. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- G. Round Duct Joint O-Ring Seals:
1. Seal shall provide maximum leakage class of **3 cfm/100 sq. ft. at 1-inch wg** and shall be rated for **10-inch wg** static-pressure class, positive or negative.
 2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
 3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.6 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," **Table 5-1**, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
- F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

- G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- H. Trapeze and Riser Supports:
 - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
 - 2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
 - 3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install **round** ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.
- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- 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 **2 inch**, plus allowance for insulation thickness.
- I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least **1-1/2 inches**.
- K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.

- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. **Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines"** .

3.2 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
 - 1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 2. **Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class A.**
 - 3. **Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.**
 - 4. **Conditioned Space, Exhaust Ducts: Seal Class A.**
 - 5. **Conditioned Space, Return-Air Ducts: Seal Class A.**

3.3 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Where practical, install concrete inserts before placing concrete.
 - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than **4 inches** thick.
 - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than **4 inches** thick.
 - 5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," **Table 5-1**, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within **24 inches** of each elbow and within **48 inches** of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.

- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of **16 feet**.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.4 SEISMIC-RESTRAINT-DEVICE INSTALLATION

- A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with the requirements specified in Section 230548 "Vibration and Seismic Controls for HVAC."
 - 1. Comply with **ASCE/SEI 7**.

3.5 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 PAINTING

- A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Leakage Tests:
 - 1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
 - 2. Test the following systems:
 - a. Supply Ducts with a Pressure Class of **2-Inch wg** or Higher: Test representative duct sections, selected by Architect from sections installed, totaling no less than 50 percent of total installed duct area for each designated pressure class.
 - b. Return Ducts with a Pressure Class of **2-Inch wg** or Higher: Test representative duct sections, selected by Architect from sections installed, totaling no less than 50 percent of total installed duct area for each designated pressure class.
 - c. Exhaust Ducts with a Pressure Class of **2-Inch wg** or Higher: Test representative duct sections, selected by Architect from sections

installed, totaling no less than 50 percent of total installed duct area for each designated pressure class.

3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
4. Test for leaks before applying external insulation.
5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
6. Give **seven** days' advance notice for testing.

C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.
2. Any liner showing evidence that it has wet at any time shall be removed and replaced with new liner.
 - a. Disinfect affected sheet metal, and pins.
 - b. Install new liner per specifications
 - c. Seal friable edges and seams of repaired liner.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.8 DUCT CLEANING

A. Clean **new** duct system before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with **99.97 percent** collection efficiency for **0.3-micron-size** (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).

2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.9 START UP

- A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.10 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel.
- B. Ductwork running in areas where there are no ceilings or when noted on the drawings shall be doubled wall duct and shall meet the requirements indicated below.
- C. Supply Ducts:
1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
 - a. Pressure Class: Positive **2-inch wg**.

- b. Minimum SMACNA Seal Class: **A**.
 - c. Minimum SMACNA Seal Class: **A**.
 - d. SMACNA Leakage Class for Rectangular: **16**.
 - e. SMACNA Leakage Class for Round: **8**.
2. Ducts Connected to Variable-Air-Volume Air-Handling Units:
- a. Pressure Class: Positive **6-inch wg**.
 - b. Minimum SMACNA Seal Class: **A**.
 - c. SMACNA Leakage Class for Rectangular: **4**.
 - d. SMACNA Leakage Class for Round: **2**.
3. Ducts Connected to Equipment Not Listed Above:
- a. Pressure Class: Positive **4-inch wg**.
 - b. Minimum SMACNA Seal Class: **A**.
 - c. SMACNA Leakage Class for **Rectangular**: **4**.
 - d. SMACNA Leakage Class for Round: **2**.
- D. Return Ducts:
1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
- a. Pressure Class: Positive or negative **2-inch wg**.
 - b. Minimum SMACNA Seal Class: **A**.
 - c. SMACNA Leakage Class for Rectangular: **16**.
 - d. SMACNA Leakage Class for Round: **8**.
2. Ducts Connected to Air-Handling Units:
- a. Pressure Class: Positive or negative **2-inch wg**.
 - b. Minimum SMACNA Seal Class: **A**.
 - c. SMACNA Leakage Class for Rectangular: **16**.
 - d. SMACNA Leakage Class for Round: **8**.
3. Ducts Connected to Equipment Not Listed Above:
- a. Pressure Class: Positive or negative **3-inch wg**.
 - b. Minimum SMACNA Seal Class: **A**.
 - c. SMACNA Leakage Class for Rectangular: **8**.
 - d. SMACNA Leakage Class for Round: **4**.
- E. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
 - a. Pressure Class: Negative **2-inch wg**.
 - b. Minimum SMACNA Seal Class: **A**.
 - c. SMACNA Leakage Class for Rectangular: **16**.
 - d. SMACNA Leakage Class for Round: **4**.

- F. Intermediate Reinforcement:
 1. Galvanized-Steel Ducts: **Galvanized steel**.

- G. **Duct Liner Restrictions:**
 1. **Duct liner exposed to air movement shall not be used in supply air ducts serving the following rooms: Operating rooms, trauma rooms, LDR rooms, NICU nurseries, ICU nurseries, positive pressure isolation rooms, cath labs, bone marrow, triage rooms, angiogram rooms, fluoroscopy rooms, linear accelerators, decontamination areas and any invasive procedure rooms where the duct insulation could be a source of contamination.**
 2. **Duct Liner exposed to air movement shall not be used on medium pressure ductwork (2000 to 4000 FPM velocity). See section 230713 "Duct Insulation" for insulation requirements.**
 3. **All duct liner shall meet all of the requirements found in 2018 IECC**

- H. Liner: (Ductwork located Interior to building Insulated Envelope)
 1. Low Pressure Supply Air Ducts (Less than 2000 FPM velocity): **Fibrous glass, Type I, 1 inch** thick with a minimum R value of 4.0 for ducts in unconditioned spaces.
 2. Supply Air Ducts: **Fibrous glass, Type I, 1 inch** thick for ducts in conditioned spaces.
 3. Return Air Ducts: **Fibrous glass, Type, 1 inch** thick for ducts in conditioned spaces.
 4. Exhaust Air Ducts: **Fibrous glass, Type I, 1 inch** thick.

- I. Elbow Configuration:
 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
 - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
 - 1) Velocity **1000 fpm** or Lower: 1.0 radius-to-diameter ratio and three segments for 90-degree elbow.
 - 2) Velocity **1000 to 1500 fpm**: 1.5 radius-to-diameter ratio and four segments for 90-degree elbow.
 - 3) Velocity **1500 fpm** or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
 - 4) Radius-to Diameter Ratio: 1.5.
 - b. Round Elbows, **12 Inches** and Smaller in Diameter: Stamped or pleated.
 - c. Round Elbows, **14 Inches** and Larger in Diameter: Welded.
- J. Branch Configuration:
1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
 - a. Rectangular Main to Rectangular Branch: 45-degree entry high efficiency take-off.
 - b. Rectangular Main to Round Branch: 45-degree entry high efficiency take-off.
 2. **Round:**
 - a. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
 - b. Velocity **1000 to 1500 fpm**: **45-degree entry high efficiency tap.**
 - c. Velocity **1500 fpm** or Higher: 45-degree lateral.

END OF SECTION

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SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Backdraft dampers.
2. Manual volume dampers.
3. Control dampers.
4. Fire dampers.
5. Smoke dampers.
6. Combination fire and smoke dampers.
7. Turning vanes.
8. Remote damper operators.
9. Duct-mounted access doors.
10. Flexible connectors.
11. Flexible ducts.
12. Duct accessory hardware.
13. High efficiency take-offs.

- B. Related Requirements:

1. Division 23 "HVAC Gravity Ventilators" for roof-mounted ventilator caps.
2. Division 23 "Diffusers, Registers and Grilles".
3. Division 28 "Digital, Addressable Fire-Alarm System" for duct-mounted fire and smoke detectors.
4. Division 28 "Zoned (DC-Loop) Fire-Alarm System" for duct-mounted fire and smoke detectors.

1.3 ACTION SUBMITTALS

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

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. Manual volume damper installations.
 - c. Control-damper installations.
 - d. Fire-damper, smoke-damper, combination fire- and smoke-damper, pressure relief-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
 - e. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.
- B. Source quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.6 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.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

- 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."
- B. 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.

2.2 MATERIALS

- A. Galvanized Sheet Steel: Comply with ASTM A 653.
 - 1. **Galvanized Coating Designation: G60.**
 - 2. Exposed-Surface Finish: Mill phosphatized.
- B. 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.
- C. Extruded Aluminum: Comply with **ASTM B 221**, Alloy 6063, Temper T6.
- D. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel 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**.

2.3 BACKDRAFT DAMPERS

- 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. Greenheck Fan Corporation.
 - 3. Nailor Industries Inc.
 - 4. Pottorff.
 - 5. Ruskin Company.
 - 6. United Enertech
- B. Function:
 - 1. Designed to allow airflow in one direction and prevent reverse airflow.
 - 2. Keeps outside air out of the space by sensing and closing against mass flow.
- C. Description:
 - 1. Gravity balanced.
- D. Maximum Air Velocity:
 - 1. **1000 fpm**
- E. Maximum System Pressure:
 - 1. **3-inch wg.**
 - 2. **4-inch wg.**
- F. Frame: Hat-shaped, with welded corners or mechanically attached and mounting flange:
 - 1. **16GA 0.063-inch- thick extruded aluminum.**
- G. Blades: Multiple single-piece blades, maximum **6-inch** width noncombustible, tear-resistant, neoprene-coated fiberglass with sealed edges:
 - 1. **Center pivoted: 16GA 0.050-inch- thick aluminum sheet.**

- H. Blade Action: Parallel.
- I. Blade Seals: Mechanically locked.
 - 1. **Neoprene.**
- J. Blade Axles: **0.20 inch** diameter:
 - 1. **Material: Nonferrous metal.**
- K. Tie Bars and Brackets:
 - 1. **Aluminum .**
- L. Return Spring: Adjustable tension.
- M. Bearings:
 - 1. **Synthetic pivot bushings.**
- N. Accessories.
 - 1. Adjustment device to permit setting for varying differential static pressure.
 - 2. Counterweights and spring-assist kits for vertical airflow installations.
 - 3. Screen Mounting: Front mounted in sleeve.
 - a. Sleeve Thickness: **20 gage** minimum.
 - b. Sleeve Length: **6 inches** minimum.
 - 4. Screen Mounting: Rear mounted.
 - 5. Screen Material:
 - a. **Aluminum.**
 - 6. Screen Type:
 - a. **Bird**
 - 7. 90-degree stops.

2.4 MANUAL VOLUME DAMPERS

- A. Standard, Steel, Manual Volume Dampers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Warming and Ventilating; a division of Mestek, Inc.
 - b. McGill AirFlow LLC.
 - c. Nailor Industries Inc.
 - d. Pottorff.
 - e. Ruskin Company.
 - f. United Enertech
 - 2. Standard leakage rating , **with linkage outside airstream .**
 - 3. Suitable for horizontal or vertical applications.
 - 4. Frames: Hat-shaped, Mitered and welded corners. Flanges for attaching to walls and flangeless frames for installing in ducts.
 - a. **16GA 0.064-inch thick, galvanized sheet steel.**

5. Blades:
 - a. Multiple or single blade. Parallel- or opposed-blade design. Stiffened damper blades for stability.
 - b. Material:
 - 1) **Galvanized -steel, 16GA 0.064 inch thick.**
 6. Blade Axles:
 - a. **Nonferrous metal**
 - b. Shall extend full length of damper blades in ducts with pressure classes of **3-inch wg** or more.
 7. Bearings:
 - a. Material:
 - 1) **Molded synthetic.**
 - b. Bearings at both ends of damper operating shafts in ducts with pressure classes of **3-inch wg** or more.
 8. Tie Bars and Brackets: Galvanized steel.
- B. Jackshaft:
1. Size:
 - a. **1-inch diameter.**
 2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
 3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.
- C. Damper Hardware:
1. 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.
 2. Include center hole to suit damper operating-rod size.
 3. Include elevated platform for insulated duct mounting.
- ## 2.5 CONTROL DAMPERS
- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Greenheck Fan Corporation.
 2. Pottorff.
 3. Ruskin Company.
 4. Young Regulator Company.
 5. United Enertech
- B. Low-leakage rating, **with linkage outside airstream**, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
- C. Frames:
1. Section:

- a. **Hat** shaped.
- 2. Material:
 - a. **20 GA 0.40-inch- thick galvanized steel** .
- 3. Corners:
 - a. **Mitered-and-welded.**

D. Blades: Multiple.

- 1. Maximum blade width:
 - a. **6 inches.**
- 2. **Opposed -blade design.**
- 3. Material:
 - a. **Galvanized-steel.**
- 4. Thickness:
 - a. **20 GA 0.40-inch- thick galvanized steel**
- 5. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.
 - a. **Closed-cell neoprene**

E. Blade Axles:

- 1. Section:
 - a. **3/8-inch-square**
- 2. Material:
 - a. **Galvanized steel.**
- 3. Blade-linkage hardware:
 - a. Zinc-plated steel and brass.
 - b. Ends sealed against blade bearings:
- 4. Operating Temperature Range: From **minus 40 to plus 200 deg F.**

F. Bearings:

- 1. Type:
 - a. **Molded synthetic.**
- 2. Axles: Dampers in ducts with pressure classes of **3-inch wg** or more shall have axles full length of damper blades.
- 3. Bearings: Thrust bearings at each end of every blade. Bearings at both ends of each operating shaft.

2.6 FIRE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1. Arrow United Industries; a division of Mestek, Inc.
- 2. Greenheck Fan Corporation.
- 3. Nailor Industries Inc.
- 4. Pottorff.
- 5. Ruskin Company.
- 6. United Enertech

B. Type:

- 1. **Dynamic.**

- C. Standard: Rated and labeled according to UL 555 by an NRTL.
- D. Closing rating in ducts up to **4-inch wg** static pressure class and minimum **2000-fpm** velocity.
- E. Fire Rating:
 - 1. **1-1/2 hours.**
- F. Frame:
 - 1. **Curtain type with blades outside airstream.**
 - 2. Material:
 - a. Fabricated with roll-formed galvanized steel; with mitered and interlocking corners.
 - b. Thickness:
 - 1) **20GA-0.040-inch.**
- G. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel. Length to suit application.
 - 1. Minimum Thickness:
 - a. **18GA-0.05 inch, as indicated.**
 - 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.
- H. Mounting Orientation: Vertical or horizontal as indicated.
- I. Blades: Roll-formed, interlocking, galvanized sheet steel.
 - 1. Thickness:
 - a. **24GA-0.024-inch-**
 - 2. In place of interlocking blades, use full-length, **0.034-inch-** thick, galvanized-steel blade connectors.
- J. Horizontal Dampers: Include blade lock and Type 301 constant force stainless-steel closure spring.
- K. **Heat-Responsive Device:** Replaceable, **212 deg F** rated, fusible links.

2.7 SMOKE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Greenheck Fan Corporation.
 - 2. Nailor Industries Inc.
 - 3. Pottorff.
 - 4. Ruskin Company.
 - 5. United Enertech
- B. General Requirements: Label according to UL 555S by an NRTL.
- C. Smoke Detector: Integral, factory wired for single-point connection.

1. Type: Photoelectric.
- D. Frame: Galvanized sheet steel. With or without mounting flange as required.
1. Thickness:
 - a. **Hat-shaped, 16GA-0.064-inch.**
 2. Corners:
 - a. **Welded.**
- E. Blades: Horizontal, galvanized sheet steel.
1. Section;
 - a. **Roll-formed.**
 2. Fit:
 - a. **Interlocking.**
 3. Thickness:
 - a. **14GA-0.079-inch.**
- F. Leakage:
 1. **Class II.**
- G. Seals:
1. Blade: Inflatable silicone fiberglass material to maintain smoke leakage rating to a minimum of **450 deg F** .
- H. Rated pressure and velocity to exceed design airflow conditions.
- I. Mounting Sleeve: Factory-installed, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone calking.
1. Minimum **17-inches** long.
 2. Thickness:
 - a. **0.05-inch-**.
- J. Damper Motors:
1. Action:
 - a. **Two-position**
 2. Mode: Fail close.
 3. Mounting: External.
- K. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
1. Electrical Connection: **115 V, single phase, 60 Hz** .
- L. Accessories:
1. Auxiliary switches for signaling:
 - a. **Position indication.**
 2. Test Switch type:
 - a. **Momentary test switch.**
 3. Test Switch Mounting:
 - a. **Damper.**

2.8 COMBINATION FIRE AND SMOKE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Greenheck Fan Corporation.
 2. Nailor Industries Inc.
 3. Pottorff.
 4. Ruskin Company.
 5. United Enertech
- B. Type: Dynamic; rated and labeled according to UL 555 and UL 555S by an NRTL.
- C. Closing rating in ducts up to **4-inch wg** static pressure class and minimum velocity of:
1. **4000-fpm**
- D. Fire Rating:
1. **1-1/2 hours.**
- E. Frame: Hat shaped, galvanized sheet steel. With or without mounting flange as required.
1. Thickness:
a. 16GA-0.064-inch
 2. Corners:
a. Welded.
- F. **Heat-Responsive Device:** Replaceable, **212 deg F** rated, fusible links.
- G. Blades: Horizontal, galvanized sheet steel.
1. Type:
a. Air-foil.
 2. Fit:
a. Interlocking.
 3. Thickness:
a. 0.063-inch-.
- H. Leakage:
1. **Class I.**
- I. Rated pressure and velocity to exceed design airflow conditions.
- J. Mounting Sleeve: Factory-installed, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone caulking.
1. Thickness:
a. 18GA 0.05-inch-.
- K. Master control panel for use in dynamic smoke-management systems.
- L. Damper Motors:
1. Locate outside air stream unless otherwise indicated,
 2. Action:
a. Two-position.
 3. Voltage: to match fire alarm system (coordinate).

4. Listed: UL, as part of damper assembly.
 5. Outdoor Motors and Motors in Outside-Air Intakes:
 - a. Gaskets: O-ring gaskets designed to make motors weatherproof.
 - b. Internal heaters: Equip to permit normal operation at minus **40 deg F**.
- M. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
1. Electrical Connection: 115 V, single phase, 60 Hz.
- N. Accessories:
1. Auxiliary switches:
 - a. **Signaling.**
 - b. **Position indication.**
 2. Test Switch type:
 - a. **Momentary test switch.**
 3. Test Switch Mounting:
 - a. **Damper.**

2.9 TURNING VANES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. METALAIRE, Inc.
 2. SEMCO Incorporated.
 3. 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.
1. Fabricate single blade vanes to comply with SMACNA's "HVAC Duct Construction Standards-Metal and Flexible."
 2. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
- C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
- D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vaness and Vane Runners," and 4-4, "Vane Support in Elbows."
- E. Vane Construction:
1. **Single** wall
- F. Vane Spacing:
1. 1-1/2" spacing between turning vanes

2. 3-1/4" spacing not allowed.

G. Vane Construction: Single wall for ducts up to **36 inches** wide and additional bracing for larger dimensions.

2.10 REMOTE DAMPER OPERATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Pottorff.
2. Ruskin Company; Tomkins PLC.
3. Young Regulator Company.

B. Cable Type:

1. Description: Cable system designed for remote manual damper adjustment.
2. Tubing/Sheathing: Galvanized, Brass, Copper or Aluminum.
3. Cable: Stainless steel or Steel.
4. Wall-Box Mounting: Coordinate with Architect.
5. Wall-Box Cover-Plate Material: Coordinate with Architect.

C. Activated Electric Type:

1. Description: Electrically activated zone control damper for remote adjustment. When an adjustment is needed the system is powered up.
2. Means: Factory mounted actuator factory wired to damper.
3. Portable **9 volt** system. No field power requirement.
4. Mounting: Recessed Wall Box or Diffuser or Hand Held.
5. Wall-Box Cover Finish: Coordinate with Architect.
6. Wall-Box Porting: 1 to 6 ports or more.

2.11 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.
2. McGill AirFlow LLC.
3. Pottorff.
4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
5. Ruskin Company

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures **7-2**, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."

1. Door:

- a. Double wall, rectangular.
- b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
- c. Vision panel.

- d. Hinges and Latches: **1-by-1-inch** butt or piano hinge and cam latches.
 - e. 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:
 - 1) Hinges:
 - a) **Two hinges and two sash locks.**
 - c. Access Doors up to **24 by 48 Inches**, provide outside and inside handles:
 - 1) Hinges:
 - a) **Three hinges and two compression latches.**
 - d. Access Doors Larger Than **24 by 48 Inches**, provide outside and inside handles:
 - 1) Hinges:
 - a) **Continuous and two compression latches with outside and inside handles.**

2.12 FLEXIBLE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ductmate Industries, Inc.
 - 2. Ventfabrics, Inc.
 - 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
 - 4. Duro Dyne Inc.
 - 5. Elgen Manufacturing.
- 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 wide fabric strip attached to two narrower metal strips. Provide strips of metal compatible with connected ducts.
 - 1. Wide Strip:
 - a. **3-1/2 inches.**
 - 2. Narrow Strips:
 - a. **0.028-inch- thick, galvanized sheet steel.**
- E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
 - 1. Minimum Weight: **26 oz./sq. yd..**
 - 2. **Tensile Strength: 530 lbf/inch** in the warp and **440 lbf/inch** in the filling.
 - 3. Service Temperature: **Minus 40 to plus 200 deg F.**

2.13 FLEXIBLE DUCTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flexmaster U.S.A., Inc.
 2. McGill AirFlow LLC.
 3. Themaflex
 4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Ducts shall conform to the requirements for Class I connectors when tested in accordance with "Standard for Factory Made Air Ducts Materials and Air Duct Connectors" (UL 181).
- C. Ducts shall also pass the 15 minute U.L. flame penetration test as specified in the UL 181 Standard.
- D. Insulated, Flexible Duct: Two-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene or aluminized vapor-barrier film.
1. Pressure Rating: **10-inch wg** positive and **1.0-inch wg** negative.
 2. Maximum Air Velocity: **4000 fpm**.
 3. Temperature Range: **Minus 10 to plus 160 deg F**.
 4. Insulation R-value: **Comply with ASHRAE/IESNA 90.1**.
- E. Flexible Duct Connectors:
1. **Clamps:** in sizes **3 through 18 inches**, to suit duct size.
 - a. **Material:** Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action.

2.14 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.
- C. Splitter Damper Accessories: Zinc-plated damper blade bracket; **1/4-inch**, zinc-plated operating rod; and a duct-mounted, ball-joint bracket with flat rubber gasket and square-head set screw.
- D. Flexible Duct Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action, in sizes **3 to 18 inches** to suit duct size.

2.22 HIGH EFFICIENCY TAKE-OFFS

A.Manufacturers: Subject to compliance with requirements, provide products by one of the following.

1. Air-Rite
2. Hercules Industries
3. Sheet Metal Connectors, Inc.
4. Spiral Manufacturing Co. Inc.

5. Ferguson
- B. Materials:
 1. 24 gauge galvanized sheet metal meeting ASTM A653 and A924
- C. Take-off shall meet SMACNA third edition Section 4.8 figure 4.6 - 45 degree entry.
- D. Rectangular opening with flanged sides on all sides. Complete with closed cell neoprene gasket to provide a tight seal.

PART 3 - EXECUTION

3.1 INSTALLATION

General

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Use the Remote Damper Operator when they are called out on the drawings or when the damper cannot be easily accessed.
- D. Install high efficiency take-off on all branch duct take-offs. Provide take-off with balancing damper as shown on drawings. Spin-in fittings are not allowed.

Flexible Ducts / Flexible Duct Connectors

- E. Install flexible connectors to connect ducts to equipment.
- F. Flexible duct connections from the main trunk ducts to diffuser boots shall be furnished and installed as shown on the drawings. Flexible ductwork shall only be used as indicated on the drawings.
- G. Where flexible duct is indicated, use insulated flexible duct for supply air return and exhaust air.
- H. Flexible ductwork shall be run in straight lengths.
- I. Provide support in flexible duct every three feet.
- J. Flexible ducts shall have compression fittings on both ends.

- K. Flexible ductwork is not allowed to bend 90 degrees. If a bend is needed use sheet-metal hard elbows. Hard turns, offsets, or kinks will not be allowed.
- L. Flexible ducts shall connect to trunk duct with high efficiency takeoffs.
- M. Connect flexible ducts to metal ducts with **draw bands**.
- N. Connect terminal units to supply ducts:
 - 1. **With maximum 12-inch lengths of flexible duct.**
- O. Do not use flexible ducts to change directions.
- P. Connect diffusers or light troffer boots to ducts:
 - 1. **With maximum 60-inch** lengths of flexible duct clamped or strapped in place.

Backdraft/Control/Pressure Relief Dampers

- Q. **Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.**

Volume Damper

- R. 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.
- S. Set dampers to fully open position before testing, adjusting, and balancing. Exception: Pressure relief damper.
- T. A balance damper with locking quadrant will be provided downstream of take-off from trunk duct.

Fans And Test Holes

- U. For fans developing static pressures of **5-inch wg** and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- V. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of **1/4-inch** movement during start and stop of fans.
- W. Install duct test holes where required for testing and balancing purposes.
- X. Install test holes at fan inlets and outlets and elsewhere as indicated.

FIRE, SMOKE AND FIRE-SMOKE DAMPERS

- Y. Install fire **and smoke** dampers according to UL listing.
 - 1. Install fusible links in fire dampers.

- Z. For round ductwork **24-inch** and smaller a true round fire damper with the same rating may be used.

Access Doors

- AA. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
1. On upstream side of duct coils.
 2. **Upstream** from duct filters.
 3. At outdoor-air intakes and mixed-air plenums.
 4. At drain pans and seals.
 5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
 6. 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 **standard access doors** and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
 7. At each change in direction and at maximum **50-foot** spacing.
 8. **Upstream** from turning vanes.
 9. Upstream or downstream from duct silencers.
 10. Control devices requiring inspection.
 11. Elsewhere as indicated.
- BB. Install access doors with swing against duct static pressure.
- CC. Access Door Sizes:
1. One-Hand or Inspection Access: **8 by 5 inches**.
 2. Two-Hand Access: **12 by 6 inches**.
 3. Head and Hand Access: **18 by 10 inches**.
 4. Head and Shoulders Access: **21 by 14 inches**.
 5. Body Access: **25 by 14 inches**.
 6. Body plus Ladder Access: **25 by 17 inches**.
- DD. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

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.
5. Operate remote damper operators to verify full range of movement of operator and damper.

3.3 ADJUSTING

- A. Adjust duct accessories for proper settings.
- B. Adjust fire and smoke dampers for proper action.
- C. Final positioning of manual-volume dampers is specified in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

END OF SECTION

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SECTION 233423 - HVAC POWER VENTILATORS

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. In-line centrifugal fans.

1.3 PERFORMANCE REQUIREMENTS

- A. Project Altitude: Base fan-performance ratings on:
 - 1. Actual Project site elevations.
- B. Operating Limits: Classify according to AMCA 99.
- C. Fan Schedule: Fan characteristics and performance data are described in an equipment schedule on the drawings including:
 - 1. Fan arrangement with wheel configuration, inlet and discharge configurations, and required accessories.
 - 2. Capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, shipping weights, operating weights, operating characteristics, and furnished specialties and accessories. Also 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.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.
 - a. Detail all wiring systems and differentiate clearly between manufacturer-installed and field-installed wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
 1. Roof framing and support members relative to duct penetrations.
 2. Ceiling suspension assembly members.
 3. Size and location of initial access modules for acoustical tile.
 4. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
- B. Field quality-control Reports

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.7 MATERIALS MAINTENANCE 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. Belts: One set for each belt-driven unit.

1.8 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.
- C. NEMA Compliance: Power ventilator electrical components shall comply with applicable NEMA standards.
- D. UL Standards: Power ventilators shall comply with UL 705. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.
- E. TUV Certified: High Volume low speed fan shall comply with UL 507

1.9 COORDINATION

- A. Coordinate size and location of structural-steel support members.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided.
- C. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

PART 2 - PRODUCTS

2.1 PRODUCTS FURNISHED BUT NOT INSTALLED

- A. Products furnished, but not installed, under this Section include roof curbs for roof-mounted exhaust fans. Roof curbs to be installed by Division 07, section "Roof Accessories".

2.2 IN-LINE CENTRIFUGAL FANS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Greenheck Fan Corporation.
 - 2. Loren Cook Company.
 - 3. PennBarry.
 - 4. Twin City.
- B. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.
- C. Direct-Drive Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing with:
 - 1. **Wheel, inlet cone.**
- D. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.
 - 1. Fan Guard: **1/2- by 1-inch** mesh of galvanized steel in removable frame. Provide guard for inlet or outlet on units not connected to ductwork, where contact with fan wheel is within personal reach through access opening, or where falling objects and/or debris may enter fan.
- E. Accessories:
 - 1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
 - 2. Dampers:
 - a. **Motorized parallel-blade** dampers with electric actuator; wired to close when fan stops. These dampers to be black in all cases.
 - 3. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.
 - 4. Disconnect Switch: Nonfusible type:
 - a. Thermal-overload protection; factory wired through an internal aluminum conduit.

1) Mounted inside fan housing.

2.3 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "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.
- B. Enclosure Type: Totally enclosed;
 - 1. **Fan cooled**

2.4 FACTORY FINISH

- A. Metal Parts: All assembly parts shall be protected from rust and corrosion.
 - 1. Stainless steel, aluminum, and other non-corroding materials require no protective finish.
 - 2. Non-galvanized sheet metal parts shall be prime coated or powder coated before final assembly.
 - 3. Prime coated parts shall receive baked enamel finish coat after assembly.

2.5 SOURCE QUALITY CONTROL

- A. Certify sound-power level ratings according to 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. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions for compliance with requirements of installation tolerances and other conditions affecting performance of the power ventilators. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions by field measurements. Verify clearances.
- B. Do not operate fans until ductwork is clean, filters are in place, bearings are lubricated, and fans have been commissioned.

3.3 INSTALLATION

- A. Install power ventilators level and plumb according to manufacturer's written instructions.
- B. Ceiling Units: Suspend units from structure; use steel wire or metal straps.
- C. **Support Steel:** Support suspended units from structure using threaded steel as specified in Division 23 "Vibration and Seismic Controls for HVAC."
- D. Label units according to requirements specified in Division 23 "Identification for HVAC Piping and Equipment."
- E. Install power ventilators with factory recommended and code required clearances for service and maintenance.

3.4 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 Section 233300 "Air Duct Accessories."
- B. Install ducts adjacent to power ventilators to allow service and maintenance.
- C. Ground equipment according to Division 26 "Grounding and Bonding for Electrical Systems."
 - 1. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- D. Connect wiring according to Division 26 "Low-Voltage Electrical Power Conductors and Cables."
 - 1. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

3.6 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Comply with requirements in Division 23 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.
- C. Lubricate bearings.

3.7 CLEANING

- A. After completing installation, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes including chips, scratches, and abrasions.
- B. Clean fan interiors to remove foreign material and construction debris. Vacuum clean fan wheel and cabinet.

3.8 DEMONSTRATION

- A. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.
- B. Review data in the operation and maintenance manuals. Refer to Division 1 Section "Contract Closeout."
- C. Schedule training with Owner, through Architect, with at least 7 days' advance notice.
- D. Demonstrate operation of power ventilators. Conduct walking tour of the Project. Briefly identify location and describe function, operation, and maintenance of each power ventilator.

END OF SECTION

SECTION 233600 - AIR TERMINAL UNITS

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. Shutoff, single-duct air terminal units.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of the following products, including rated capacities, furnished specialties, sound-power ratings, and accessories.
 - 1. Air terminal units.
 - 2. Liners and adhesives.
 - 3. Sealants and gaskets.
 - 4. Seismic-restraint devices.
- B. Shop Drawings: For air terminal units. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Wiring Diagrams:
 - a. For power, signal, and control wiring.
 - b. Differentiate between manufacturer-installed and field-installed wiring.
 - 3. **Hangers and supports**, including methods for duct and building attachment and vibration isolation.
- C. Delegated-Design Submittal:
 - 1. Materials, fabrication, assembly, and spacing of hangers and supports.
 - 2. **Design Calculations:** Calculations, **including analysis data signed and sealed by the qualified professional engineer responsible for their preparation** for selecting hangers and supports.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
1. Ceiling suspension assembly members.
 2. Size and location of initial access modules for acoustic tile.
 3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
- B. Field quality-control reports.

1.5 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Air terminal units shall withstand the effects of earthquake motions determined according to **SEI/ASCE 7**.
1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air terminal units to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
1. Instructions for resetting minimum and maximum air volumes.
 2. Instructions for adjusting software set points.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Fan-Powered-Unit Filters: Furnish **one** spare filter for each filter installed.

1.8 QUALITY ASSURANCE

- A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."
- B. Product Options: Drawings and schedules indicate requirements of air terminals and are based on specific systems indicated. Other manufacturers' systems with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."
- C. Listing and Labeling: Provide electrically operated air terminals specified in this Section that are listed and labeled.
1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.

- D. NFPA Compliance: Install air terminals according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."
- E. Comply with NFPA 70 for electrical components and installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. **Structural Performance:** Hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" .

2.2 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 SHUTOFF, SINGLE-DUCT AIR TERMINAL UNITS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Anemostat Products; a Mestek Company.
 - 2. Carnes.
 - 3. Environmental Technologies, Inc.
 - 4. Krueger.
 - 5. METALAIRE, Inc.
 - 6. Nailor Industries Inc.
 - 7. Price Industries.
 - 8. Titus.
 - 9. Trox USA Inc.; a subsidiary of the TROX GROUP.
 - 10. Tuttle & Bailey.
 - 11. Warren Technology.
- B. Configuration: Volume-damper assembly inside unit casing with control components inside a protective metal shroud.
- C. **Casing: 0.034-inch steel, single wall.**
 - 1. **Casing Lining:** Adhesive attached, **coated, fibrous-glass duct liner** complying with ASTM C 1071, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.
 - a. Lining thickness:
 - 1) **1/2-inch-**
 - b. Cover liner with nonporous foil.

2. Air Inlet: Round stub connection or S-slip and drive connections for duct attachment.
 3. Air Outlet: S-slip and drive connections.
 4. Air Outlet: S-slip and drive connections **size matching inlet size**.
 5. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket.
- D. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.
1. Maximum Damper Leakage:
 - a. ARI 880 rated, **3** percent of nominal airflow at **3-inch wg** inlet static pressure.
 2. Damper Position:
 - a. Normally **open**.
- E. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than **0.1 inch**, and rated for a minimum working pressure of **200 psig** and a maximum entering-water temperature of **220 deg F**. Include manual air vent and drain valve.
- M. Direct Digital Controls: Single-package unitary controller and actuator specified in Section 230900 "Instrumentation and Control for HVAC."
- F. Control Sequence:
1. Suitable for operation with duct pressures between **0.25- and 3.0-inch wg** inlet static pressure.
 2. System-powered, wall-mounted thermostat.

2.4 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. **Steel Cables: Galvanized steel complying with ASTM A 603.**
- D. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- E. Air Terminal Unit Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- F. Trapeze and Riser Supports: Steel shapes and plates for units with steel casings; aluminum for units with aluminum casings.

2.5 SOURCE QUALITY CONTROL

- A. Factory Tests: Test assembled air terminal units according to ARI 880.
 - 1. Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory-set airflows, and ARI certification seal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."
- B. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.
- C. Install wall-mounted thermostats.
- D. Install discharge air temperature sensors at the outlet of each Air Terminal Unit.
- E. Connect ductwork to air terminals according to Division 23 ductwork Sections.
- F. Comply with SEI/ASCE 7 and with requirements for seismic-restraint devices in Section 230548 "Vibration and Seismic Controls for HVAC."
- G. For Diffuser Type Air Terminal Units, provide and install all necessary control wiring and control voltage transformer. See drawings AND schedules for additional information.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Where practical, install concrete inserts before placing concrete.
 - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes and for slabs more than **4 inches** thick.
 - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes and for slabs less than **4 inches** thick.
 - 5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hangers Exposed to View: Threaded rod and angle or channel supports.

- D. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.3 CONNECTIONS

- A. Install piping adjacent to air terminal unit to allow service and maintenance.
- B. Hot-Water Piping: In addition to requirements in Section 232113 "Hydronic Piping" and Section 232116 Hydronic Piping Specialties," connect heating coils to supply with shutoff valve, strainer, control valve, and union or flange; and to return with balancing valve and union or flange.
- C. Connect ducts to air terminal units according to **Section 233113 "Metal Ducts.**
- D. Electrically ground all equipment:
 - 1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 IDENTIFICATION

- A. Label each air terminal unit with plan number, nominal airflow, and maximum and minimum factory-set airflows. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for equipment labels and warning signs and labels.

3.5 FIELD QUALITY CONTROL

- A. **Testing Agency: Owner will engage** a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Tests and Inspections:
 - 1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.
 - 2. Leak Test: After installation, fill water coils and test for leaks. Repair leaks and retest until no leaks exist.
 - 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.
- E. Air terminal unit will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.
- G. Cleaning:
 1. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes.

3.6 STARTUP SERVICE

- A. **Engage a factory-authorized service representative to perform** startup service.
 1. Complete installation and startup checks according to:
 - a. Manufacturer's written instructions.
 - b. Construction documents.
 2. Verify that inlet duct connections are as recommended by air terminal unit manufacturer to achieve proper performance.
 3. Verify that controls and control enclosure are accessible.
 4. Verify that control connections are complete.
 5. Verify that nameplate and identification tag are visible.
 6. Verify that controls respond to inputs as specified.

3.7 DEMONSTRATION

- A. **Engage a factory-authorized service representative to train** Owner's maintenance personnel to adjust, operate, and maintain air terminal units:
 1. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.
 2. Review data in the maintenance manuals. Refer to Division 1 Section "Contract Closeout."
 3. Review data in the maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
 4. Schedule training with Owner, through Architect, with at least 7 days' advance notice.

END OF SECTION

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SECTION 233713 - DIFFUSERS, REGISTERS, AND GRILLES

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 ceiling- and wall-mounted diffusers, registers, and grilles.
- B. Related Sections:
 - 1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.
 - 2. Section 230594 "General Testing, Adjusting and Balancing" for balancing diffusers, registers, and grilles.

1.3 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.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
 - 1. Ceiling suspension assembly members.
 - 2. Method of attaching hangers to building structure.
 - 3. Size and location of initial access modules for acoustical tile.
 - 4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
 - 5. Duct access panels.
- B. Source quality-control reports.

1.5 QUALITY ASSURANCE

- A. Product Options: Drawings and schedules indicate specific requirements of diffusers, registers, and grilles and are based on the specific requirements of the systems indicated.
- B. NFPA Compliance: Install diffusers, registers, and grilles according to NFPA 90A, "Standard for the Installation of Air-Conditioning and Ventilating Systems."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Air Factors
 - 2. Carnes.
 - 3. Kruegar.
 - 4. METALAIRE, Inc.
 - 5. Nailor Industries Inc.
 - 6. Price Industries.
 - 7. Titus.
 - 8. Tuttle & Bailey.
 - 9. Air Concepts.
 - 10. Trox.

2.2 REGISTERS, GRILLES, & DIFFUSERS

- A. General: The frames for all registers, grilles, and diffusers shall match type of ceiling where they are to be installed. Special frames shall be provided for narrow T-bar ceilings. Refer to reflected ceiling plan and other specification divisions for ceiling type. See drawings AND schedules for additional information.

2.3 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 EXAMINATION

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb, according to manufacturer's written instructions, coordination drawings, original design, and referenced standards.
- 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.
- C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

3.4 CLEANING

- A. After installation of diffusers, registers, and grilles, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace diffusers, registers, and grilles that have damaged finishes.

END OF SECTION

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SECTION 23 4133 -HEPA FILTER FAN MODULES

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. HEPA filter fan modules.
 - 2. Filter gages.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include dimensions; operating characteristics; required clearances and access; rated flow capacity, including initial and final pressure drop at rated airflow; efficiency and test method; fire classification; furnished specialties; and accessories for each model indicated.
- B. LEED Submittals:
 - 1. Product Data for Prerequisite IEQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
- C. Shop Drawings: For air filters. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Show filter rack assembly, dimensions, materials, and methods of assembly of components.
 - 2. Include setting drawings, templates, and requirements for installing anchor bolts and anchorages.
 - 3. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of filter and rack to include in emergency, operation, and maintenance manuals.

1.6 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. Provide one complete set(s) of filters for each filter bank. If system includes prefilters, provide only prefilters.
 - 2. Provide one container(s) of red oil for inclined manometer filter gage.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. ASHRAE Compliance:
 - 1. Finish of Interior Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- B. Comply with IEST-RP-CC001.5.
- C. Comply with UL 586.
- D. Comply with IEST-RP-CC007.2.
- E. Comply with NFPA 90A and NFPA 90B.
- F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended use.

2.2 HEPA FILTER FAN MODULES

- A. Description: Factory-fabricated, room side replaceable HEPA filter ceiling module with fan.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AAF International.
 - b. Flanders
 - c. Microzone Corporation
 - d. Price.
- B. Casing:
 - 1. Configuration: Ducted inlet.
 - 2. Module Material: Extruded aluminum, 16 gage with mill finish.
 - 3. Suspension: Independent.
- C. Media: Fibrous glass, constructed of continuous sheets with closely spaced pleats with aluminum separators.

1. Frame Material: Galvanized steel.
 2. Media to Frame Side Bond: Knife edge in fluid-filled channel.
 3. Face Gasket: Neoprene expanded rubber.
 4. Faceguard: Stainless steel.
- D. Accessories: Filter test port.
- E. Control: Variable speed.
- F. Motor:
1. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
 2. Type: Electronically commutated motor.
 3. Fan-Motor Assembly Isolation: Rubber isolators.
 4. Enclosure Materials: Rolled steel.
 5. Efficiency: Premium efficient.
 6. Removable perforated steel supply air diffuser.

2.3 FILTER GAGES

- A. Manometer-Type Filter Gage: Molded plastic, with epoxy-coated aluminum scale, logarithmic-curve tube gage with integral leveling gage; graduated to read from 0- to 3.0-inch wg and accurate within 3 percent of full-scale range.
- B. Accessories: Static-pressure tips, tubing, gage connections, and mounting bracket.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Equipment Mounting:
1. Comply with requirements for vibration isolation and seismic-control devices specified in Section 23 0548 "Vibration and Seismic Controls for HVAC."
- B. Position each filter unit with clearance for normal service and maintenance. Anchor filter holding frames to substrate.
- C. Install filters in position to prevent passage of unfiltered air.
- D. Install filter gage for each filter bank.
- E. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters that were used during construction and testing with new, clean filters.

3.2 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform the following tests and inspections:
 - 1. HEPA Filters: Pressurize housing to a minimum of 3.0-inch wg or to designed operating pressure, whichever is higher; test housing joints, door seals, and sealing edges of filter with soapy water to check for air leaks.
- D. Air filter will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.3 CLEANING

- A. After completing system installation and testing, adjusting, and balancing air-handling and air-distribution systems, clean filter housings and install new filter media.

3.4 PROTECTION

- A. Protect installed products and accessories from damage during construction.

END OF SECTION

DIVISION 26 – ELECTRICAL

- 26 0500 COMMON WORK RESULTS FOR ELECTRICAL
- 26 0519 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES
- 26 0526 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
- 26 0529 HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
- 26 0533 RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS
- 26 0548 VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS
- 26 0553 IDENTIFICATION FOR ELECTRICAL SYSTEMS
- 26 0923 LIGHTING CONTROL DEVICES
- 26 2726 WIRING DEVICES
- 26 5100 INTERIOR LIGHTING

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SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL

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. Electrical equipment coordination and installation.
 - 2. Sleeves for raceways and cables.
 - 3. Sleeve seals.
 - 4. Grout.
 - 5. Common electrical installation requirements.

1.3 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

1.4 COORDINATION

- A. Coordinate arrangement, mounting, and support of electrical equipment:
 - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 - 3. To allow right of way for piping and conduit installed at required slope.
 - 4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

- 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.

- C. Sleeves for Rectangular Openings: Galvanized sheet steel.
 - 1. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
 - b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 - 1. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 - 2. Pressure Plates: Carbon steel or Stainless steel. Include two for each sealing element.
 - 3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating or Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable, unless indicated otherwise.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
 - 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
- I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."
- J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."
- K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

- A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

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. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.

1.4 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. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- 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. Alcan Products Corporation; Alcan Cable Division.
 - 2. American Insulated Wire Corp.; a Leviton Company.
 - 3. General Cable Corporation.
 - 4. Senator Wire & Cable Company.
 - 5. Southwire Company.
- B. Aluminum and Copper Conductors: Comply with NEMA WC 70.
- C. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN or XHHW (for feeders).
- D. Multiconductor Cable: Comply with NEMA WC 70 for armored cable, Type AC, Type AC-HCF, metal-clad cable, Type MC, metal-clad cable, type MC-HCF, and Type SOW with ground wire.

2.2 CONNECTORS AND SPLICES

- 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. AFC Cable Systems, Inc.

2. Hubbell Power Systems, Inc.
3. O-Z/Gedney; EGS Electrical Group LLC.
4. 3M; Electrical Products Division.
5. Tyco Electronics Corp.

- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper for feeders smaller than No. 4 AWG; copper or aluminum for feeders No. 4 AWG and larger. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid or stranded for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Feeders: Type THHN-THWN or XHHW, single conductors in raceway.
- B. Exposed Branch Circuits, Including in Crawlspace: Type THHN-THWN, single conductors in raceway.
- C. Branch Circuits Concealed in Ceilings, Walls, and Partitions:
1. Type THHN-THWN, single conductors in raceway
 2. Armored cable, Type AC or Metal-clad cable, Type MC for connections between devices, but not for home-runs
- D. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
- E. Cord Drops and Portable Appliance Connections: Type SOW, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
- F. Class 1 Control Circuits: Type THHN-THWN, in raceway.
- G. Class 2 Control Circuits: Type THHN-THWN, in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

- E. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."
- F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
 - 1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches (300 mm) of slack.

END OF SECTION

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SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes methods and materials for grounding systems and equipment

1.3 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. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 4. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
- C. Grounding Bus: Rectangular bars of annealed copper, 1/4 by 2 inches (6 by 50 mm) in cross section, unless otherwise indicated; with insulators.

2.2 CONNECTORS

- A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.
 - 1. Pipe Connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid or stranded conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.
- B. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- C. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
 - 1. Install bus on insulated spacers 1 inch (25 mm), minimum, from wall 6 inches (150 mm) above finished floor, unless otherwise indicated.
 - 2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, down to specified height above floor, and connect to horizontal bus.
- D. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors, except at ground rods and as otherwise indicated.
 - 3. Connections to Ground Rods: Bolted connectors.
 - 4. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- D. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- E. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
 - 1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch (6-by-50-by-300-mm) grounding bus.
 - 2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.
- C. Grounding and Bonding for Piping:
 - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 - 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
 - 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- D. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.
- E. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70, using a minimum of 20 feet (6 m) of bare copper conductor not smaller than No. 4 AWG.
 - 1. If concrete foundation is less than 20 feet (6 m) long, coil excess conductor within base of foundation.
 - 2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to grounding electrode external to concrete.

END OF SECTION

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SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Hangers and supports for electrical equipment and systems.
 - 2. Construction requirements for concrete bases.
- B. Related Sections include the following:
 - 1. Division 26 Section "Vibration And Seismic Controls For Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.
- C. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- C. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.5 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with NFPA 70.

1.6 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 - 1. 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:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. ERICO International Corporation.
 - d. GS Metals Corp.
 - e. Thomas & Betts Corporation.
 - f. Unistrut; Tyco International, Ltd.
 - g. Wesanco, Inc.
 - 2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - 3. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 - 4. Channel Dimensions: Selected for applicable load criteria.
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - 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) Hilti Inc.
 - 2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 3) MKT Fastening, LLC.
 - 4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.
 - 2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - 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) Cooper B-Line, Inc.; a division of Cooper Industries.
 - 2) Empire Tool and Manufacturing Co., Inc.
 - 3) Hilti Inc.
 - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 5) MKT Fastening, LLC.
 - 3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
 - 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.

5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 50 percent in future without exceeding specified design load limits.
 1. Secure raceways and cables to these supports with conduit clamps.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT and RMC may be supported by openings through structure members, as permitted in NFPA 70.
- C. 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 (90 kg).
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 1. To Wood: Fasten with lag screws or through bolts.
 2. To New Concrete: Bolt to concrete inserts.
 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 4. To Existing Concrete: Expansion anchor fasteners.
 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm)

thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.

6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts or Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Cast-in-Place Concrete."
- C. Anchor equipment to concrete base.
 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

- A. Touchup: 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 (0.05 mm).
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

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SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
- B. Related Sections include the following:
 - 1. Division 26 Section "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. FMC: Flexible metal conduit.
- C. IMC: Intermediate metal conduit.
- D. LFMC: Liquidtight flexible metal conduit.
- E. RNC: Rigid nonmetallic conduit.

1.4 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. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

- A. Rigid Steel Conduit: ANSI C80.1.
- B. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
 - 1. Comply with NEMA RN 1.
 - 2. Coating Thickness: 0.040 inch (1 mm), minimum.
- C. EMT: ANSI C80.3.
- D. FMC: Zinc-coated steel or aluminum.
- E. LFMC: Flexible steel conduit with PVC jacket.

- F. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
 - 1. Fittings for EMT: Steel or die-cast, set-screw or compression type.
 - 2. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.
- G. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.2 OPTICAL FIBER/COMMUNICATIONS CABLE RACEWAY AND FITTINGS

- 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. Arco Corporation.
 - 2. Endot Industries Inc.
 - 3. IPEX Inc.
 - 4. Lamson & Sessions; Carlon Electrical Products.

2.3 METAL WIREWAYS

- 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. Cooper B-Line, Inc.
 - 2. Hoffman.
 - 3. Square D; Schneider Electric.
- B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1 or 3R, unless otherwise indicated.
- C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Screw-cover type.
- E. Finish: Manufacturer's standard enamel finish.

2.4 BOXES, ENCLOSURES, AND CABINETS

- A. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy or aluminum, Type FD, with gasketed cover.
- C. Metal Floor Boxes: Cast or sheet metal, fully adjustable, rectangular.
- D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- E. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum or galvanized, cast iron with gasketed cover.
- F. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic.

G. Cabinets:

1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:

1. Exposed Conduit: Rigid steel conduit.
2. Concealed Conduit, Aboveground: Rigid steel conduit.
3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Comply with the following indoor applications, unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed and Subject to Physical Damage: Rigid steel conduit. Includes raceways in the following locations:
 - a. Mechanical rooms.
3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
5. Damp or Wet Locations: Rigid steel conduit.
6. Raceways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air: Plenum-type, optical fiber/communications cable raceway or EMT.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.

C. Minimum Raceway Size: 3/4-inch (21-mm) trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

F. Do not install aluminum conduits in contact with concrete.

3.2 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

- B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."
- E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
- H. Raceways Embedded in Slabs:
 - 1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
 - 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 - 3. Change from RNC, Type EPC-40-PVC to rigid steel conduit before rising above the floor.
- I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- K. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire.
- L. Raceways for Optical Fiber and Communications Cable: See division 27 section Communications Raceways.
- M. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where otherwise required by NFPA 70.
- N. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F (17 deg C), and that has straight-run length that exceeds 25 feet (7.6 m).
 - 1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.

- c. Indoor Spaces: Connected with the Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
 - 2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change.
 - 3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.
- O. Flexible Conduit Connections: Use maximum of 72 inches (1830 mm) of flexible conduit for recessed and semirecessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
- 1. Use LFMC in damp or wet locations.
- P. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.
- Q. Set metal floor boxes level and flush with finished floor surface.
- 3.3 PROTECTION
- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
- 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

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SECTION 260548 - VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Isolation pads.
 - 2. Channel support systems.
 - 3. Restraint cables.
 - 4. Hanger rod stiffeners.
 - 5. Anchorage bushings and washers.
- B. Related Sections include the following:
 - 1. Division 26 Section "Hangers And Supports For Electrical Systems" for commonly used electrical supports and installation requirements.

1.3 DEFINITIONS

- A. The IBC: International Building Code.
- B. ICC-ES: ICC-Evaluation Service.
- C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.4 PERFORMANCE REQUIREMENTS

- A. Seismic-Restraint Loading:
 - 1. Site Class as Defined in the IBC: D.
 - 1. Site Class as Defined in the IBC: D.
 - 2. Assigned Seismic Use Group or Building Category as Defined in the IBC: IV.
 - a. Component Importance Factor:
 - 1) General: 1.0.
 - 2) Life Safety (EM): 1.5
 - b. Component Response Modification Factor:
 - 1) Fixtures: 1.5
 - 2) Equipment: 2.5
 - 3) Conduit and Cables: 5.0.
 - c. Component Amplification Factor: 2.5.
 - 3. Design Spectral Response Acceleration at Short Periods (0.2 Second): 173%.
 - 4. Design Spectral Response Acceleration at 1.0-Second Period: 76%.

1.5 QUALITY ASSURANCE

- A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

- C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.
- D. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SEISMIC-RESTRAINT DEVICES

- 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. Amber/Booth Company, Inc.
 - 2. California Dynamics Corporation.
 - 3. Cooper B-Line, Inc.; a division of Cooper Industries.
 - 4. Hilti Inc.
 - 5. Loos & Co.; Seismic Earthquake Division.
 - 6. Mason Industries.
 - 7. TOLCO Incorporated; a brand of NIBCO INC.
 - 8. Unistrut; Tyco International, Ltd.
- B. General Requirements for Restraint Components: Rated strengths, features, and application requirements shall be as defined in reports by an agency acceptable to authorities having jurisdiction.
 - 1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
- C. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.
- D. Restraint Cables: ASTM A 603 galvanized or ASTM A 492 stainless-steel cables with end connections made of steel assemblies with thimbles, brackets, swivels, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.
- E. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or Reinforcing steel angle clamped to hanger rod. Do not weld stiffeners to rods.
- F. Bushings for Floor-Mounted Equipment Anchor: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchors and studs.
- G. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices.
- H. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

- I. Mechanical Anchor: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchors with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.
- J. Adhesive Anchor: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.2 FACTORY FINISHES

- A. Finish: Manufacturer's standard prime-coat finish ready for field painting.
- B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.
 - 1. Powder coating on springs and housings.
 - 2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
 - 3. Baked enamel or powder coat for metal components on isolators for interior use.
 - 4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
- B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Equipment and Hanger Restraints:
 - 1. Install restrained isolators on electrical equipment.
 - 2. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
 - 3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

- B. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- C. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- D. Drilled-in Anchors:
 - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 - 4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in 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.
 - 5. Set anchors to manufacturer's recommended torque, using a torque wrench.
 - 6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where they terminate with connection to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.5 ADJUSTING

- A. Adjust isolators after isolated equipment is at operating weight.
- B. Adjust active height of spring isolators.
- C. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 1. Identification for raceways.
 2. Identification of power and control cables.
 3. Identification for conductors.
 4. Underground-line warning tape.
 5. Warning labels and signs.
 6. Equipment identification labels.
 7. Miscellaneous identification products.

1.3 QUALITY ASSURANCE

- A. Comply with ANSI A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.4 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.

- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- C. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- D. Write-On Tags: Polyester tag, 0.010 inch (0.25 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
 - 1. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.2 FLOOR MARKING TAPE

- A. 2-inch- (50-mm-) wide, 5-mil (0.125-mm) pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

2.3 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.
- C. Warning label and sign shall include, but are not limited to, the following legends:
 - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
 - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."
 - 3. Arc Flash Warning: As specified.

2.4 EQUIPMENT IDENTIFICATION LABELS

- A. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).
- B. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

2.5 CABLE TIES

- A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.
 - 1. Minimum Width: 3/16 inch (5 mm).
 - 2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
 - 3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
 - 4. Color: Black except where used for color-coding.
- B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self extinguishing, one piece, self locking, Type 6/6 nylon.
 - 1. Minimum Width: 3/16 inch (5 mm).
 - 2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).

3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black.

- C. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.
1. Minimum Width: 3/16 inch (5 mm).
 2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 7000 psi (48.2 MPa).
 3. UL 94 Flame Rating: 94V-0.
 4. Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).
 5. Color: Black.

2.6 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in Division 09 painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- F. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.
- G. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
- H. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
1. Outdoors: UV-stabilized nylon.
 2. In Spaces Handling Environmental Air: Plenum rated.
- I. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches (400 mm) overall.

- J. Painted Identification: Comply with requirements in Division 09 painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

- A. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:
1. Emergency Power.
 2. Power.
 3. UPS.
- B. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded feeder and branch-circuit conductors.
 - a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
 - b. Colors for 277/480-V Circuits:
 - 1) Phase A: Brown.
 - 2) Phase B: Orange.
 - 3) Phase C: Yellow.
 - 4) Neutral: Gray with spiral stripe matching associated phase
 - 5) Ground: Green
 - c. Colors for 208/120-V Circuits:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - 4) Neutral: White with spiral stripe matching associated phase
 - 5) Ground: Green
 - 6) Isolated ground: Green with continuous yellow strip
 - d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- C. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.
- D. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.
- E. Auxiliary Electrical Systems Raceway Identification: Identify field installed alarm, control, and signal raceways with factory applied color. Color schedule is as follows:
1. Fire Alarm: Red
 2. Security: Blue
 3. Communications: Green
 4. Control: Yellow
- F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.

3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.
- G. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- H. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.
1. Comply with 29 CFR 1910.145.
 2. Identify system voltage with black letters on an orange background.
 3. Apply to exterior of door, cover, or other access.
 4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
 - a. Light fixtures
- I. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
1. Labeling Instructions:
 - a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.
 - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
 - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
 - d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
 2. Equipment to Be Labeled:
 - a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be self-adhesive, engraved laminated acrylic or melamine label.
 - b. Enclosures and electrical cabinets.
 - c. Access doors and panels for concealed electrical items.
 - d. Enclosed controllers.
 - e. UPS equipment.
 - f. Fire Alarm panel and annunciator

END OF SECTION

SECTION 260923 - LIGHTING CONTROL DEVICES

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 lighting control devices:
 - 1. Outdoor and indoor photoelectric switches.
 - 2. Indoor occupancy sensors.
- B. Related Sections include the following:
 - 1. Division 26 Section "Network Lighting Controls" for low-voltage, manual and programmable lighting control systems.
 - 2. Division 26 Section "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.

1.3 DEFINITIONS

- A. LED: Light-emitting diode.
- B. PIR: Passive infrared.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show installation details for occupancy and light-level sensors.
 - 1. Interconnection diagrams showing field-installed wiring.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

1.5 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.

1.6 COORDINATION

- A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 INDOOR OCCUPANCY SENSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Hubbell Lighting.
 2. Leviton Mfg. Company Inc.
 3. Lithonia Lighting; Acuity Lighting Group, Inc.
 4. Novitas, Inc.
 5. RAB Lighting, Inc.
 6. Sensor Switch, Inc.
 7. TORK.
 8. Watt Stopper (The).
- B. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit.
1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
 3. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
 4. Mounting:
 - a. Sensor: Suitable for mounting in any position on a standard outlet box.
 - b. Relay: Externally mounted through a 1/2-inch (13-mm) knockout in a standard electrical enclosure.
 - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
 5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
 6. Bypass Switch: Override the on function in case of sensor failure.
 7. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (21.5 to 2152 lx); keep lighting off when selected lighting level is present.
- C. PIR Type: Ceiling mounting; detect occupancy by sensing a combination of heat and movement in area of coverage.
1. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm).
 2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
 3. Detection Coverage (Corridor): Detect occupancy within 90 feet (27.4 m) when mounted on a 10-foot- (3-m-) high ceiling.
- D. Ultrasonic Type: Ceiling mounting; detect occupancy by sensing a change in pattern of reflected ultrasonic energy in area of coverage.
1. Detector Sensitivity: Detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
 2. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. (56 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
 3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.

4. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. (186 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
 5. Detection Coverage (Corridor): Detect occupancy anywhere within 90 feet (27.4 m) when mounted on a 10-foot- (3-m-) high ceiling in a corridor not wider than 14 feet (4.3 m).
- E. Dual-Technology Type: Ceiling mounting; detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on-off functions shall be selectable in the field by operating controls on unit.
1. Sensitivity Adjustment: Separate for each sensing technology.
 2. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm), and detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
 3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.

2.2 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 22 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 16 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

- A. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.2 WIRING INSTALLATION

- A. Wiring Method: Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 1/2 inch (13 mm).
- B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.3 IDENTIFICATION

- A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."
 - 1. Identify controlled circuits in lighting contactors.
 - 2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.

3.4 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
 - 2. Operational Test: Verify operation of each lighting control device, and adjust time delays.
- B. Lighting control devices that fail tests and inspections are defective work.

3.5 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.6 DEMONSTRATION

- A. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control system specified in Division 26 Section "Network Lighting Controls."

END OF SECTION

SECTION 262726 - WIRING DEVICES

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. Receptacles, receptacles with integral GFCI, and associated device plates.
 2. Twist-locking receptacles.
 3. Receptacles with integral surge suppression units.
 4. Wall-box motion sensors.
 5. Snap switches and wall-box dimmers.
 6. Wall-switch and exterior occupancy sensors.
 7. Pendant cord-connector devices.
 8. Cord and plug sets.
 9. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
- C. Samples: One for each type of device and wall plate specified, in each color specified.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.
- 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. Comply with NFPA 70.

1.5 COORDINATION

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
 1. Cord and Plug Sets: Match equipment requirements.

1.6 EXTRA MATERIALS

- A. Furnish extra materials described in subparagraphs below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. TVSS Receptacles: One for every 10 of each type installed, but no fewer than two of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
 2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
 3. Leviton Mfg. Company Inc. (Leviton).
 4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.2 STRAIGHT BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 5351 (single), 5352 (duplex).
 - b. Hubbell; HBL5351 (single), CR5352 (duplex).
 - c. Leviton; 5891 (single), 5352 (duplex).
 - d. Pass & Seymour; 5381 (single), 5352 (duplex).

2.3 GFCI RECEPTACLES

- A. General Description: Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.
- B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; GF20.
 - b. Hubbell
 - c. Leviton
 - d. Pass & Seymour; 2084.
- C. Faceless GFCI Receptacles, 125V, 20A, 1HP
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper;
 - b. Hubbell
 - c. Leviton; 7590
 - d. Pass & Seymour

2.4 TVSS RECEPTACLES

- A. General Description: Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 1449, with integral TVSS in line to ground, line to neutral, and neutral to ground.

1. TVSS Components: Multiple metal-oxide varistors; with a nominal clamp-level rating of 400 volts and minimum single transient pulse energy dissipation of 240 J, according to IEEE C62.41.2 and IEEE C62.45.
2. Active TVSS Indication: Visual and audible, with light visible in face of device to indicate device is "active" or "no longer in service."

B. Duplex TVSS Convenience Receptacles:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper;
 - b. Hubbell;
 - c. Leviton; 8380.
 - d. Pass & Seymour
3. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R.

2.5 TWIST-LOCKING RECEPTACLES

A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; L520R.
 - b. Hubbell; HBL2310.
 - c. Leviton; 2310.
 - d. Pass & Seymour; L520-R.

B. Isolated-Ground, Single Convenience Receptacles, 125 V, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; IG2310.
 - b. Leviton; 2310-IG.
3. Description: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.6 PENDANT CORD-CONNECTOR DEVICES

A. Description: Matching, locking-type plug and receptacle body connector; NEMA WD 6 configurations L5-20P and L5-20R, heavy-duty grade.

1. Body: Nylon with screw-open cable-gripping jaws and provision for attaching external cable grip.
2. External Cable Grip: Woven wire-mesh type made of high-strength galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.7 CORD AND PLUG SETS

A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.

1. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30 percent.

2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.8 SNAP SWITCHES

- A. Comply with NEMA WD 1 and UL 20.
- B. Switches, 120/277 V, 20 A:
 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
 - b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
 - c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
 - d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).

2.9 WALL-BOX DIMMERS

- A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
- B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.
- C. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.
- D. LED Lamp Dimmer Switches: Modular; compatible with dimmer power supplies; dimmer-lamp combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.10 OCCUPANCY SENSORS

- A. Wall-Switch Sensors:
 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; AT120 for 120 V, AT277 for 277 V.
 - b. Leviton; ODS 15-ID.
 3. Description: Adaptive-technology type, 120/277 V, adjustable time delay up to 20 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft. (84 sq. m).

2.11 WALL PLATES

- A. Single and combination types to match corresponding wiring devices.
 1. Plate-Securing Screws: Metal with head color to match plate finish.
 2. Material for Finished Spaces: Steel with white baked enamel, suitable for field painting or Smooth, high-impact thermoplastic.
 3. Material for Unfinished Spaces: Galvanized steel.

4. Material for Damp Locations: Thermoplastic or Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."

B. Wet-Location in-use, Weatherproof Cover Plates:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Arlington: In-Box with Stainless steel box
2. Description: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum or thermoplastic with lockable cover. Flush in-use

2.12 FLOOR SERVICE FITTINGS

- A. Type: Modular, flush-type, dual-service units suitable for wiring method used.
- B. Compartments: Barrier separates power from voice and data communication cabling.
- C. Service Plate: Rectangular, die-cast aluminum with satin finish.
- D. Power Receptacle: NEMA WD 6 configuration 5-20R, gray finish, unless otherwise indicated.

2.13 FINISHES

- A. Color: Wiring device catalog numbers in Section Text do not designate device color.
 1. Wiring Devices Connected to Normal Power System: Almond unless otherwise selected by Architect, unless otherwise indicated or required by NFPA 70 or device listing.
 2. Wiring Devices Connected to Emergency Power System: Red.
 3. TVSS Devices: Blue.
 4. Isolated-Ground Receptacles: As specified above, with orange triangle on face.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
- B. Coordination with Other Trades:
 1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
 1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.

D. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the left.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

A. Comply with Division 26 Section "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. In healthcare facilities, prepare reports that comply with recommendations in NFPA 99.
2. Test Instruments: Use instruments that comply with UL 1436.
3. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.

4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 5. Using the test plug, verify that the device and its outlet box are securely mounted.
 6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.
- C. Test straight blade convenience outlets in patient-care areas for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz. (115 g).

END OF SECTION

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SECTION 265100 - INTERIOR LIGHTING

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. Interior lighting fixtures, lamps, and ballasts.
 - 2. Emergency lighting units.
 - 3. Exit signs.
 - 4. Lighting fixture supports.
- B. Related Sections include the following:
 - 1. Division 26 Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
 - 2. Division 26 Section "Network Lighting Controls" for manual or programmable control systems with low-voltage control wiring or data communication circuits.
 - 3. Division 26 Section "Wiring Devices" for manual wall-box dimmers for incandescent lamps.

1.3 DEFINITIONS

- A. BF: Ballast factor.
- B. CRI: Color-rendering index.
- C. CU: Coefficient of utilization.
- D. LER: Luminaire efficacy rating.
- E. Luminaire: Complete lighting fixture, including ballast housing if provided.
- F. RCR: Room cavity ratio.

1.4 SUBMITTALS

- A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
 - 1. Physical description of lighting fixture including dimensions.
 - 2. Emergency lighting units including battery and charger.
 - 3. Energy-efficiency data.
 - 4. Sound Performance Data: For air-handling lighting fixtures. Indicate sound power level and sound transmission class in test reports certified according to standards specified in Division 23 Section "Diffusers, Registers, and Grilles."
 - 5. Life, output, and energy-efficiency data for lamps.
 - 6. Photometric data, in IESNA format, based on laboratory tests of each lighting fixture type, outfitted with lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.

- B. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.
 - 1. Wiring Diagrams: Power wiring.
- C. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, signed by product manufacturer.
- D. Qualification Data: For agencies providing photometric data for lighting fixtures.
- E. Field quality-control test reports.
- F. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.
- G. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.
- 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. Comply with NFPA 70.
- D. FMG Compliance: Lighting fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FMG.

1.6 COORDINATION

- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.7 WARRANTY

- A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Emergency Lighting Unit Batteries: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.
 - 2. Warranty Period for Emergency Fluorescent Ballast and Self-Powered Exit Sign Batteries: Seven years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining six years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
- B. In Interior Lighting Fixture Schedule where titles below are column or row headings that 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 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

- A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
- B. LED Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE5 and NEMA LE5A as applicable
- C. Metal Parts: Free of burrs and sharp corners and edges.
- D. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.
- E. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- F. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
 - 1. White Surfaces: 85 percent.
 - 2. Specular Surfaces: 83 percent.
 - 3. Diffusing Specular Surfaces: 75 percent.
 - 4. Laminated Silver Metallized Film: 90 percent.
- G. Plastic Diffusers, Covers, and Globes:
 - 1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - a. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless different thickness is indicated.
 - b. UV stabilized.
 - 2. Glass: Annealed crystal glass, unless otherwise indicated.

2.3 LED LUMINAIRES

- A. Solid State Drivers and LED: Comply with DOE LM 79
 - 1. Total Harmonic Distortion Rating: Less than 10 percent
 - 2. Transient Voltage protection
 - 3. Power factor: 0.90 or higher
 - 4. Temperatures: Minus 40 deg F (minus 40 deg C) and higher
 - 5. Heat sink to remove heat from circuits
 - 6. L70 compliant to 70,000 hours minimum
 - 7. Dimmable
 - a. Dimming Range: 100 to 1 percent of rated lamp lumens
 - b. Input watts: Can be reduced to 20 percent of normal

- c. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.

2.4 EMERGENCY POWER UNIT

- A. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast. Comply with UL 924.
 1. Emergency Connection: Operate LED fixture(s) continuously at an output of 1400 lumens each. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture driver.
 2. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
 - a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 3. Battery: Sealed, maintenance-free, nickel-cadmium type.
 4. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
 5. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is announced by an integral audible alarm and flashing red LED.

2.5 EXIT SIGNS

- A. Description: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:
 1. Lamps for AC Operation: LEDs, 70,000 hours minimum rated lamp life.
 2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
 - a. Battery: Sealed, maintenance-free, nickel-cadmium type.
 - b. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 - d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - f. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is announced by an integral audible alarm and flashing red LED.

2.6 LIGHTING FIXTURE SUPPORT COMPONENTS

- A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.
- B. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).
- C. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage (2.68 mm).

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.
- B. Support for Lighting Fixtures in or on Grid-Type Suspended Ceilings: Use grid as a support element.
 - 1. Install a minimum of four ceiling support system rods or wires for each fixture. Locate not more than 6 inches (150 mm) from lighting fixture corners.
 - 2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
 - 3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees.
 - 4. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.
- C. Suspended Lighting Fixture Support:
 - 1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
 - 2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
 - 3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
- D. Adjust aimable lighting fixtures to provide required light intensities.
- E. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.2 FIELD QUALITY CONTROL

- A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.
- B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION

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DIVISION 27 – COMMUNICATIONS

- 27 0000 GENERAL COMMON CONDITIONS FOR ALL COMMUNICATIONS SECTIONS
- 27 0100 OPERATION AND MAINTENANCE OF COMMUNICATIONS SYSTEMS
- 27 0113 WARRANTY PRODUCT AND SYSTEM
- 27 0119 FIELD TESTING AND REPORTING
- 27 0133 SHOP DRAWINGS, PRODUCT DATA, SAMPLES, DESIGN RECORDS & EXISTING CONDICITONS
- 27 0143 QUALIFICATIONS AND REQUIRED TRAINING FOR CONTRACTOR AND INSTALLER
- 27 0171 RESPONSIBILITY AND WORKMANSHIP OF CONTRACTOR
- 27 0500 COMMON WORK RESULTS FOR COMMUNICATIONS
- 27 0526 GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS
- 27 0528 PATHWAYS FOR COMMUNICATIONS SYSTEMS
- 27 0529 HANGERS AND SUPPORTS FOR COMMUNICATION SYSTEMS
- 27 0533 CONDUITS AND BACK BOXES FOR COMMUNICATIONS SYSTEMS
- 27 0536 CABLE TRAYS FOR COMMUNICATIONS SYSTEMS
- 27 0543 UNDERGROUND DUCTS, UTILITY POLES, AND RACEWAYS FOR INTERBUIILDING/CAMPUS CABLE ROUTING
- 27 0553 IDENTIFICATION FOR LOW-VOLTAGE CABLES AND LABELING
- 27 1100 EQUIPMENT ROOM FITTINGS
- 27 1116 CABINETS, RACKS, FRAMES, AND ENCLOSURES
- 27 1119 TERMINATION BLOCKS AND PATCH PANELS
- 27 1300 BACKBONE CABLING
- 27 1500 HORIZONTAL CABLING
- 27 1513 COPPER CABLE
- 27 1543 FACEPLATES AND CONNECTORS
- 27 1619 PATCH CABLES
- 27 5113 OVERHEAD PAGING
- 27 5319 INTERNAL CELLULAR, PAGING, AND ANTENNA SYSTEMS
- 27 6001 APPENDIX 01 – DEVIATION REQUEST PROCESS
- 27 6002 APPENDIX 02 – DOCUMENT REFRESH PROCESS
- 27 6003 APPENDIX 03 – DATA CENTER, TEC, TDR PART NUMBERS
- 27 6004 APPENDIX 04 – REFERENCE STANDARDS
- 27 6005 APPENDIX 05 – DEFINITIONS AND ABBREVIATIONS
- 27 6006 APPENDIX 06 – MATERIAL SUPPLIERS
- 27 6007 APPENDIX 07 – SIEMON CERTIFIED INSTALLATION FIRMS
- 27 6008 APPENDIX 08 – LEAD WALL PENETRATIONS

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SECTION 27000

GENERAL COMMON CONDITIONS FOR ALL
COMMUNICATION SECTIONS

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, and other documents as designated, apply to this Document.
- B. See Division 7 and section 27 01 00 Part 3 for additional requirements.

1.2 RELATED SECTIONS

- A. Specifications throughout all Divisions of the Project Manual are directly applicable to this section, and this section is directly applicable to them.
 - 1. All Division 27 Sections
 - 2. Requirements of the following Division 26 sections apply to this section
 - a. Basic electrical requirements
 - b. Basic electrical materials and methods
 - c. Grounding, earthing, and bonding
 - 3. Division 21 Fire Suppression
 - 4. Division 22 Plumbing
 - 5. Division 23 HVAC
 - 6. Division 28 Electronic Safety and Security

1.3 SUMMARY

- A. The work on many processes in this section are not part of the Division 27 contract. The respective trades shall include their portions, and administration topics that are applicable to all Division 27 Sections in their proposals.
- B. This document is based upon the 2018 Construction Specification Institute (CSI) Master Format numbers and titles for sections within Division 27: Communications.
- C. Where IT or Owner representation is stipulated in this Division, it shall be provided by the Data Center Operations Infrastructure Cabling team.

1.4 SUBMITTALS

- A. Product data shall be supplied for any parts/equipment that does not match the specified part number.
- B. Shop drawings
 - 1. Labeling schedules and layouts in owner designated electronic format
 - 2. Cabling administrative drawings

1.5 CONDITIONS

- A. Drawings and General provisions of the contract, including Uniform General Conditions, Supplementary General Conditions, architectural plans and specifications, requirements of Division 1, electrical, mechanical, plumbing, audio visual, security and telecommunications specifications and plans apply to the communications section, and shall be consider a part of this section. The contractor shall read all sections in their

entirety and apply them as appropriate for work in this section.

- B. Prior to beginning installation, a kick-off meeting to properly coordinate the tray installation and expectations should be held. It should be arranged by the General Contractor, and at a minimum include representatives of the following trades: FP&D, Electrical (Div. 26), Structured cable, Nurse Call, paging, building automation and control, plumbing, HVAC, fire sprinkler, framing, and others as applicable. The Data Center Operations Infrastructure Cabling Team will lead the meeting.
- C. Conflicts:
 - 1. Drawings and specifications are to be used in conjunction with one another and to supplement one another. In general, the drawings determine the nature and quality of the installation, materials, and tests. The quantities are derived from the drawings, details, listings, and manufacturer's directions.
 - a. Final order counts and distances are the contractor's responsibility.
 - 2. If there is an apparent conflict between the drawings and specifications, or between specification sections, the items with the greater quality or quantity shall be submitted, estimated, and installed.
 - 3. Clarification with the Owner and/or Owner's Representative about these items shall be made prior to the ordering and installation.
- D. Owner / Contractor
 - 1. The Architect/Project Manager will submit appropriate scope of work information that will allow the contractor to appropriately plan and bid the project.
- E. Contractor
 - 1. Furnish all labor, materials, tools, equipment and services for the installation described herein. Provide add/deduct unit pricing for all components as part of the bid response. Base fixed price add/deduct units on an average cable length of 175 linear feet.
 - 2. The Contractor shall procure and maintain for the duration of this agreement, insurance against claims.
 - 3. Use of Subcontractors: Successful bidder shall inform the Owner's contact and/or General Contractor in writing about the intention to use Subcontractors and the scope of work for which they are being hired. The Owner or Owner's designated contact must approve the chosen Subcontractors in writing prior to the Subcontractor's hiring and start of any work. The low voltage Subcontractor must be approved and certified. Refer to the listing in appendix 7.
 - 4. Use of Subcontractors: The Contractor's designated project manager will be recognized as the single point of contact. The Project manager shall oversee all work performed to ensure compliance with specifications as outlined in bid documents (which includes all specifications and drawings) to ensure a quality installation.

1.6 SCOPE OF WORK:

- A. This establishes a communications infrastructure to be used as signal pathways for voice, high-speed data transmission, and other low voltage services. Contractor shall:
 - 1. Comply with all Master Specifications documents and the following requirements for a complete project installation.
 - 2. Provide a structured cabling system as described hereafter that includes, but is not limited to, supplying, installing, labeling and testing of fiber backbone, fiber and voice riser cable; data copper, fiber, and voice copper horizontal cabling, cable connectors, communications outlets and terminations, patch cables, and equipment racks/cabinets for networking hardware and patch panels.
 - 3. All requirements and specifications will be enforced. Cable pathways and runs to individual outlets are not shown in their entirety but shall be provided as if shown in their entirety.

4. Coordinate with electrical tradespersons to verify conduit routing does not cause cabling to exceed allowable link length.
5. Follow industry standard installation procedures, including BICSI Installation Standard and guidelines as well as specified manufacturers standard recommended procedures and installation practices for communications cable to assure that the mechanical and electrical transmission characteristics of this cable plant and equipment are maintained.
6. The Division 27 work shall be performed by an approved, certified installer.
7. The low voltage communications Subcontractor shall complete non-concealed work.

1.7 REFERENCE STANDARDS:

- A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
- B. All reference amendments adopted prior to the effective date of the Contract shall be applicable to this Project.
- C. The publications listed below form a part of this specification. The publications are referred to in the text by basic designation only.
- D. Specific reference in specifications to codes, rules, regulations, standards, manufacturer's instructions, or requirements of regulatory agencies shall mean reference to the latest printed edition of each in effect at the date of contract.
- E. Codes and Standards (Most recent editions with addenda/TSB, etc.) All materials, installation and workmanship shall meet or exceed the applicable requirements and standards addressed within the references listed in **Appendix 04**.

1.8 DEFINITIONS:

- A. Definitions and Abbreviations are listed in **Appendix 05**:

PART 2 - PRODUCTS

2.1 PRODUCTS AND WORK NOT included BY DIVISION 27

- A. Others shall separately purchase and/or provide certain equipment and miscellaneous items that will be installed during the installation process. Such items may not be indicated in the documents. Contractor shall coordinate with the Owner and his suppliers when considering:
 1. Provision and installation of phone systems, computer hardware, and related networking software and equipment.
 2. Provision and installation of multi-port routers, hubs in communications rooms.
 - a. TEC/TDR UPS's are owner provided.
 3. Communications grounding bus bars and grounding wires connecting to the main building electrode system by Division 26.
 4. Dedicated power panels, ground bus bars, circuits and utility outlets.
 5. Installation and finishing of fire-rated plywood backboards.
 6. Building mechanical ductwork, cooling/heating system, and environmental control sensors.
 7. Communication pathway devices such as, conduits, conduit sleeves, back boxes, and penetrations in walls and floors. Including, but not limited to concealed work, office spaces and open areas.
 8. Provision and installation of modular furniture and millwork.

PART 3 - PENETRATIONS

3.1 THE WORK IN THIS SECTION IS IN DIVISION 7 CONTRACT; AND VERIFIED COMPLETE AT PROJECT TURNOVER.

- A. Wall Penetrations - Fire - Smoke – Sound
1. All fire, smoke, and sound wall penetrations must be correctly made to protect the safety of patients and employees. A facility is designed/architected and built with fire integrity that must not be lost as the building is modified over its lifetime.
 2. The items listed often penetrate 1 – and 2 – hour fire-resistance-rated (FRR) assemblies. General requirements for filling the space between the item in question and the wall are found in NFPC 101® Section 8.2.3.2.4.2. There is the option to either fill the space with appropriately rated fire-stop material or protect the space with an approved device designed to maintain the fire resistance of the wall.
 3. If a sleeve is used around the item that transverses the wall, the sleeve must be installed into the wall without any opening between the sleeve and the wall. The open space within the sleeve must then be filled with appropriately rated fire stop.
- B. All items listed in 1 through 2 must have penetrations in fire-resistance-rated assemblies filled to maintain the integrity of the fire barrier.
1. Conduits
 - a. When conduit passes through a wall that is either rated or must be fire-stopped due to lack of sprinklers in the compartment, it is essential to fill any gap around the conduit as described above.
 2. Cables/Wires
 - a. Sometimes cables or wires are passed through a penetration contained in a fire wall as a single installation. This often happens in a health care organization with communication cables. Even in these cases, the penetration must be patched appropriately.
 3. NOTE: Fire, smoke, and sound wall penetrations are also governed by local and state building codes.
 4. NOTE: This requirement applies to all departments, organizations, employees, and/or vendors who perform structured cable work in the facilities for:
 - a. Telephony and Computer networks, fire, smoke, and sound wall penetrations, alarm systems, security systems, HVAC Control or sensors, patient entertainment systems, announcing systems, nurse call, telemetry, RFID, etc.
 5. NOTE: While this document is written specifically for low voltage wiring, the JCAHO standards apply for any fire or smoke wall penetration. As you perform work in the facility, if you note any existing penetrations that are not up to standard, please notify the construction Project Manager immediately.
 6. While Facility Engineering has the overall responsibility, each department, organization, employee, and/or vendor has the responsibility to follow the process in obtaining a permit from facility engineering before work is started and to follow the guidelines to maintain the fire/smoke wall integrity.
- C. Process:
1. NOTE: This process applies to any person, group, and/or vendor who perform low voltage cable installations at any Intermountain facility or clinic.
 - a. Fire/Smoke Walls
 - 1) Any Vendor, department, and/or person needing to do any cable work that involves wall penetrations, adding to existing or new, are required to obtain a “Low Voltage Cable Work Permit” from Facility Engineer.
 - b. Above Ceiling Work
 - 1) Any vendor, department, and/or person needing to do any cable work above ceiling tiles, adding to existing or new, are required

to obtain all required permits.

- c. Above Ceiling Permit to be obtained from Facilities Management
 - 1) The permit requires detail information as to what work is being done, where the work will be done. The permit will also state the current approved sealing compound for the facility and specific requirements for conduits etc.
 - 2) There may also be specific rules regarding how work may be conducted in certain areas of the hospital. NOTE: Different manufacture's sealing products can NOT be used in the same penetration. Therefore, if an additional cable is added to an existing penetration, and you don't have the same brand of caulk, you must remove all of the caulk and re-do the seal completely.
- d. ICRA Permit to be obtain from Infectious Preventionist
- e. Hot Work Permit to be obtain from Facilities Engineer
- 2. Quality of Work
 - a. Facility Engineering Orientation

3.2 MEASUREMENT PROCEDURES:

- A. The Contractor shall
 - 1. Coordinate supports, adjacent construction, and fixture locations to ensure actual dimensions correspond to established dimensions.
 - 2. Verify dimensions in areas of installation by field measurements before fabrication and indicate measurements and scale on shop drawings.
 - 3. Coordinate fabrication schedule with construction progress to avoid delaying the work.
 - 4. Where field measurements cannot be made without delaying the work, establish dimensions and coordinate with the General Contractor.
 - 5. When approved, proceed with fabricating units without field measurements.

3.3 CHANGES

- A. ALTERNATES:
 - 1. If an alternate material is proposed that is equal to or exceeds specified requirements, Contractor shall provide manufacturers' specifications in writing for Owner approval prior to purchase and installation.
 - 2. Substitutions of material by the Contractor shall be in writing complete with written manufacturers' specifications. The material substituted shall not void, alter or change manufacturers' structured cabling system warranty.
 - 3. Contractor shall:
 - a. Provide a complete cabling infrastructure according to these written specifications and drawings. If the Owner changes the scope of work to be performed by the Contractor, it shall be in writing.
 - b. Promptly respond to these changes with a complete material list, including pricing, and labor in writing presented to the Owner for approval. Also include unit pricing.
 - c. Do not proceed with any additional scope of work without a signed approval by the Owner.
 - 4. Owner will not pay for additional work performed by the Contractor without signed approval of these changes. Contractor will submit a copy of signed change order upon billing.
 - 5. The Owner's Infrastructure Cable team will be the final judge of acceptability, with review by Owner's Representative and the distribution of the acceptance by the Architect. No substitute shall be ordered, installed or utilized without the

Architect's prior written verification of acceptance from the Owner's Infrastructure Cable team.

B. SUBSTITUTION PROCEDURES

1. Substitution may be considered when a product becomes unavailable through no fault of the Contractor.
2. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Include in each request for substitution:
 - a. Product identification, manufacturer's name and address.
 - b. Product Data: Description, performance and test data, reference standards, finishes and colors.
 - c. Samples: Finishes
 - d. Complete and accurate drawings indicating construction revisions required (if any) to accommodate substitutions.
 - e. Data relating to changes required in construction schedule.
 - f. Cost comparison between specified and proposed substitution.
3. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.
4. The Owner will be the final judge of acceptability, with review by Owner's Representative and the distribution of the acceptance by the Architect.
5. No substitute shall be ordered, installed or utilized without the Architect's prior written verification of acceptance from the Owner's Infrastructure Cable team.

PART 4 - EXECUTION

4.1 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Contractor shall supply all city, county, and state telecommunication cabling permits required by appropriate governing agency.
2. Prior to commencing work, the Contractor and staff shall secure all required Intermountain Healthcare permits including, but not limited to; facility sign in, ceiling work permits, hot work permits, and confined space permits.
3. Contractor shall be city, county, and state-licensed and/or bonded as required for communications/low voltage cabling systems work.

B. Certifications:

1. Contractor shall submit an up-to-date and valid certification verifying qualifications of the Contractor and installers to perform the work specified herein at time of bid submission.
2. Contractor shall have a complete working knowledge of low voltage cabling applications such as, but not limited to data, voice and video network systems.
3. Contracting firm shall have installed similar-sized systems in at least ten (10) other projects in the last five years prior to this bid and be regularly engaged in the business of installation of the types of systems specified in this document. Certification shall include, but not be limited to, items such as name and location of project contacts and numbers, total square footage, total number of cables/drops, types of media, etc.
4. Contractor shall provide certificates for the appropriate insurance coverage as defined in contract documents.
5. All installer personnel that will be assigned to this project shall be listed in a qualification document. 50% of the personnel working on the job site shall have a minimum of 3 years' experience in the installation of the types of systems, equipment, and cables specified in this document. Any personnel substitutions shall be noted in writing to Owner's Data Center Operations Infrastructure

Cabling representative prior to commencement of work.

6. BICSI ITS Cabling Installation Program Installer Level 1 or 2 or Technician certifications may be substituted in lieu of the 3-year requirement. All cabling

installers shall be trained and certified by the cable manufacturer for communication cabling installations and maintenance of said materials.

7. Refer also to General Conditions.

C. Administrative Requirements and Coordination:

1. The Contractor shall:

- a. Ensure that all technicians performing work have obtain badge access 48 hours prior to scheduled start.
- b. Provide a specified contact person (name and contact number) for coordination to attend project meetings with the communication consultant, the Owner and others.
- c. Coordinate work of this section with Owner's system specifications, workstations, equipment suppliers, and installers.
- d. Coordinate installation work with other crafts (examples include ceiling grid contractors, HVAC and sheet metal contractors, etc.) under the direction of the General Contractor to resolve procedures and installation placement for cable trays and cable bundle pathways. The goal of this coordination will be to establish priority pathways for critical data/voice network cable infrastructure, materials, associated hardware, as well as mitigate delays to the project and to allow service access for communications and HVAC components. Damage by Contractor to the craftwork of others will be remediated at the Contractor's expense in a timely manner.
- e. Exchange information and agree on details of equipment arrangements and installation interfaces. Record agreements reached in meetings and distribute record to other participants, Owner and communication consultant.
- f. Arrangement, layout, and locations of distribution frames, patch panels, and cross-connect blocks in equipment rooms and racks to accommodate and optimize arrangement and space requirements of any service provider equipment, telephone system, and LAN equipment as directed by Data Center Operations. Tasks shall be coordinated with the Owner's Data Center Operations team, and other trades' installation representatives.
- g. Where installed, confirm exact locations and method of mounting outlets in modular furniture. Follow furniture manufacturers' written instructions for installing cable and devices in modular partitions. Obtain modular furniture and power pole locations from the General Contractor. Wiring locations noted in plans along walls for modular furniture are approximate and will have to be determined by Contractor at time of installation. Field condition adjustments for installation may have to be made and coordination efforts with the mechanical and electrical contractor for pathway must take place early in the project to comply with maximum 40% conduit fill factor requirements.
- h. When requested by Owner or Owner's representative, furnish extra materials that match specified products and that are factory packaged with protective covering for storage and identified with labels describing contents. Unit pricing shall apply.

D. Contract Administration:

1. Change orders shall be submitted to the Owner/Project Manager complete with price breakdown and description for approval before any work is done.
2. Owner's Data Center Operations Representative will provide job field reports upon inspection of Contractor's installation, materials, supporting hardware, coordination with other trades and progress to schedule to the Owner's project manager.
3. Job Field Report outline:

- a. General installation progress in relation to scheduled work made by the Contractor up to that date.
 - b. All deficiencies noted in the cable installation to be corrected by the Contractor.
- E. Pre-Installation Meetings - Contractor shall:
- 1. Attend and/or arrange a scheduled pre-installation conference prior to beginning any work of this section.
 - a. Agenda: This venue is to ask and clarify questions in writing related to work to be performed, scheduling, coordination, etc. with consultant and/or project manager/and Data Center Operations Infrastructure Cabling representative.
 - b. Attendance: Communications project manager/supervisor shall attend meetings arranged by General Contractor, Owner's Data Center Operations Infrastructure Cabling representatives, and other parties affected by work of this document.
 - c. All individuals who will be installers of communication cables and equipment in an on-site supervisory capacity shall be required to attend the pre-installation conference. Individuals who do not attend the conference will not be permitted to supervise the installation of, or install, terminate, or test communications cables on the project. This includes supervisors, project managers, and lead installers of this project.
- F. Request for Change (RFC)
- 1. A Request for Change shall be opened and approved by the Change Approval Board prior to any modifications, attachments, or other activities that may affect production systems.
 - a. Policy and details available through the Data Center Operations Infrastructure Cable Representative.
- G. Post-Installation Meetings:
- 1. Schedule Div. 27 Final Inspection
 - 2. At the time of substantial completion, or shortly thereafter, the low voltage Sub-Contractor shall call and arrange for a post-installation meeting to present and review all submittal documents to include, but not limited to as-built drawings, test reports, warranty documentation, etc. Attendees shall be Owner staff, Owner's Representative, General Contractor, and others that the General Contractor deems appropriate.
 - 3. At this meeting the Contractor shall present and explain all documentation, including test results, and ask for feedback on its completeness. Any discrepancies or deviations noted by and agreed to by participants shall be remedied by Contractor and resubmitted within one week of meeting.

4.2 DELIVERY, STORAGE, AND HANDLING:

- A. Coordination with delivery companies, drivers, site address, and contact person(s) will be the responsibility of the Contractor.
- B. Contractor Shall:
 - 1. Be responsible for prompt material deliveries to meet contracted completion date.
 - 2. Coordinate deliveries and submittals with the General Contractor to ensure a timely installation.
 - 3. No equipment materials shall be delivered to the job site more than three weeks prior to the commencement of its installation.
 - 4. Equipment shall be delivered in original packages with labels intact and identification clearly marked.
 - 5. Materials shall not be damaged in any way and shall comply with manufacturer's operating specifications.

6. Equipment and components shall be protected from the weather, humidity, temperature variations, dirt, dust, or other contaminants. Equipment damaged prior to system acceptance shall be replaced at no cost to the Owner.
 7. Material Contractor shall be responsible for all handling and control of equipment.
 8. Material Contractor is liable for any material loss due to delivery and storage problems.
- C. Owner/General Contractor shall supply a list of security requirements for Contractor to follow.

4.3 PROJECT/SITE CONDITIONS

- A. For all environmental recommendations, refer to master Architectural section.
- B. For all security recommendations, refer to related Division 01.
- C. After completing system installation, including outlet fittings and devices, inspect exposed finish. Contractor will remove burrs, dirt, and construction debris. If applicable, the Contractor will repair damaged finishes, including chips, scratches, and abrasions.
- D. Contractor shall provide daily a clean work environment, free from trash/rubbish accumulated during and after cabling installation.
- E. Food and drink are not permitted in work areas. They shall be stored, prepared, and consumed only in designated break or cafeteria areas.
- F. Contractor shall keep all liquids (drinks, sodas, etc.) off finished floors, carpets, and tiles. If any liquid or other detriment (cuts, soils, stains, etc.) damages the above finishes, Contractor shall provide professional services to clean or repair scratched/soiled finishes, at Contractor's expense.

4.4 CLEANING

- A. Work areas will be kept in a broom clean condition throughout the duration of the installation process.
- B. Remove all unnecessary tools and equipment, unused materials, packing materials, and debris from each area where work has been performed daily, unless designated for storage.
- C. The Contractor will damp clean all surfaces prior to final acceptance by Owner.

END OF SECTION

SECTION 270100

OPERATION AND MAINTENANCE OF COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 INTRODUCTION

- A. To make the approval of such a large topic possible, the structured cable topic has been broken into its subcomponents and each subcomponent was completed, reviewed, and approved in turn. The result is this comprehensive guideline that should provide adequate guidance on this topic.

PART 2 - PRODUCT

2.1 KEY POINTS

- A. Category 6A shielded foil over unshielded twisted pair (F/UTP) is the only approved standard for cabling.
 - 1. Specifically, Siemon category CAT6A F/UTP (foil over unshielded twisted pair) cable and associated patch panels, wall plates and jacks; for data centers, and all clinical and hospital campus'.
 - 2. Only Siemon certified contractors or certified Intermountain Healthcare cable technicians will install structured cable at Intermountain Healthcare facilities.

2.2 IMPLEMENTATION

- A. This guide is to be used for New Construction and Remodels. These standards will be implemented over time in existing cabling environments as rework is performed.
- B. If there is a current need to connect servers at 10GBaseT and the only option is copper, CAT6A F/UTP is required. New Server connections shall be a minimum OS1 Single Mode Fiber.
- C. Installations already in place are not required to remove or replace existing cabling CAT5e or newer. All new cabling shall follow the recommendation to use CAT6A F/UTP cabling.

2.3 STANDARD PRODUCT

- A. The Approved cable type for horizontal cabling is CAT 6A F/UTP.
 - 1. The Approved Standard Manufacturer for Intermountain Healthcare's horizontal cabling is:
 - a. **Siemon Company USA**
101 Siemon Company Drive
Watertown, CT 06795
 - 2. Approved Suppliers of Siemon cable, patch panels, jacks, and parts are listed in Appendix 06:

PART 3 - EXECUTION

3.1 Horizontal Cabling

- A. Horizontal Subsystem is the portion of the cabling system that extends from (and includes) the work area telecommunications outlet/connector to the Floor Distributor (FD)/Horizontal Cross-connect (HC) in the telecommunications room (TDR). It consists of the communications outlet/connector, the horizontal cable, optional consolidation point,

and that portion of the cross-connect in the telecommunications room serving the horizontal cable. Each floor of a building should be served by its own Floor Distributor/Horizontal (FD/HC) Subsystem located in the telecommunications Room (TDR).

1. NOTE: Cable installers have rigorous requirements to be certified for Siemon cables and products. Validation of certification is required prior to accepting a bid.
 2. Current Siemon Approved/Certified Cable Installers for Siemon Network are listed in Appendix 07.
- B. Reliability of the horizontal cabling system is critical to the operation of IS equipment throughout a facility. Installing the cable is extremely labor intensive and there are several learned skills used to correctly install the cable. Cable installers are certified, and installers must demonstrate the ability to install the cable correctly to be certified. If the cable is installed by a certified installer and is installed in accordance with the manufacturer's guidelines, the manufacturer will warranty the cable installation.
- C. The manufacturer also requires the cables to be individually labeled and 100% tested and certified. Cable testing and certification equipment is usually expensive and is not commonly available at the facility or by many telecom installers. Certified Installer companies are required by the manufacturer to be knowledgeable in the use of "Qualified" Field Testing equipment and provide test results for warranty registration.
1. Contractor is to verify with the manufacturer the current "Qualified" tester manufacturers and the current operating software.
 2. Contractors will provide test results in the operating software format (not PDF, text or Word) to Intermountain Healthcare upon completion.
- D. Much of the cable is installed in walls and in the ceiling and usually lasts the lifespan of the building. As with most technology, the lifespan of cable is its usability and applicability to its use on future computing technology.

END OF SECTION

SECTION 270113

WARRANTY, PRODUCT AND SYSTEM

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.
- B. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them, including but not limited to the listing found in Section 27 00 00.

PART 2 - PRODUCTS

2.1 STANDARD WARRANTY

- A. Contractor shall provide a minimum one (1) year warranty on installation and workmanship PLUS an Extended Product Warranty and System Assurance Warranty for this wiring system and shall commit to make available local support for the product and system during the Warranty period.
- B. System Certification: Upon successful completion of the installation and subsequent inspection, the customer shall be provided with a Manufacture Warranty certificate.
- C. Either a permanent link or channel model configuration may be applied to the horizontal and/or backbone sub-systems of the structured cabling system. Applications assurance is only applied to a channel model configuration. All channels are to be qualified for linear transmission performance up to 500 MHz to ensure that high-frequency voltage phase and magnitude contributions do not prove cumulative or adversely affect channel performance.

2.2 EXTENDED WARRANTY

- A. The manufacturer of passive telecommunications equipment used in a manner not associated with the Systems Warranty must have a minimum five (5) year Component Warranty on all its product. The Products Warranty covers the components against defects in material or workmanship under normal and proper use.
 - 1. Special Project Warranty: A full end-to-end written warranty mutually executed by manufacturer and the principal Installer, agreeing to replace and install voice/data distribution system components that fail in materials or workmanship, or do not meet manufacturer's official published specifications and performance criteria within the special Project warranty period specified below. This shall cover applications assurance, cable, and connecting hardware including both labor and materials. This warranty shall be in addition to, and not a limitation of, other rights and remedies the Owner may have against the Contractor under the Contract Documents.
- B. A twenty (20) year warranty available for the Category 6A Z-MAX copper structured cabling system shall be provided for an end-to-end channel model installation which covers applications assurance, cable, connecting hardware and the labor cost for the repair or replacement thereof. The fiber warranty will be an XGLO twenty (20) year warranty, which is based on using laser optimized single mode fiber as minimum.
 - 1. Performance claims based on worst case testing and channel configurations.

2. Special Project Warranty Period: 20 years minimum, beginning on the date of Substantial Completion.
3. Siemon Certified Warranty Requirements:
 - a. Upon Completion of the project, Intermountain Healthcare must receive the Full Warranty Documentation from The Siemon Company before final retention funds are released to the general contractor, electrical contractor and structured cabling subcontractor if applicable.

2.3 MAINTENANCE

- A. Support Availability: The Contractor shall commit to make available local support for the product and system during the Warranty or Extended Warranty period.

END OF SECTION

SECTION 270119

FIELD TESTING AND REPORTING

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.
- B. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them, including but not limited to the listing found in Section 27 00 00.

1.2 SYSTEM DESCRIPTION

- A. Owner reserves the right to be present during any or all testing.
- B. The objective of this project is to provide a complete communications cabling infrastructure system installation including, but not limited to: fiber backbone, riser system, horizontal data and voice cabling with associated terminations, mounting equipment, cable pathway and management systems, testing and other items/materials, as specified in drawings, these specifications, and contract documents.
- C. The Contractor's BICSI Registered Communications Distribution Designer (RCDD) supervisor shall review, approve and stamp all documents prior to submitting. The Contractor's RCDD shall warrant in writing that 100% of the installation meets the requirements specified herein upon completion of all work.
- D. Product Certificates shall be signed by manufacturers of cables, connectors, and terminal equipment certifying that products furnished comply with requirements.
- E. Contractor shall submit the required Field Test Reports in the format and media specified, upon completion of testing the installed system.
- F. Contractor shall deliver manufacturer's signed long-term Warranty of installed cabling system to include all components that comprise the complete cabling system. Delivery to be affected within two weeks of the time of final punch list review. Failure of any component to pass system component tests shall be promptly corrected, repaired or replaced to meet standards compliance.

1.3 PREFERRED OWNER INSPECTION & TEST CHECKPOINTS

- A. DCO & ICT Inspection Milestones & Responsibilities need to be coordinated into master project plan to allow the GC to make timely arrangements. All are per floor and/or phase.
 - 1. ICT & DCO = Framing, during and/or after boxes & conduits are in place; prior to sheetrock.
 - 2. ICT = When cable basket is starting to be installed.
 - 3. ICT = When cable basket is ready, but prior to starting to pull cable.
 - 4. ICT & DCO = When TDR's are ready for racks and ladders.
 - 5. DCO = When anchoring racks and laying out equipment.
 - 6. ICT & DCO = When TDR environmental requirements are ready, room is dust free, and securable.
 - a. The TEC and TDRs must be high on the build timeline and be completed early in the construction to accommodate the building systems to be tested and commissioned, such as BAS, Security, and Wireless Network.
 - 7. ICT = When trim and testing are in progress.
 - 8. OTHERS
 - a. Depending on project, the manufacturer will inspect 1 or 2 times.

- b. DCO or ICT = When problems or questions arise.

PART 2 - PRODUCTS

2.1 SITE TESTS & INSPECTIONS

- A. Prior to pulling cable, the cabling contractor shall schedule an inspection of the pathways with a member of the Data Center Operations Infrastructure cabling team.
- B. Upon completion of the communications infrastructure systems, including all pathways and grounding, the Contractor shall test the system.
 - 1. Cables and termination modules shall be affixed, mounted or installed to the designed/specified permanent location prior to testing.
 - 2. Any removal and reinstallation of any component in a circuit, including faceplates, shall require retesting of that circuit and any other disturbed or affected circuits.
 - 3. Approved instruments, apparatus, services, and qualified personnel shall be utilized.
 - 4. If tests fail, Contractor shall correct as required to produce a legitimate passing test.
 - 5. Manipulation of tester parameters on a failing test in order to achieve a passing test is unacceptable.
- C. These specifications will be strictly enforced. The Contractor must verify that the requirements of the specifications are fully met through testing with an approved tester (rated for testing the cable type in use), and documentation as specified below. This includes confirmation of requirements by demonstration, testing and inspection. Demonstration shall be provided at final walk-through in soft copy.
- D. Notification of the likelihood of a cable exceeding standardized lengths must be made prior to installation of the cable. Without contractor's prior written notice and written approval by the Owner, testing that shows some or all pairs of cable not meeting specifications, shall be replaced at Contractor's expense (including respective connectors).
- E. Testing is still required for non-compliant cabling. The tests shall be for wire-mapping, opens, cable-pair shorts, and shorts-to-ground. The test results must be within acceptable tolerances and shall be submitted with the Owner's acceptance document.

2.2 CABLE TESTING PLAN

- A. The Contractor shall:
 - 1. Provide a complete and detailed test plan for approval of the cabling system specified herein, including a complete list of test equipment for copper and fiber optic components and accessories prior to beginning cable testing. The following minimal items shall be submitted for review:
 - a. All testing methods that clearly describes procedures and methods.
 - b. Product data for test equipment
 - c. Certifications and qualifications of all persons conducting the testing.
 - d. Calibration certificates indicating that equipment calibration meets National Institute of Standards and Technology (NIST) standards and has been calibrated at least once in the previous year of the testing date.
 - 2. Include validation, and testing. Owner will require that the telecommunications cabling system installed by the Contractor be fully certified to meet all necessary requirements to be compliant with referenced IEEE and TIA specifications and vendor's warranty.

3. Will determine the source/cause of test failure readings and correct malfunctioning component and/or workmanship within each channel or permanent link and retest to demonstrate compliance until corrected failure produces a passing result.

2.3 CABLE TESTING REPORTS

- A. The Contractor shall submit cable test reports as follows:
 1. Submit certified test reports of Contractor-performed tests.
 - a. The tests shall clearly demonstrate that the media and its components fully comply with the requirements specified herein.
 - b. (1) set of electronic test reports shall be submitted and clearly identified with cable identification.

PART 3 - EXECUTION

3.1 TEST EQUIPMENT

- A. All transmission testing of balanced twisted-pair cables shall be performed with an approved Level III balance twisted pair tester found on the Siemon Ally Website. The latest version of software shall be installed prior to performing testing. Refer to the Siemon Warranty Documents for proper testing requirements of associated cable and components.
- B. All balanced twisted-pair field testers shall be factory calibrated each calendar year by the field test equipment manufacturer as stipulated by the manuals provided with the field test unit. The calibration certificate shall be provided for review prior to the start of testing
- C. Auto test settings provided in the field tester for testing the installed cabling shall be set to the default parameters
- D. Test settings selected from options provided in the field testers shall be compatible with the installed cable under test.

3.2 TEST METHOD / CRITERIA

- A. Copper Testing
 1. Testing of all newly installed cable channels shall be performed prior to system cutover.
 - a. Visually inspect F/UTP and optical fiber cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments and inspect cabling connections for compliance with TIA/EIA-568-C.1.
 - b. Visually confirm Category 6A marking of outlets, cover plates, outlet/connectors, and patch panels.
 - c. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
 - d. Test F/UTP copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
 - e. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-C, and those required by manufacturer to validate and start warranty.
 2. Copper Testing all 500 MHz category 6A field-testing shall be performed with an approved level 111e balanced twisted-pair field test device, that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)"

- Annex (Level IIe or IIIe balanced twisted pair field test device). Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
3. All installed 500 MHz category 6A channels shall perform equal to or better than the minimum requirements as specified below:
 - a. Category 3, balanced twisted-pair backbone cables, for the channel shall be 100 percent tested according to ANSI/TIA/EIA-568-C.1. Test parameters include wire map plus F/UTP (ScTP) shield continuity (when present), insertion loss, length and NEXT loss (pair-to-pair). NEXT testing shall be done in both directions.
 - b. 500 MHz Category 6A balanced twisted-pair horizontal and backbone cables, shall be 100 percent tested.
 4. F/UTP Performance Tests
 - a. Wire map.
 - b. Length (physical vs. electrical, and length requirements)
 - c. Insertion loss
 - d. Near-end crosstalk (NEXT) loss
 - e. Power sum near-end crosstalk (PSNEXT) loss
 - f. Equal-level far-end crosstalk (ELFEXT)
 - g. Power sum equal-level far-end crosstalk (PSELFEXT)
 - h. Return loss
 - i. Propagation delay
 - j. Delay skew
 - k. F/UTP Shield continuity
 5. Final Verification Tests: Perform verification tests for F/UTP systems after the complete communications cabling and workstation outlet/connectors are installed.
 6. Document data for each measurement. Data for submittals shall be printed in a summary report.
 7. End-to-end cabling will be considered defective if it does not pass tests and inspections.
 8. Prepare and submit test and inspection reports.
- B. Horizontal Fiber Testing
1. Fiber horizontal cables shall be 100% tested for insertion loss and length.
 2. Insertion loss shall be tested at 850 nm or 1300 nm for 50/125 μ m and 62.5/125 μ m multimode cabling in at least one direction using the Method B (1-jumper) test procedure as specified in ANSI/TIA/EIA-526-14A.
 3. Length shall be tested using an OTDR, optical length test measurement device or sequential cable measurement markings.
 4. The horizontal link performance guarantees are based on an optical fiber calculation for the appropriate fiber solution. Optical fiber calculations shall be determined using the Siemon Fiber Loss Calculator found on the Siemon Ally Website.
- C. Backbone Fiber Testing
1. Fiber backbone cables shall be 100% tested for insertion loss.
 2. Insertion loss shall be tested at both 850 nm and 1300 nm for 50/125 μ m and 62.5/125 μ m multimode cabling and both 1310 nm and 1550 nm for 8.5/125 μ m single mode cabling and in at least one direction using the Method B (1-jumper) test procedure as specified in ANSI/TIA/EIA-526-14A.
 3. Insertion loss shall be tested at 1310 and 1550 for single-mode cabling in at least one direction using the Method A.1 (1-jumper) test procedure as specified in ANSI/TIA/EIA-526-7.
 4. Length shall be tested using an OTDR, optical length test measurement device or sequential cable measurement markings.

5. The backbone link performance guarantees are based on an optical fiber calculation for the appropriate fiber solution. Optical fiber calculations for any fiber cable greater than 90m (295 ft.) shall be determined using the Siemon Fiber Loss Calculator found on the Siemon Ally Website.

3.3 DEMONSTRATION

- A. Include training for appropriate IT staff in numbering system and documentation system methods and record keeping. Proper fiber terminations and fiber jumper installations.

END OF SECTION

SECTION 270133

SHOP DRAWINGS, PRODUCT DATA, SAMPLES
DESIGN RECORDS & EXISTING CONDITIONS

PART 1 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

1.1 SUBMITTALS

- A. The Contractor:
 - 1. Shall not perform any portion of the work requiring submittal and review of shop drawings, product data, or samples until Owner has approved the respective submittal. Such work shall be in accordance with approved submittals.
 - a. Shop drawings as required by the owner or as a minimum to include a minimum of two sets of a plan view and elevations of all work to be installed. The Contractor shall make any corrections required by the owner or the owner's representative or consultant team, file with him two corrected copies and furnish such other copies as may be needed. The consultant's approval of such drawings or schedules shall not relieve the Contractor from responsibility for deviations from drawings or specifications, unless he has in writing and called to the Architect's attention such deviations at the time of submission, nor shall it relieve him from responsibility for errors of any sort in shop drawings or schedules.
- B. The Contractor shall provide a copy of the Certified Test Data Sheet, available from the delivering distribution warehouse for either a full run or cut piece from the Master Reel of the fiber cable to be installed
 - 1. The Certified Test Data Sheet shall include the Master Reel number, cable description, a passing test result with details, test equipment description, date certified, and a certificate of compliance stamp, and shall be included in the O&M Manual as a component of the final deliverables submittal package.

1.2 DRAWINGS

- A. Shop Drawings
 - 1. The Contractor shall:
 - a. Submit catalogue cut sheets that include manufacturer, trade name, and complete model number for each product specified. Model number shall be handwritten, marked with an arrow or underlined to indicate exact selection.
 - b. Identify applicable specification section reference for each product performance for each component specified for approval prior to purchase and installation.
- B. Record Drawings
 - 1. Drawings for the cabling system infrastructure elements shall be maintained and kept on file by the Siemon Certified Installer (Company) for the entire term of the warranty. Drawings shall include:
 - a. Horizontal cable routing and terminations
 - b. Telecommunications outlets/connectors
 - c. Backbone cable routing and terminations
 - d. Telecommunication Spaces (TS)
- C. Samples

1. For workstation outlet connectors, jack assemblies, housing and faceplates for color selection and evaluation of technical specifications and requirements. Confirm with Architect, interior designer, and Owner representative for color before purchasing materials. Face plates shall match the electrical face plates in Color and material type.
 2. Upon request, provide samples for workstation outlets, jacks, jack assemblies, in specified finish, one for each size and outlet configuration
 3. Sample mock-up rooms may be required in some areas to ensure proper equipment placement and fit.
- D. Qualifications:
1. The Contractor shall provide the appropriate documentation to comply with the requirements set forth in Section 01 43 23 Qualifications, included with, and at the time of, bid submittal.

PART 2 - SUSTAINABLE DESIGN RECORDS AND REPORTS

2.1 DRAWINGS

- A. Closeout Submittals (As-built Drawings):
1. Communications Design drawings are to be supplied to the Architect to prepare the master "As-Built" drawings.
 2. As-Built drawings shall be in a format that is compatible with the format used by the Architect and consultant. Dimensions and scale of the drawing sheets submitted shall match the size of the drawing used for the contract documents and shall include the cable numbers labeled in accordance with this document.
 3. Utilize normal recognized drafting procedures that match standards, Architect and consultant guidelines and methodology.
 4. The As-Built drawings shall incorporate all changes made to the building identified in, but not limited to, addendum, change notices, site instructions or deviations resulting from site conditions.
- B. Contractor shall:
1. Clearly identify any resubmitted drawing sheets, documents or cut sheets either by using a color to highlight or cloud around resubmitted information.
 2. Maintain drawing numbering or page/sheet scheme consistency as per previously issued drawings/documents.
 3. Provide dimensioned plan and elevation views of networking components, showing:
 - a. All communications data/voice outlet locations complete with outlet/cable labeling.
 - b. Cable routing paths of communications cables to identified infrastructure pathways.
 - c. All rack and cabinet locations and labeling thereof.
 - d. One-line diagram of equipment/device interconnecting data/voice cabling of the data and voice systems.
 - e. Standard or typical installation details of installations unique to Owner's requirements.
 - f. Graphic symbols and component identification on detail drawing shall conform to the latest ANSI/TIA 568-C, ANSI/TIA 569-B, ANSI/TIA 606-A and ANSI/NECA/BICSI 607-A conventions.
 4. Submit one soft (compatible with Microsoft software) and hard copy with project deliverables within three weeks subsequent to substantial completion.
 5. Hard copy of floor plans for record shall be plotted to a standard, saleable, identified drawing scale.

2.2 RECORDS AND REPORTS

- A. All records shall be created by the installation contractor and turned over at the completion of work.
 - 1. The format shall be computer based
 - a. Soft copies and hard copies shall be part of the As-built package.
 - b. The minimum requirements include:
 - 1) Cable records must contain the identifier, cable type, termination positions at both ends, splice information as well as any damaged pairs/conductors.
 - 2) Connecting hardware and connecting hardware position records must contain the identifier, type, damaged position numbers, and references to the cable identifier attached to it.
 - 2. Test documentation on all cable types shall be included as part of the As-built package.
- B. All Siemon Warranty Registration documents shall be included.
- C. All reports shall be generated from the computer-based program used to create the records above. These reports should include but not limited to:
 - 1. Cable Reports
 - 2. Cross-connect Reports
 - 3. Connecting Hardware Reports

PART 3 - EXISTING CONDITIONS SITE SURVEY

3.1 SITE SURVEY

- A. Prior to placing any cable pathways or cable, the contractor shall survey the site to determine job conditions will not impose any obstructions that would interfere with
- B. the safe and satisfactory placement of the cables. The arrangements to remove any obstructions with the Project Manager need to be determined at that time.

END OF SECTION

SECTION 270143

QUALIFICATIONS AND REQUIRED TRAINING
FOR CONTRACTORS AND INSTALLERS

PART 1 - GENERAL INSTALLER QUALIFICATIONS

1.1 ENTITIES

- A. Communications contractors
1. The Communications Contractor shall at a minimum possess the following qualifications:
 - a. Contractor shall be a Siemon Certified Contractor with valid up to date contract certification and in good standing with the Siemon Company.
 - b. Be in business a minimum of five (5) years.
 - c. Contractor shall demonstrate satisfaction of sound financial condition and can be adequately bonded and insured if the project deems necessary.
 - d. Possess those licenses/permits required to perform telecommunications installations in the specified jurisdiction.
 - e. Use personnel knowledgeable in local, state, province and national codes and regulations. All work shall comply with the latest revision of the codes or regulations. When conflict exists between local or national codes or regulations, the most stringent codes or regulations shall be followed.
 2. Contractor must possess current liability and workers compensation insurance certificates.
 3. Contractor must be registered with BICSI and have at least one RCDD on staff or ITS Cabling Installer Program Technician certification and Installer Level 1 & 2 for a minimum of 75 percent of staff.

1.2 TRAINING

- A. The Contractor shall be fully conversant and capable in the cabling of low voltage applications such as, but not limited to data, voice and imaging network systems. The Contractor shall at a minimum possess the following qualifications:
1. Personnel trained and certified in the design of the Siemon Cabling System®.
 2. Personnel trained and certified to install the Siemon Cabling System®.
 3. The Designer and Installer shall show proof of current certification of the Siemon Cabling System® via an updated certificate given after attending the Certified Installer training course or an on-line re-certification class given every two years.
 4. Provide references of the type of installation provided in this specification.
 5. Personnel trained and certified in the installation of copper cable and in the use of Level IIIe Copper Transmission Performance testers, fiber optic cabling, splicing, termination and testing techniques. Personnel must have experience using an optical light source and power meter plus an OTDR.
 6. Personnel trained in the installation of pathways and supports for housing horizontal and backbone cabling.
- B. Facilities Orientation

END OF SECTION

SECTION 270171

RESPONSIBILITY AND WORKMANSHIP
OF CONTRACTOR

PART 1 - GENERAL

1.1 CONTRACTOR RESPONSIBILITY

- A. Contractor shall be obligated to exercise the highest standard of care in performing its obligations as defined in a request for proposal. All work shall be done in a workman like fashion of the highest standards in the telecommunications industry.
- B. All equipment and materials are to be installed in a neat and secure manner, while cables are to be properly dressed in accordance with standards recommendation for a specific type of media (i.e. UTP vs. F/UTP @ 10 Gigabit)
- C. Workers must clean any debris and trash at the close of each job and workday.
- D. Contractor acknowledges that Intermountain Healthcare will rely on contractor's expertise, ability and knowledge of the system being proposed and shall be obligated to exercise the highest standard of care in performing contractual obligation as defined in the Scope of Work.
- E. Contractor must submit The Siemon warranty, Cable Records, As Built Drawings and Test Results at the completion of work. Note: Intermountain Healthcare reserves the right to withhold final payments until all registration documents are approved by the Siemon Company and received by Intermountain Healthcare.

1.2 CONTRACTOR AND EMPLOYEE RESPONSIBILITY

- A. Contractors, their employees, and installers will attend annually Intermountain Healthcare required Infection Control training.
- B. Contractors, their employees, and installers will complete Reprax registration.
- C. Contractors, their employees, and installers will attend Intermountain Healthcare required site and job specific orientation.
- D. Contractors, their employees, and installers will maintain Intermountain Healthcare required immunizations.
- E. Contractors, their employees, and installers will keep their Intermountain Healthcare required confidentiality agreements current.
- F. Contractors, their employees, and installers always agree to follow all Intermountain Healthcare Policies and procedures and wear the appropriate ID while on any of Intermountain properties.
- G. Contractor will determine with Owner the appropriate level of Environmental Containment precautions to utilize for each work location. Infection Control Risk Assessments and permits will be performed as required.
- H. Upon request, provide qualification data for all qualified layout technicians, installation supervisors, and field inspector
 - 1. Siemon issued qualification badges shall be readily available for this purpose.

1.3 EXAMINATION

- A. Field Measurements: Verify dimensions in areas of installation by field measurements before fabrication and indicate measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the work.
- B. Established Dimensions: Where field measurements cannot be made without delaying the work, establish dimensions and proceed with fabricating units without field

measurements. Coordinate supports, adjacent construction, and fixture locations to ensure actual dimensions correspond to established dimensions.

1.4 PREPARATION

- A. Pre-installation inspection
 - 1. The Contractor shall visually inspect all cables, cable reels, and shipping cartons to detect possible cable damage incurred during shipping and transport. Visibly damaged goods are not acceptable and shall be replaced by the contractor at no additional cost to the Owner.

1.5 MISCELLANEOUS CONTRACTOR RESPONSIBILITIES

- A. Contractor will maintain unobstructed egress in work areas.
- B. Contractor will keep an access for all Emergency Services.
- C. Contractor will maintain training for Personnel in alternate exits if needed.
- D. Contractor will maintain Temporary construction partitions, as required, that are smoke tight and built of non-combustible materials.
- E. Additional Fire Extinguishers may be required and will be properly maintained and inspected.
- F. Construction site will be maintained clean and orderly.
- G. Contractor will observe Intermountain Healthcare's Tobacco Use Policy. (All forms of tobacco use are strictly prohibited)
- H. All Electrical Extension cords will be grounded, and in good condition and, plugged into approved GFI Receptacles.
- I. Construction site will be restricted. (Approved personnel Only)
- J. Required Personal Protective Equipment (PPE) will be worn as required. (i.e. hard hats, safety glasses, safety shoes, fluorescent vest, in accordance with general contractor's safety policy)
- K. Tools will be unplugged, and power secured at the end of each working day.
- L. All employees and contractors will understand how to obtain MSDS sheets.
- M. Contractor will notify proper personnel of any fire system shut down. A 48-hour notification is required.
- N. Contractor will address all vibration concerns with Intermountain Healthcare and general contractor's staff.
- O. Contractor will address all Noise Issues with Intermountain Healthcare and general contractor's staff.
- P. Contractor will fill out a Hot Work permit and keep it on site daily as needed.
- Q. Contractor will fill out an Above Ceiling Work Permit and keep it on site daily as needed.
- R. Contractor will obtain a Confined Space Permit, when required, and keep it on site.
- S. Contractor shall notify Information Systems 72 hours in advance of any shutdown or known interruption of required environmental services. Follow up by notifying the Service Desk.
- T. Demolition of low voltage cabling shall be performed by the Low Voltage installation contractor.
 - 1. To prevent accidental removal of in-use circuits.
 - 2. To allow for re-use of circuits where practical.

END OF SECTION

SECTION 270500

COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 - PRODUCT

1.1 SUMMARY

- A. This section covers general work results for all Communications Division detail subsections.
- B. Work of the following sections cover a complete installation of both permanent and channel links for a data and voice communications network utilizing copper and fiber transmission media.

PART 2 - EXECUTION

2.1 SCOPE OF WORK

- A. Includes, but is not limited to the following.
 - 1. The Contractor shall:
 - a. Provide and install fabric and/or either plenum, PE or PVC Innerduct, rated appropriately for the installation environment; in accordance with all applicable codes and ordinances.
 - b. Provide, install, terminate, test, label and document all fiber backbone, fiber and copper riser cable.
 - c. Provide, install, terminate, test, and document all fiber, copper voice, and data horizontal cable.
 - 1) CAT6A UTP and CAT6A F/UTP shall not be mixed on the same campus.
 - d. Provide and place all termination devices such as, but not limited to, modular patch panels, termination blocks, information outlets (jacks and plates), phone jacks, fiber distribution panels, bulkheads, connectors, and fiber fan out kits.
 - e. Provide in quantities specified interconnect components such as, but not limited to, copper patch cords, fiber patch cables and data station cables.
 - f. Provide and place horizontal and vertical cable support devices such as, but not limited to, rack and wall-mounted horizontal and vertical cable management, cable runway, communications cable runway, and all required mounting hardware, unless otherwise noted.
 - g. Provide and install all equipment mounting racks, cabinets and/or brackets.
 - h. Provide and install UL-approved fire stopping systems in all communication pass-thru, conduits, cable trays and ceiling, wall and floor penetrations in coordination with General Contractor.
 - i. Provide all appropriate consumable items required to complete the installation.
 - j. Grounding and bonding in TEC and TR rooms to grounding bus provided by Division 26.
 - k. Provide complete documentation and demonstration of work.
 - l. Completion of all punch list deficiencies within 10 working days.

- m. Provide indexed and organized complete Test Results of all copper and fiber cable and their components.
- n. Provide Submittals.

- o. Conduct a final document handover meeting with client, consultant, and PM to review, discuss and educate the Owner on the test results and As-Built Drawings.
- p. Provide a Manufacturer's Extended Product Warranty and System Assurance Warranty for this wiring system.

END OF SECTION

SECTION 270526

GROUNDING AND BONDING FOR
COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. This work shall be provided by Division 26.
 - 1. Division 26 shall provide and install the communications system grounding bus bar.
 - 2. Systems other than the voice/data system shall be bonded by their respective installers or Division 26.
- B. Exception: Division 27 shall bond racks, ladders, and other conductive IT equipment and enclosures as required.
- C. Requirements of the following Division 26 Sections apply to this section:
 - 1. Basic Electrical Requirements
 - 2. Basic Electrical Materials and Methods
 - 3. Grounding and Bonding for Electrical Systems

1.2 SUMMARY

- A. This Section includes methods and materials for grounding and bonding Communications systems.
- B. All grounding / earthing and bonding shall be done to applicable codes and regulations. It is recommended that the requirements of IEC/TR 61000-5-2: 1.0, ANSI-J-STD-607-A, or both be observed throughout the entire cabling system.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
 - 1. Stranded conductors No. 6 AWG.

2.2 CONNECTORS

- A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
- B. Compression fitting – 2-hole strap.

PART 3 - EXECUTION

3.1 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70 (NEC), Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

3.2 APPLICATIONS

- A. Conductors: Install stranded conductors for No. 6 AWG and larger, unless otherwise indicated.

3.3 INSTALLATION

- A. Grounding Conductors
 - 1. Route along shortest and straightest paths possible, unless otherwise indicated or required by Code.
 - 2. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
 - a. Jumper across all tray junctions use two-hole crimp lugs with a bolt, lock washer and nut to prevent loosening of ground connections over time.
 - b. Contractor to remove small area of powder coat or paint to create a metal to metal bonding connection.
 - c. Per current BICSI TDMM "Grounding, Bonding and Electrical Protection":
 - 1) Grounding and bonding connectors should be one of the following: Tin plated copper, copper or copper alloy
 - 2) Connections should be made using crimp connectors, or exothermic welding.
 - d. Per TIA/EIA 607-A the TBB (Telecommunications Bonding Backbone) connections "shall be made using irreversible compression-type connectors, exothermic welding or equivalent."

END OF SECTION

SECTION 270528

PATHWAYS FOR COMMUNICATONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Main pathways for communications systems shall be the responsibility of the Division 27 low voltage contract.
 - 1. Includes, but is not limited to, hangars, supports, J-hooks and cable tray.
 - 2. Sections 270536, 270539, and 270543_46, are supplemental clarifications that are additions to this section. The appropriate section(s) shall add for the material used.
- B. Conduits, pathways, and boxes which are embedded within building finishes for communications systems shall be the responsibility of the Division 26 electrical contractor
- C. Requirements of the following Division 26 sections apply to this section
 - 1. Basic electrical requirements
 - 2. Basic electrical materials and methods
 - 3. Grounding, earthing, and bonding for electrical systems

1.2 SUMMARY

- A. Contractor shall install work following specifications, drawings, manufacturer's instructions and approved submittal data.

PART 2 - PRODUCTS

2.1 CABLE PATHWAYS

- A. Comply with TIA/EIA-569-B.
- B. Pathways shall be designed and installed to meet applicable local and national building and electrical codes or regulations.
 - 1. All materials shall be UL- and/or CSA and/or ETL-approved and labeled in accordance with NEC for all products where labeling service normally applies.
 - 2. NRTL labeled for support of Category 6A cabling, designed to prevent degradation of cable performance and pinch points that could damage cable
 - 3. Materials and equipment requiring UL 94, 149 or 1863 listing shall be so labeled. Modification of products that nullifies UL labels are not permitted.
 - 4. The installed systems shall not generate, nor be susceptible to any harmful electromagnetic emission, radiation, or induction that degrades, or obstructs any equipment.
- C. Pathways consist of conduit, basket tray/ladder rack, J-hooks, surface mounted raceway and power poles.
 - 1. Basket tray shall be utilized for distribution pathways
 - a. Provides proper support and load distribution along pathways.
 - b. Flexibility, scalability, and accessibility
 - c. Ladder rack shall be used in data rooms.
 - 2. Conduits may be utilized where cable tray is not viable, providing the cross-sectional area of the conduit is greater than the cross-sectional area of the cable tray.
 - 3. J-hooks are the minimum pathway device required for all low voltage contractors for use in ceiling distribution.
 - a. Refer to section 270529.

4. Note: Surface mounted raceway and power poles should be installed only when other pathway choices are not feasible.

2.2 EQUIPMENT

- A. Compatibility
 1. All material and equipment as provided should be the standard Commercial-Off-The-Shelf (COTS) products of a manufacturer engaged in the manufacturing of such products. All shall be typical commercial designs that comply with the requirements specified. All material and equipment shall be readily available through manufacturers and/or distributors.
 - a. All equipment shall be standard catalogued items of the manufacturer and shall be supplied complete with any optional items required for proper installation.
 - b. Coordinate the features of materials and equipment so they form an integrated system. Match components and interconnections for optimum future performance and backward compatibility
- B. Horizontal cables shall be installed in "clean, dry" locations that provide protection from moisture levels above the intended operating range of inside plant (ISP) cables
 1. Cable pathways shall be installed to provide protection from the elements (i.e. moisture) and other hazards.
 2. Cables and cable pathways shall be protected from detritus elements such as paints, adhesives, water and cleaners.
 - a. In case of contamination, cables shall be replaced at the General Contractors expense. Cleaning is not acceptable.
 3. Pathways shall not have exposed sharp edges that may come into contact with telecommunications cables.
- C. Pathways shall not be in elevator shafts.
- D. Grounding / Earthing and bonding of pathways shall comply with applicable codes and regulations. It is recommended that the requirements of IEC/TR3 61000-5-2 - Ed. 1.0, ANSI-J-STD-607-B, or both be observed throughout the entire cabling system.

2.3 SURFACE MOUNTING

- A. Surface Mount Cable Runs and Faceplate Boxes
 1. Surface mounting of cable pathway runs and/or boxes for outlets/faceplates are only authorized as a last resort and exception to running cables through the wall and above the ceiling.
 2. If surface mount cable runs are used:
 - a. Burrs will be removed from the inside of the plastic or metal surface mount pathway to prevent damage to cables pulled through the run.
 - b. Raceway manufacturer plastic bushings shall be installed at all outlet openings in raceway to prevent damage to cable.
 - c. "T", Splice, and corner pieces will be used to join runs. Runs will not be butted together without the appropriate joining pieces.

PART 3 - EXECUTION

3.1 HORIZONTAL PARAMETERS

- A. Allowable Cable Bend Radius and Pull Tension:
 1. In general, communications cable cannot tolerate sharp bends or excessive pull tension during installation.
 - a. Bend radius for 4 pair UTP and F/UTP under no load (no pulling tension) shall not exceed four (4) times the outside diameter of the cable and

eight (8) times the outside diameter of the cable under load (110N/25lbf).
Note: Cable bend radius and pulling tensions for cables other than 4 pair

cable increase with the diameter and type of cable refer to the manufacturer's recommendations for specific requirements.

2. After installation, exposed cable and other surfaces must be cleaned free of lubricant residue. Use only lubricants specifically designed for cable installation.
- B. Pull Strings:
1. Horizontal and Vertical Pathways
 - a. The pathway installer shall:
 - 1) Provide pull strings in all new conduits, including all conduits with cable installed as part of this contract.
 - 2) Provide pull strings in all new cable trays.
 - 3) Pull string shall have a rated average breaking strength of 200 pounds.
 - 4) During pulling sessions, pull strings must move freely to prevent cable jacket/cable damage.
 - 5) Free moving pull strings shall be provided in all locations where they are utilized as part of this contract.
- C. Conduit Fill:
1. Reference manufacturer's Design Installation Guidelines manual.
 2. Comply with requirements of NFPA 70 (NEC)
 3. The number of cables placed in a pathway shall not exceed manufacture specifications, nor, will the geometric shape of a cable be affected.
 - a. Conduit pathways shall have a maximum fill ratio of 40% to allow for proper pulling tension and lay of the CAT6A F/UTP cable. A minimum of a 1" diameter conduit is required for new construction. Existing conduits will require the reduction of the number of cables placed in the conduit to meet the required fill ratio.

3.2 INTRA-BUILDING CABLE ROUTING

- A. Pathways
1. The backbone subsystem shall include cable installed in a vertical manner between floor telecommunications rooms and the main or intermediate cross-connect in a multi-story building and cable installed horizontally between telecommunications rooms and the main or intermediate cross-connect in a long single-story building.
 2. Adequate riser sleeve/slot space shall be available with the ability to ingress the area later in all telecommunications rooms, such that no drilling of additional sleeves/slots is necessary. Proper fire stopping is required for all sleeves/slots per national and local codes. Install fire stop material designed specifically for the building construction conditions and to meet the existing fire stop material as directed by the building engineer.
 3. Backbone pathways shall be installed or selected such that the minimum bend radius of backbone cables is kept within manufacturer specifications both during and after installation.
 4. Where redundant paths are required, they shall be separated by a minimum of 24".
 - a. Separate innerducts and/or armored fiber are required for each leg of the redundant path.
 - b. Separate physical routing for each path shall be utilized where possible.
 5. Building backbone cables shall be installed in "dry" locations that provide protection from moisture levels above the intended operating range of inside plant (ISP) cables. "Slab-on-Grade" building designs wherein pathways are installed underground on/in the poured concrete slabs that are in direct contact with the soil are considered wet locations and hence are not permitted.

END OF SECTION

SECTION 270529

HANGERS AND SUPPORTS FOR
COMMUNICATION SYSTEMS

PART 1 - PRODUCTS

1.1 APPROVED PRODUCT

- A. The J-hooks shall meet or exceed the below characteristics of construction and features
 - 1. Provide broad based support for cabling to aid in maintaining overall system performance.
 - 2. Be available in 50.8mm (2") and 101.6mm (4") options
 - 3. Come equipped with a cable retention clip
 - 4. Offers a full line of mounting accessories.

1.2 APPROVED MANUFACTURERS

- A. Ericson / Caddy
- B. B-Line
- C. Stiffy

PART 2 - EXECUTION

2.1 J-HOOKS AND OTHER SUPPORTS SHALL BE INSTALLED SUCH THAT THEY:

- A. Shall be supported with devices designed for this purpose and shall be installed independently of any other structural component. J-Hooks shall not use the suspended ceiling support wires or lighting fixture support wires.
- B. The number of cables placed into the J-hooks shall be limited to a number that will not cause a change to the geometric shape of the cables.
 - 1. Limit to a 40% fill in new construction.
- C. J-hooks shall not be spaced farther than 1.5 meters (5 ft.) apart, with a recommendation that they be spaced at 1 meter (3 ft.) apart. Note: Construction may require distances to exceed the maximum and are considered an exception requiring approval of project manager or building engineer.
- D. J-hooks or better must be installed without exception.

2.2 UNACCEPTABLE INSTALLATIONS

- A. Free flight of cables
- B. Resting or attaching of cables on pipes, conduits, HVAC duct work, fire sprinkler systems, basket tray, basket tray supports or on the ceiling tiles/grid.

END OF SECTION

SECTION 270533

CONDUITS AND BACK BOXES FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Division 26 – Electrical work

PART 2 - PRODUCTS

2.1 APPROVED PRODUCT

- A. Conduits and Back boxes shall meet the construction requirements of the NEC for the type of structure and space in which they are installed and will be of the diameter and size to provide adequate fill, bend radius and connector space. Refer to section 270528.

PART 3 - EXECUTION

3.1 CONDUIT SIZING

- A. Conduit size shall be based on the type of cable installed and the required fill ratio and bend radius associated with the type of cable specified.
 - 1. Minimum conduit size to back box for CAT6A F/UTP shall be 1-inch EMT.
- B. Conduit and installation shall be provided by Division 26.
- C. All conduit stubs shall be installed with plastic bushings appropriate for the size of conduit used.
- D. Conduits that stub to accessible ceiling shall be installed in the direction to provide the shortest path to the TDR, complete with pull string.

3.2 BACK BOX SIZING

- A. New work back boxes for CAT6A F/UTP shall be a minimum of trade size 4-11/16" x 4-11/16" x 3" (depth) plus a 5/8" plaster ring to allow for proper bend radius and connector termination/installation. Side knockouts shall be avoided.
- B. Back boxes for rework shall meet the same specification as for new work.
 - 1. If existing back boxes or back boxes that are smaller due to construction restrictions, then devices such as extension rings, bezels or faceplates shall be used to modify the back box to insure proper bend radius and connector termination/installation.
 - a. Verification and approval of the size change must have DCO Infrastructure Cabling and engineering approval.

3.3 BACK BOX COMPOSITION

- A. All back boxes for IT systems shall be UL/CSA listed and approved for the purpose.

1. Non-metal back boxes shall not be used for any interior IT related device.

3.4 SPECIAL CONDITIONS – LEAD LINED WALLS FOR RADIATION CONTROL

- A. Refer to the complete IT Lead Lined Wall Procedure – Attachment Appendix 8

END OF SECTION

SECTION 270536

CABLE TRAY FOR
COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. This section shall be coordinated with Sections 270528, 270539, and 270543_46

1.2 COORDINATION

- A. Prior to beginning installation, a kick-off meeting to properly coordinate the tray installation and expectations should be held. It should be arranged by the General Contractor, and at a minimum include representatives of the following trades: FP&D, Electrical (Div 26), Structured cable, Nurse Call, paging, building automation and control, plumbing, HVAC, fire sprinkler, framing, and others as applicable. The Data Center Operations Infrastructure Cabling Team will lead the meeting.
- B. The wire basket tray routing shall be approved by the low voltage CI cable contractor (Div. 27 sub-contractor), and the Data Center Operations.
- C. Where adequate space is available a Triple tier J-Hook pathway shall parallel the basket trays for other services
1. The triple tier J-Hooks shall be installed by the cable tray installer.
- D. Single J-Hooks as needed to extend beyond the triple tier, shall be installed by the trade that will be utilizing them.
- E. Cable tray shall be a high priority installation to allow adequate time for proper and complete cable installation prior to ceiling grid.

PART 2 - PRODUCTS

2.1 APPROVED PRODUCT

- A. The Cable Tray shall meet or exceed the below characteristics of construction and features:
1. It shall be fully welded and available in a galvanized silver or powder coat black finish
 2. Have an optional construction using "elongated" shaped wires offering a more broad-based support for installed cables.
 3. Cable ladder shall be used in data rooms for horizontal management above the racks.
 4. Ladder shall match the manufacturer of the data racks or exact equal.
 5. Ladder shall be assembled with manufacturer approved parts and methods.
- B. APPROVED MANUFACTURES
1. WBT – Wire Basket Tray (preferred)
 2. Siemon RouteIT™ Wire Mesh Cable Tray, or equal basket type tray
 3. Cabofil per owner's approval

2.2 PART NUMBERS (SUBMITTAL REQUIRED)

- A. Cable Tray
1. Refer to plans for part numbers.

PART 3 - EXECUTION

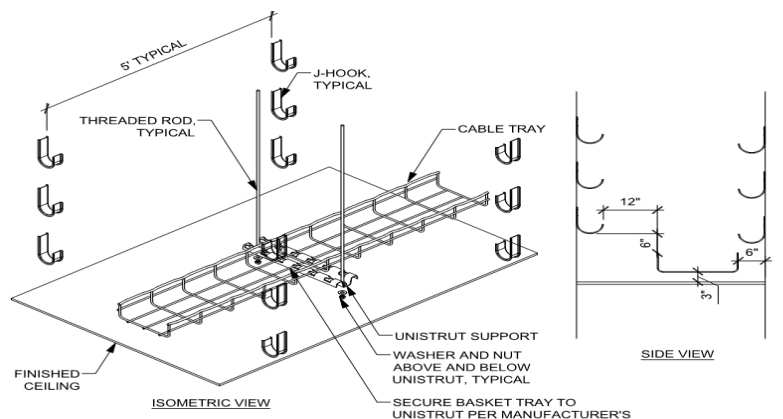
3.1 PATHWAY INSTALLATION

A. Supports

1. Installed per Manufacturer's Specifications and utilize components specific to the maintenance of proper access in and out of the cable tray using bend delimiters.
2. Distance between supports shall not exceed 5 feet
 - a. Less distance between supports required if per manufacturer's instructions.
 - b. Minimum of one support required within 24" on each side of any junction point.
3. Supports shall be of the trapeze design to provide maximum stability.
 - a. Each support shall attach to structure via its own hangers.
 - 1) All hanger supports shall be constructed of a rigid material such as all-thread.
 - 2) All hangers and supports shall be installed perpendicular and plumb to the tray. No angle supports shall be permitted unless augmented perpendicularly.
 - 3) Vibration and sway (seismic) damping required.
 - 4) Provide support across width of tray underneath, not via basket side wires.
 - 5) Building walls do not qualify as a support and shall not be used as a support.
4. Supports shall be of sufficient strength to support at least 200% of the expected load
5. Wall mounted angle brackets shall not be used as a load bearing support for cable tray.

B. Complete system access

1. Cable tray shall have a dedicated free clearance zone surrounding it.
 - a. 12" clear space shall be provided on the side where natural feed will occur.
 - b. 6" clear space shall be provided on the side opposite the feed access.
 - c. 8" clear space above the top of tray minimum – recommended 12".
 - d. 3" clear space below the tray.
2. Exception: other services may pass through the free clearance zone provided it is perpendicular to the tray direction and providing they do not exceed 6' in width or interfere with the access to pull wire in the tray.



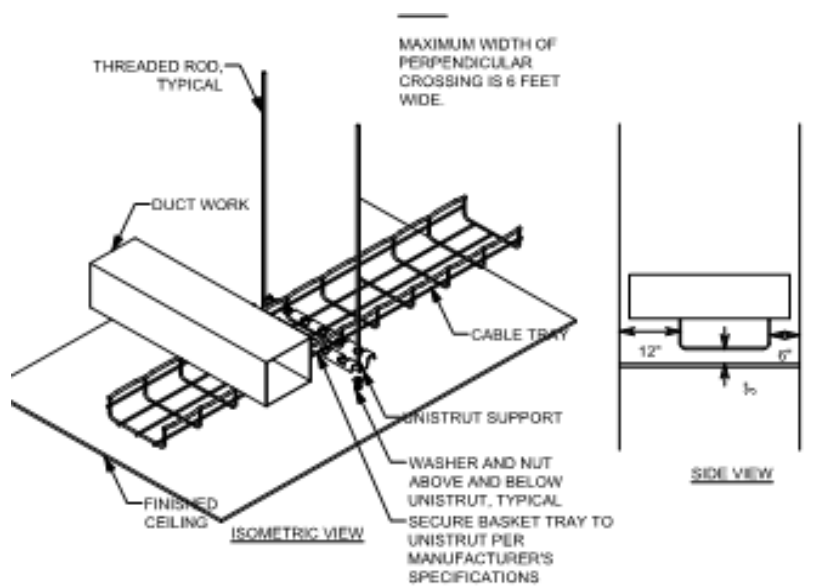
TYPICAL CABLE TRAY WITH J-HOOK INSTALL
NO SCALE

3.2 ROUTING OF BASKET TRAY

- A. Exact cable tray location shall be coordinated with other trades to ensure proper clearances and access. Prior to installation, final cable tray routing must be approved by the Owner's Data Center Operations/Infrastructure cabling team.
- B. Cable tray shall be installed in straight lines, either parallel or perpendicular to building lines
- C. Cable tray shall follow corridor paths
 - 1. Routing above rooms and other partitions shall be avoided
- D. Cable tray and flush penetrations shall be utilized over hard-lid areas as specified.
- E. Access panels shall be provided where needed to provide access to the cable tray on both sides of the wall in hard lid areas within 3' or less of the basket tray.

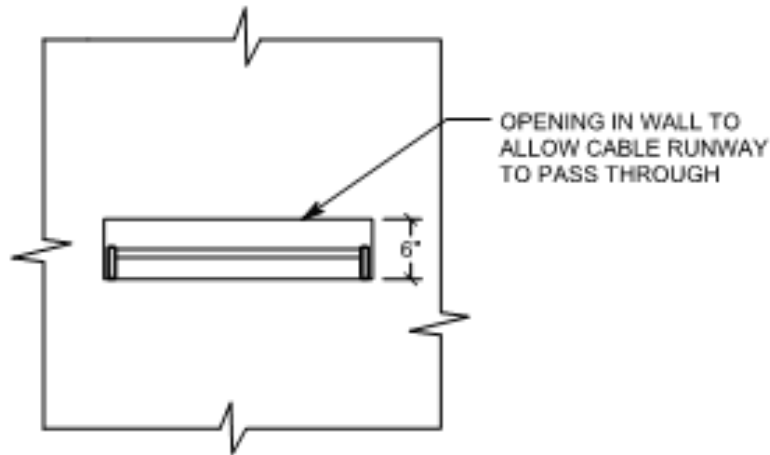
3.3 TRAY INTEGRITY

- A. Tray shall be installed as a complete, continuous system with no open spaces, cut outs, or missing segments. Bonding between sections shall be accomplished by the manufacturer's approved clamp or designated method.
- B. Tray shall be free from obstructions, other systems, trash or debris. Access to the tray shall be provided as outlined.
- C. There shall not to be any other trades infrastructure or equipment attached to or supported by the basket tray or basket tray support system.
- D. Tray must not be notched or cut-out to accommodate other trades. Repairs will not be accepted. Section replacement will be required at no cost to owner.
- E. As much tray material as possible shall be left uncut at turns, junctions, elevation changes, width changes, etc. Overlap shall be clamped to maximize strength and prevent pinch points.



TYPICAL CABLE TRAY WITH PERPENDICULAR CROSSING

PART 4 - #



PART 5 - # CABLE RUNWAY THROUGH WALL DETAIL

5.1 WALL OR OTHER PENETRATIONS (SUBMITTAL REQUIRED)

- A. Fire and smoke rated assemblies
 - 1. Penetrations shall comply with all fire and smoke prevention methods per codes and as outlined elsewhere in this document, including Section 270528 and Division 7.
- B. Approved penetration methods
 - 1. Preferred barrier penetration method shall be to run the tray continuous through the barrier, with closure provided by Firestop pillows.
 - a. Framing shall be boxed around openings to permit proper pillow insertion. Coordinate with framing contractor.
 - 2. Sleeves or conduits
 - a. EZ-Path or alternate penetrations must provide 150% of the designed cross-sectional area of the basket.
 - b. Conduit permitted only with written pre-bid permission or engineering notation on the drawings.
 - c. Each penetration sleeve or conduit shall be bonded on both sides of the penetrated barrier using UL and AHJ approved methods.
 - 3. All penetrations shall be positioned in-line with the cable tray to facilitate ease of pulling conductors and provide a straight-line path.
 - a. The bottom of the penetration device shall be flush with the bottom of the cable tray
 - b. Side-to-side penetrations must be completely within the cable tray space or directly above whenever possible.
 - 4. Approved penetration devices shall be a minimum size of 4"
 - a. Total penetration space at each location shall be sized for 20% growth and be equal to or greater than the cross-sectional area of the basket tray.
 - b. Approved devices where smaller penetrations are permitted shall be a minimum size of 1".

5. Approved devices shall be approved by the local facility manager:
 - a. Fire rated STI EZ-Path
 - b. Hilti self-sealing device
 - c. Tray with enclosed wall and properly sized and installed pillows
 - d. Conduit sleeves
 - 1) Conduit sleeves should only be used as a last resort upon approval from owner's Data Center Operations Infrastructure Cabling representative.

5.2 UTILIZATION

- A. Capacity
 1. Trays and penetration devices shall be properly sized
 - a. Provide a maximum calculated fill ratio of 40% to an inside depth not to exceed 3 inches (75 mm)
 - b. Provide capacity to allow for at least 20% future growth
- B. Systems served
 1. Cable trays, J-hooks, and penetrations shall be dedicated to a single system. Mixing of other systems with voice and data shall not be permitted in tray or J-hook paths.
 2. Exception: Different systems may share cable tray providing the following conditions are met:
 - a. Less than 40% overall fill is maintained, plus 20% additional space for growth
 - b. There is a minimum 3" separation between systems
 - c. There is a grounded physical divider between systems
- C. Restricted content in trays
 1. The wire basket tray shall only contain cables for the voice and data communications systems.
 - a. If there is sufficient space in the tray, and with approval from both the data network sub-contractor and the Data Center Operations, certain other IP services may share tray space. (i.e. camera, telemetry, similar).
 - b. Service loops must not reduce tray capacity.
 - c. Nurse call cabling shall be run in the J-Hook path. All nurse call installations must provide their own path or utilize the triple J-Hook system.
- D. Triple J-Hook path assignments
 1. The Lower tier of the triple J-Hook path is designated for Card Access and building automation and controls
 2. The Middle tier of the triple J-Hook path may alternately be utilized for Nurse Call, or other EMI producing systems.
 3. The Top tier of the triple J-Hook path is designated for satellite, DAS, or similar systems.
 4. When a triple J-hook pathway is not installed or available each system provider shall install their own j-hook pathway and wall penetrations.
 5. Service loop and slack shall not interfere with other pathways.

END OF SECTION

SECTION 270543/46

UNDERGROUND DUCTS, UTILITY POLES,
AND RACEWAYS FOR INTER-
BUILDING/CAMPUS CABLE ROUTING

PART 1 - PRODUCTS

1.1 INTER-BUILDING/CAMPUS CABLE ROUTING

- A. The backbone subsystem shall include cable installed between buildings via approved underground, tunnel, direct -buried, aerial or any combination of these from the Campus Distributor/Main Cross-connect (CD/MC/TEC) to Building Distributor/Intermediate Cross-connect (BD/IC/TDR) in a multi-building campus.
 - 1. 4" Conduit is required
 - 2. (3) 1 ¼" inner ducts shall be installed in all 4" conduits going building to building.
 - 3. Armored Fiber is required.
 - 4. Microduct/microfiber is optional.
- B. Backbone pathways shall be installed or selected such that the minimum bend radius and pulling tension of backbone cables is kept within cable manufacturer specifications both during and after installation.
- C. In an underground system, adequate underground conduit space shall be available and accessible at each building. The conduits shall not exceed a fill ratio of 40%.
 - 1. All underground systems shall be designed to prevent water runoff from entering the building. All underground systems must be cleared of any moisture prior to installation of any cable type. These systems must be sealed at both ends when not in use and after cable installation to prevent moisture and rodent infiltration.

PART 2 - EXECUTION

2.1 INSTALLATION

- A. The backbone cables shall be installed in a hierarchical star topology, emanating from the Campus Distributor/Main Cross-connect to each satellite building, Building Distributor/Intermediate Cross-connect or Floor Distributor/Horizontal Cross-connect located in a telecommunication room. All Inter-building/Campus cables shall be installed to the applicable codes and regulations.
- B. Where redundant paths are required, they shall be separated by a minimum of 24".
 - 1. Separate innerducts are required for each leg of the redundant path.
 - 2. Separate physical routing for each path shall be utilized where possible.
- C. Optical fiber shall be run for all Inter-building/Campus backbone segments, and as a recommendation, at least one balanced twisted-pair cable should be run for each Inter-building backbone segment.
 - 1. Fibers will be Fusion Spliced in the telecommunications rooms using LC Pigtailed in wall mounted interconnect centers or rack mounted panels equipped with sufficient ports, slack storage space and splice trays if required to terminate and secure all fibers.
- D. ST connectors are no longer recommended in the TIA 568-C.3 standard but may be used in legacy installations.
- E. Over-voltage Circuit Protection shall be utilized for cabling which enters or exits a building shall comply with applicable codes and regulations.
- F. OSP (outside plant) cables shall transition to an ISP (inside plant) within 50 feet of changing environment, per national and local codes and regulations.

END OF SECTION

SECTION 270553

IDENTIFICATION FOR LOW-VOLTAGE
CABLES AND LABELING

PART 1 - GENERAL

1.1 NOT USED

PART 2 - PRODUCTS

2.1 LABELING

- A. Structured cabling shall be labeled in accordance with ANSI/TIA 606-B standards.
- B. A unique identifier shall be marked on each faceplate to identify it as connecting hardware.
- C. Each port in the faceplate shall be labeled with its identifier.
- D. A unique identifier shall be marked on each piece of connecting hardware to identify it as connecting hardware.
- E. Each port on the connecting hardware shall be labeled with its identifier.
- F. Cable Labeling
 - 1. Label System
 - a. Labels Identification (Labeling) System:
 - 1) Brady
 - 2) Dymo
 - 3) Hellerman-Tyton
 - 4) Panduit
 - 5) Acceptable alternate
 - a) Approval from Data Center Operations Infrastructure Cabling team member required prior to bid
 - 2. Cable Labels
 - a. Self-adhesive vinyl or vinyl-cloth wraparound tape markers, machine printed with alphanumeric cable designations. Plastic, self-adhesive labels are not acceptable.
 - b. Each end of the Horizontal cables shall be labeled with a mechanically generated label within 300mm (12 in) of the end of the cable jacket with the link identifier which shall be a unique configuration determined by owner. This also applies to the Backbone Cables.
 - 3. Flat-surface labels
 - a. Self-adhesive vinyl or vinyl-cloth labels, machine printed with alphanumeric cable designations
 - 4. Contractor shall:
 - a. Provide transparent plastic label holders, and 4 pair marked colored labels.
 - b. Install colored labels according to the type of field as per ANSI/TIA 606-B.1 color code designations.
- G. PALLETTE
 - 1. Use the owners color-code guidelines for voice, data, cross-connect, riser, and backbone fields. Otherwise, use the ANSI/TIA 606-B designation strip color-code guidelines for voice, data, cross-connect, riser, and backbone fields. Color designations for F/UTP cable:
 - a. Intermountain Healthcare Standard Wiring Palettes for Horizontal Cabling

b.	Use	Color
1)	Data & IP Phones	Blue
2)	Analog Phone	Blue
3)	Security Card Readers	Grey/Yellow
4)	IP Security Cameras	Blue
5)	Fire Systems	Red
6)	TV Coax	Black
7)	Public Address/Telecom Patching in TEC only	White
8)	Clinical Engineering –	Orange
	a) Monitoring, Bed Systems	Orange
	b) Nurse Call (5e)	Orange
	c) Real time patient data	Orange
9)	Wireless	Yellow
10)	Foreseer (Belden 1422)	Red

H. Outlet/Jack/Faceplate Icons/labeling will match the color of the cable attached to the back side of the outlet/jack.

PART 3 - EXECUTION

3.1 GENERAL IDENTIFICATION

- A. Installer shall label all cable, regardless of length.
- B. Identify system components, wiring, and cabling complying with TIA/EIA-606-B.1. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
- C. Color-code cross-connect fields. Apply colors to voice and data service backboards, connections, covers, and labels.
- D. Using cable management system software specified in Part 2, develop Cabling Administration Drawings for system identification, testing, and management. Use unique, alphanumeric designation for each cable and label cable, jacks, connectors, and terminals to which it connects with same designation. At completion, cable and asset management software shall reflect as-built conditions.
- E. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
- F. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications rooms, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of TIA/EIA-606-B.1. Furnish electronic record of all drawings, in software and format selected by Owner

3.2 CONCEALED ENDS

- A. Jacks, connectors, terminations, and similar that are in concealed locations such as above grid ceilings, shall have additional labeling. The additional label shall be on the face of the grid in a visible location, immediately adjacent to the termination location.

3.3 CABLE AND WIRE IDENTIFICATION

- A. Label each cable visibly within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.

- B. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
- C. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
 - 1. Individually number wiring conductors connected to terminal strips and identify each cable or wiring group being extended from a panel or cabinet to a building mounted device shall be identified with name and number of particular devices as shown.
 - 2. Label each unit and field within distribution racks and frames.
- D. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA-606-B.1.

END OF SECTION

SECTION 271100

EQUIPMENT ROOM FITTINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Requirements of the following Division 26 sections apply to this section
 1. Basic electrical requirements
 2. Basic electrical materials and methods
 3. Grounding, earthing, and bonding
- B. Standards
 1. Minimum equipment room specifications shall comply with the 2010 AIA Guidelines for Design and Construction of Healthcare Facilities.
 2. Minimum recommended room sizes are requirements, not suggestions.
 3. Enterprise IS Architecture (EISA) maintains several documents around standards. The primary standards list is the EISA Standards 2010 – Master List. Occasionally, there is a need to breakout specific standards for an area.

1.2 SUMMARY

- A. This Section specifically details the facilities design and operations standards to be utilized for Intermountain Health Care's Data Rooms (TEC) and data closets (TDR).

1.3 COMMON REQUIREMENTS

- A. Rack layout and mounting
 1. Standard room layouts are located on the plans.
- B. Rack and wall mounting locations
 1. Rack and wall space use is pre-designated at the design stage. Before mounting any equipment on a wall or in a rack, the location must be verified by the Div 27 sub-contractor and the Data Center Operations.

1.4 DEFINITIONS

- A. **Data Center** – Major computer/technology/network facilities providing a significant percentage of the data and application services for the enterprise.
- B. **Data Rooms – ((TEC) Technology Equipment Center)** – Purpose built buildings or rooms that provide communications point-of-presence along with some data and applications services for a local facility or region.
- C. **TSER (Telecommunications Service Entrance Room)** – Houses the point at which data and voice circuits and services enter the facility and outdoor cabling interfaces with the building infrastructure. Typically, the TSER will be located in the TEC.
- D. **Data Closets – ((TDR) Technology Distribution Room)** – Specific location within a facility that provides communication services for a specific area (floor, wing, office area) of that facility only. A secure, flexible, and easily managed location for the structured cabling systems, network electronics, clinical systems, nurse call systems, and other technology and communications equipment.

PART 2 - TECHNOLOGY ROOM SPECIFIC REQUIREMENTS

2.1 TECHNOLOGY EQUIPMENT CENTER (TEC)

- A. Each Hospital will have a dedicated TEC which will serve as the main communications point-of-presence along with data and application services for the local facility or region. Houses the core networking equipment, application servers and data storage devices that serve the buildings on the campus. The Telecommunications Service Entrance Room (TSER) will be in the same room.

2.2 TEC IN HOSPITALS

- A. Physical Construction
 1. The TEC should be in an area easily accessed for delivery of equipment and high traffic without disturbing patient care.
 2. The size of the TEC will be based on the number of cabinets required to support the campus, plus 30% growth.
 3. Walls will be constructed from the floor to the deck and be completely sealed from surrounding spaces.
 4. A minimum 50% of open wall space will have $\frac{3}{4}$ " fire rated plywood covering the walls.
 5. Fire rated plywood shall be painted with fire resistant paint, leaving the fire rating stamp un-painted.
 6. The TEC should not have a ceiling other than the deck.
 7. Static Dissipative Tile is required in the TEC.
 8. The door to the TEC shall be 8' tall and 4' wide to accommodate the cabinet height.
 9. The walls of the TEC should not have any windows installed.
- B. Layout
 1. Cabinets will be in a cold isle configuration.
 2. Containment will be installed, including removable ceiling panels and isle doors.
- C. Electrical
 1. The electrical distribution system will follow an A (BLUE) – B (RED) design.
 2. Each system A (BLUE) and B (RED) will be backed up by a dedicated UPS.
 3. Outlet type is L21-30
 4. All power is to be run in conduit.
 5. Lighting will be installed above each isle.
- D. Mechanical
 1. The mechanical system will be a precision cooling solution installed in an in row, N+1 configuration designed to maintain 72 degrees F at mid cabinet.
 2. The mechanical system will be redundant and concurrently maintainable including on the electrical supply.
 3. The system shall meet engineering specifications for the room at 110 degrees outside air at 4500 feet above sea level.
 4. Chilled water, DX (Air Cooled) and Glycol (30% polyethylene glycol to water) are all acceptable cooling strategies.
- E. Security
 1. Doors will be fitted with an auditable card reader.
- F. Fire System
 1. A pre-action dry pipe fire system will be installed
- G. Monitoring
 1. Eaton Forseer system will be used to monitor all critical systems.
 2. Foreseer cables will be run to all UPSs, cooling units and TDRs.
 3. One Cat 6a F/UTP cable to each UPS.

2.3 TEC in Clinics and Office Buildings

- A. Clinics and Offices will have a room which will serve as a TEC and TDR. This room will be sized to accommodate the multifunction of the space.

2.4 TEC/TDR in Clinics

- A. Physical Construction
 1. TDRs should be in a central location off the main corridor away from patient areas.
 2. TDRs should be stacked from floor to floor.
 3. TDR size will be at least 12' x 14'.
 4. Walls will be constructed from the floor to the deck and be completely sealed from surrounding spaces.
 5. A minimum 50% of open wall space will have $\frac{3}{4}$ " fire rated plywood covering the walls.
 6. Fire rated plywood shall be painted with fire resistant paint, leaving the fire rating stamp un-painted.
 7. The TDR should not have a ceiling other than the deck.
 8. Flooring can be Static Dissipative Tile or Epoxy Paint.
 9. 3' wide door is required.
 10. When permissible, doors shall swing out of the room to provide maximum available space and rapid egress.
- B. Layout
 1. Racks in a single row with the front being the cold isle.
 2. The front of the racks should face the door.
- C. Electrical
 1. The electrical distribution system will follow an A (BLUE)-B (RED) design.
 2. System A(BLUE) will be backed up by a dedicated UPS.
 3. System B(RED) will be from a dedicated utility circuit.
 4. Outlet type is L6-30 and L5-20.
 5. All power is to be run in conduit.
 6. Lighting will be installed above each isle.
- D. Mechanical
 1. TDRs will have redundant cooling
 - a. Primary cooling is from the facility cooling system via a dedicated source.
 - b. Secondary cooling is from a standalone split or ceiling mount source.
 - c. The secondary system will be fed from the facility generator equipment electrical source if available.
 - d. The Mechanical system will be designed to maintain 72 degrees F at mid rack.
 - e. The coordination scheme between primary and secondary cooling systems can be accomplished by setting the primary system to 72 degrees F and the secondary system to 75 degrees F.
- E. Security
 1. Doors will be fitted with an auditable card reader.
- F. Fire System
 1. TDRs will utilize the facility fire detection and suppression systems.
 2. Sprinkler heads should have a 200-degree fuse.
 3. Sprinklers should be protected from accidental activation.
- G. Monitoring
 1. TDRs will be monitored using Eaton/Foreseer.
 2. Run 3 foreseeer cables to each TDR.
 3. One Cat6a F/UTP cable to each UPS.

2.5 TEC/TDR in Offices

- A. Physical Construction
 1. TDRs should be in a central location off a main corridor.
 2. TDRs should be stacked from floor to floor.
 3. TDR size will be at least 12' x 14'.

4. Walls will be constructed from the floor to the deck and be completely sealed from surrounding spaces.
 5. A minimum 50% of open wall space will have ¾" fire rated plywood covering the walls.
 6. Fire rated plywood shall be painted with fire resistant paint, leaving the fire rating stamp un-painted.
 7. The TDR should not have a ceiling other than the deck.
 8. Flooring can be Static Dissipative Tile or Epoxy Paint.
 9. 3' wide door is required.
 10. When permissible, doors shall swing out of the room to provide maximum available space and rapid egress.
- B. Layout
1. Racks in a single row with the front being the cold isle.
 2. The front of the racks should face the door.
- C. Electrical
1. The electrical distribution system will follow an A (BLUE)-B (RED) design.
 2. System A(BLUE) will be backed up by a dedicated UPS.
 3. System B(RED) will be from a dedicated utility circuit.
 4. Outlet type is L6-30 and L5-20.
 5. All power is to be run in conduit.
 6. Lighting will be installed above each row.
- D. Mechanical
1. TDRs will have redundant cooling system designed to maintain 72 degrees F at mid rack.
 - a. Primary cooling is from the facility cooling system via a dedicated source.
 - b. Secondary cooling is from a standalone split or ceiling mount source.
 - 1) The secondary system will be fed from the facility generator equipment electrical source if available.
 - c. The coordination scheme between primary and secondary cooling systems can be accomplished by setting the primary system to 72 degrees F and the secondary system to 75 degrees F.
 2. Doors will be fitted with an auditable card reader.
- E. Fire System
1. TDRs will utilize the facility fire detection and suppression systems.
 2. Sprinkler heads should have a 200-degree fuse.
 3. Sprinklers should be protected from accidental activation.
- F. Monitoring
1. TDRs will be monitored using Eaton/Foreseer.
 2. Run 3 foreseeer cables to each TDR.
 3. One Cat 6a F/UTP cable to each UPS.

2.6 TECHNOLOGY DISTRIBUTION ROOM (TDR)

- A. There shall be a minimum of one TDR on each floor of the facility. TDR's shall be provided throughout the facility as necessary to meet the 292' (90-meter) maximum cables distance. The TDR is located on each floor within a facility to house equipment and cabling, providing communication and technology services for a specific area of that facility. Based on the different needs of different facilities, the TDR's will be broken down into three categories. Hospital, Clinic and Office spaces.

2.7 TDR IN HOSPITALS

- A. Physical Construction
1. TDRs should be in a central location off a main corridor and away from patient areas.
 2. TDRs should be stacked from floor to floor.

3. TDR size will be at least 14' x 16'.
 4. Walls will be constructed from the floor to the deck and be completely sealed from surrounding spaces.
 5. A minimum 50% of open wall space will have ¾" fire rated plywood covering the walls.
 6. Fire rated plywood shall be painted with fire resistant paint, leaving the fire rating stamp un-painted.
 7. The TDR should not have a ceiling other than the deck.
 8. Flooring can be Static Dissipative Tile or Epoxy Paint.
 9. 3' wide door is required.
 10. When permissible, doors shall swing out of the room to provide maximum available space and rapid egress.
- B. Layout
1. Racks will be in a cold isle configuration.
 2. Two rows with the cold isle in the middle.
- C. Electrical
1. The electrical distribution system will follow an A (BLUE)-B (RED) design.
 2. Each system A(BLUE) and B(RED) will be backed up by a dedicated UPS.
 3. Outlet type is L6-30 and L5-20.
 4. All power is to be run in conduit.
 5. Lighting will be installed above each row.
- D. Mechanical
1. TDRs will have redundant cooling designed to maintain 72 degrees F at mid rack.
 - a. Primary cooling is from the facility cooling system via a dedicated source.
 - b. Secondary cooling is from a standalone split or ceiling mount source.
 - c. The secondary system will be fed from the facility generator equipment electrical source if available.
 - d. The coordination scheme between primary and secondary cooling systems can be accomplished by setting the primary system to 72 degrees F and the secondary system to 75 degrees F.
- E. Security
1. Doors will be fitted with an auditable card reader.
- F. Fire System
1. TDRs will utilize the facility fire detection and suppression systems.
 2. Sprinkler heads should have a 200-degree fuse.
 3. Sprinklers should be protected from accidental activation.
- G. Monitoring
1. TDRs will be monitored using Eaton/Foreseer.
 2. Run 3 foreseeer cables to each TDR.
 3. One Cat 6a F/UTP cable to each UPS.

2.8 TDR in Clinics

- A. Physical Construction
1. TDRs should be in a central location off a main corridor and away from patient areas.
 2. TDRs should be stacked from floor to floor.
 3. TDR size will be at least 10' x 12'.
 4. Walls will be constructed from the floor to the deck and be completely sealed from surrounding spaces.
 5. A minimum 50% of open wall space will have ¾" fire rated plywood covering the walls.
 6. Fire rated plywood shall be painted with fire resistant paint, leaving the fire rating stamp un-painted.
 7. The TDR should not have a ceiling other than the deck.

8. Flooring can be Static Dissipative Tile or Epoxy Paint.
 9. 3' wide door is required.
 10. When permissible, doors shall swing out of the room to provide maximum available space and rapid egress.
- B. Layout
1. Racks in a single row with the front being the cold isle.
 2. The front of the racks should face the door.
- C. Electrical
1. The electrical distribution system will follow an A (BLUE)-B (RED) design.
 2. System A(BLUE) will be backed up by a dedicated UPS.
 3. System B(RED) will be from a dedicated utility circuit.
 4. Outlet type is L6-30 and L5-20.
 5. All power is to be run in conduit.
 6. Lighting will be installed above each isle.
- D. Mechanical
1. TDRs will have redundant cooling designed to maintain 72 degrees F at mid rack
 - a. Primary cooling is from the facility cooling system via a dedicated source.
 - b. Secondary cooling is from a standalone split or ceiling mount source.
 - c. The secondary system will be fed from the facility generator equipment electrical source if available.
 - d. The coordination scheme between primary and secondary cooling systems can be accomplished by setting the primary system to 72 degrees F and the secondary system to 75 degrees F.
- E. Security
1. Doors will be fitted with an auditable card reader.
- F. Fire System
1. TDRs will utilize the facility fire detection and suppression systems.
 2. Sprinkler heads should have a 200-degree fuse.
 3. Sprinklers should be protected from accidental activation.
- G. Monitoring
1. TDRs will be monitored using Eaton/Foreseer.
 2. Run 3 foreseeer cables to each TDR.
 3. One Cat 6a F/UTP cable to each UPS.

2.9 TDR in Offices

- A. Physical Construction
1. TDRs should be in a central location off a main corridor.
 2. TDRs should be stacked from floor to floor.
 3. TDR size will be at least 10' x 12'.
 4. Walls will be constructed from the floor to the deck and be completely sealed from surrounding spaces.
 5. A minimum 50% of open wall space will have ¾" fire rated plywood covering the walls.
 6. Fire rated plywood shall be painted with fire resistant paint, leaving the fire rating stamp un-painted.
 7. The TDR should not have a ceiling other than the deck.
 8. Flooring can be Static Dissipative Tile or Epoxy Paint.
 9. 3' wide door is required.
 10. When permissible, doors shall swing out of the room to provide maximum available space and rapid egress.
- B. Layout
1. Racks in a single row with the front being the cold isle.
 2. The front of the racks should face the door.
- C. Electrical
1. The electrical distribution system will follow an A (BLUE)-B (RED) design.

2. System A(BLUE) will be backed up by a dedicated UPS.
 3. System B(RED) will be from a dedicated utility circuit.
 4. Outlet type is L6-30 and L5-20.
 5. All power is to be run in conduit.
 6. Lighting will be installed above each isle.
- D. Mechanical
1. TDRs will have redundant cooling designed to maintain 72 degrees F at mid rack.
 - a. Primary cooling is from the facility cooling system via a dedicated source.
 - b. Secondary cooling is from a standalone split or ceiling mount source.
 - c. The secondary system will be fed from the facility generator equipment electrical source if available.
 - d. The coordination scheme between primary and secondary cooling systems can be accomplished by setting the primary system to 72 degrees F and the secondary system to 75 degrees F.
- E. Security
1. Doors will be fitted with an auditable card reader.
- F. Fire System
1. TDRs will utilize the facility fire detection and suppression systems.
 2. Sprinkler heads should have a 200-degree fuse.
 3. Sprinklers should be protected from accidental activation.
- G. Monitoring
1. TDRs will be monitored using Eaton/Foreseer.
 2. Run 3 foreseeer cables to each TDR.
 3. One Cat 6a F/UTP cable to each UPS.

PART 3 - EXECUTION

3.1 COMMON REQUIRED CHARACTERISTICS FOR TDR, TEC, & TSER

- A. SECURITY - COMMON
1. Any visitor, vendor, or contractor requiring access to a Technology Room, who does not have appropriate approvals or clearances, must be escorted by a properly credentialed tech from the appropriate system.
 2. The main technology equipment shall be secured in a dedicated, locked Technology Room.
 3. Unused access jacks should be disconnected from the patch panels, and unused switch ports disabled.
 4. Technology Rooms shall be dedicated to the data and telecommunications functions.
 5. Access to the Technology Room shall be restricted to authorized service personnel and shall not be shared with building services that may interfere with the main networking interfaces, the networking equipment, the application servers, data storage devices, and telecommunications equipment systems.
 6. Technology Rooms shall not be used for building maintenance services, custodial services, or be used for general storage.
 7. Security cameras may be installed in each Technology Room upon owner's preference.
 - a. At entrances
 - b. At the end of each row of equipment racks
 - c. In electrical and mechanical rooms serving the Technology Room
 - d. Approved camera manufacturers: Axis and Bosch
 8. Access to a Technology Room shall be restricted and controlled by an auditable access control system. The access control system shall comply with the requirements of this document.
 9. All secure data areas must be secured by an auditable badge reader system.

- a. Refer to plans or quotes for detailed information
- b. Approved supplier: Intermountain Lock and Security Supply /
3106 S Main St / Salt Lake City, UT 84115 / 801-486-0079
- c. Owner of security locks and badge readers:
Intermountain Healthcare Data Center
- d. For programming on the Medeco XT Electronic Keys contact:
Intermountain Healthcare Data Center

B. PHYSICAL ENVIRONMENT

1. The Technology Room shall be in a dry area not subject to flooding and should be as close as possible to the electrical service room in order to reduce the length of the bonding conductor to electrical grounding system.
2. The Technology Room shall be in an accessible, non-sterile area.
3. Access to the Technology Room shall be directly off a corridor and not through another space.
4. The Technology Room shall be located to avoid large ducts, beams, and other building elements that may interfere with proper cable routing and may limit future access.
5. Mechanical and electrical equipment or fixtures not directly and exclusively related to the support of the Technology Room shall not be installed in, pass through, or enter the Technology Room.
6. Technology rooms shall not be located on exterior walls.
7. Technology rooms shall not have windows or other exterior openings.

3.2 TECHNOLOGY DISTRIBUTION ROOM (TDR) / DATA CLOSET

A. ELECTRICAL ENVIRONMENT

1. Separation from sources of EMI shall be in accordance with ANSI/TIA/EIA-569-C and local codes.
2. Communication grounding/earthing and bonding shall be in accordance with applicable codes and regulations. It is recommended that the requirements of IEC/TR3 61000-5-2 - Ed. 1.0, ANSI-J-STD-607-C, or both be observed throughout the entire cabling system.
 - a. All racks, equipment frames, furniture, flooring, ductwork within the IT space shall be bonded to the Central Ground bar provided and installed by Division 26.
 - 1) No AC electrical equipment bonding will be done at the Central Ground Bar. AC electrical grounding and bonding will be done according to the NEC.
3. Some TDRs will require redundant power and data feeds. See plans and drawings.
4. Lighting in the TDRs should be a minimum of 500 lx (50-foot candles) at the lowest point of termination.
 - a. Light switch should be easily accessible when entering the room.
 - b. Lighting will be fed from the generator system or have fixtures with battery backup.
5. A minimum of two dedicated duplex or two dedicated simplex electrical outlets, each on a separate 120V 20A circuit, should be provided for equipment power. Additional convenience duplex outlets should be placed at 1.8 m (6 ft) intervals around the perimeter walls.
 - a. Only twist lock receptacles will be used for rack power points. Type L-6-30R for 208 volt and type Nema L-5-20R for 120 volt.
6. All power is to originate from the facilities generator backup system with one system (A-B) originating from the critical system.
7. All circuits serving the TDR and the equipment within it shall be dedicated to serving the TDR.

8. TDRs shall be connected by a backbone of insulated, #6 (minimum) to 3/0 AWG stranded copper cable between all technology rooms. This cable shall be provided and installed by Division 26.
 - B. MECHANICAL ENVIRONMENT
 1. Reliable cooling shall be provided.
 - a. Based on criticality tiering structure individual rooms may require redundant, concurrently maintainable cooling systems.
 - b. Tier structure level shall be determined from the design guide.
 2. Heat load shall be calculated at 4KW per equipment rack
 3. Temperature and humidity in the TDR shall be controlled to an operating range of 64 to 75 degrees F (18 to 24 degrees C) with 30 to 55 percent relative humidity.
 - C. EQUIPMENT
 1. Each TDR shall be connected to the TEC (Technology Equipment Center) to provide a building-wide network and communications system.
 2. All racks, cabinets, sections of cable tray, and metal components of the technology system that do not carry electrical current shall be grounded.
- 3.3 TECHNOLOGY EQUIPMENT CENTER (TEC) / DATA ROOM
- A. ELECTRICAL ENVIRONMENT
 1. The TDR and TEC electrical environments shall match with the following exceptions:
 2. All circuits serving the TEC and the equipment within it shall be dedicated to serving the TEC.
 - B. MECHANICAL ENVIRONMENT
 1. TEC and TSER have the same mechanical environment.
 2. Reliable cooling shall be provided.
 3. Heat load shall be calculated at 4KW per equipment rack
 4. Temperature and humidity in the TEC shall be controlled to an operating range of 64 to 75 degrees F (18 to 24 degrees C) with 30 to 55 percent relative humidity.
 - C. EQUIPMENT
 1. Each TEC shall be connected to the TSER (Telecommunications Service Entrance Room) to provide an enterprise-wide network and communications system.
 2. All racks, cabinets, sections of cable tray, and metal components of the technology system that do not carry electrical current shall be grounded.
- 3.4 TELECOMMUNICATION SERVICE ENTRANCE ROOM (TSER) / D-MARC
- A. PURPOSE
 1. The TSER (Telecommunications Service Entrance Room) equipment subsystem shall consist of shared (common) electronic communications equipment in the TEC or the TSER required to interface this equipment and distribution hardware to the transmission media of enterprise Wide Area Network (WAN) infrastructure.
 2. The TSER shall be equipped to contain telecommunications equipment, cable terminations, and associated cross-connects.
 - a. Note that the AIA/State guidelines specify that the minimum size for a TSER is 12' by 14'.
 - b. Doors shall swing out of the room to provide maximum available space and rapid egress.
 - 1) Exception: where prohibited by fire or safety code.
 3. The TSER shall be dedicated to the telecommunications function.
 - B. MECHANICAL ENVIRONMENT
 1. Reliable cooling and heating shall be provided.
 2. Temperature and humidity in the TSER shall be controlled to an operating range of 64 to 75 degrees F (18 to 24 degrees C) with 30 to 55 percent relative

- humidity.
- C. EQUIPMENT
1. The TSER (Telecommunications Service Entrance Room) shall be connected to the specified WAN equipment to provide connectivity to the enterprise-wide network and communications system.
 2. All racks, cabinets, sections of cable tray, and metal components of the technology system that do not carry electrical current shall be grounded.

END OF SECTION

SECTION 271116

CABINETS, RACKS, FRAMES,
AND ENCLOSURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Cabinets and racks specifications are in TIA569-C and in the ET pages of the plans.

PART 2 - PRODUCTS

2.1 APPROVED PRODUCT

A. OPEN RACKS

1. For rack-mounted installations in a telecommunications room the installer shall use a 19 inch by 3-inch-deep equipment rack.
 - a. Equipment Rack 19" X 8', 52 RU, Black – Chatsworth 55053-715
 - b. Equipment Rack 19" X 7', 45 RU, Black – Chatsworth 55053-703
 - c. Exception: Where other size cabinets are specified by design team at owner's direction

B. WIRE MANAGERS

1. Part Numbers
 - a. Vertical Wire Manager, Double Sided, Black 10" wide x 8' tall – Chatsworth 40096-715
 - b. Vertical Wire Manager, Double Sided, Black 10" wide x 7' tall – Chatsworth 40096-703
 - c. Horizontal Wire Manager, 4U – Panduit PEHF4
2. Typical Standard Layout
 - a. Layout is 10" vertical manager, then 19" rack, then 10" vertical manager, then 19" rack, then 10" vertical manager.
 - b. Where more than 2 racks are called for, maintain the pattern of 10" vertical wire management on the ends, and 10" vertical management between racks.

C. CABINETS

1. Standard Cabinet
 - a. 2-Sided Cabinet – Vertiv E4562121120001S
 - b. 1-Sided Cabinet – Vertiv E4562122120001S
2. Wall Mount Cabinet
 - a. Vertical Wall Mount Cabinet – Legrand VWMSD-4RU-42-B
 - b. Vertical Wall Mount Cabinet – Legrand VWMSD-8RU-42-B
 - c. Fixed Mounting Rail Kit – Legrand VWM-RR-4RU
 - d. Fixed Mounting Rail Kit – Legrand VWM-RR-8RU
 - e. Pivoting Mounting Rail Kit – Legrand VWM-PIV-4RU
 - f. Fan Kits with 115 VAC fans – Legrand VWMFK-115
 - g. Top Brush Grommet Kit – Legrand VWMBGK
 - h. Circular Knockout Grommet Kit – Legrand VWMGR-30

END OF SECTION

SECTION 271119

TERMINATION BLOCKS AND
PATCH PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Requirements of the following Division 26 sections apply to this section
 - 1. Basic electrical requirements
 - 2. Basic electrical materials and methods
 - 3. Grounding, Earthing, and Bonding

PART 2 - PRODUCTS

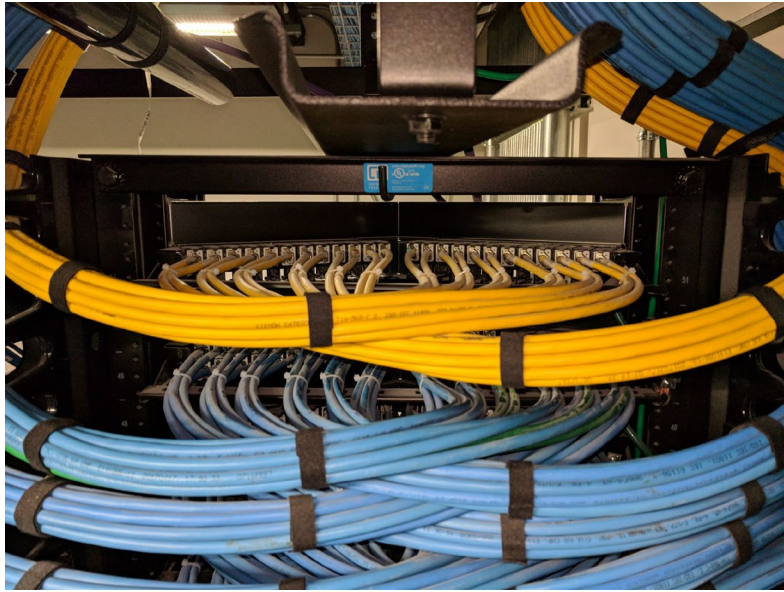
2.1 APPROVED PRODUCT

- A. PATCH PANELS – COPPER
 - 1. 48 Port CAT 6A Shielded, 1RU Angled Patch Panel with Outlets – Siemon Z6AS-PA-48A
 - 2. 48 Port CAT 6A Shielded, 1RU Flat Patch Panel with Outlets – Siemon Z6AS-PNL-U48K
 - 3. 24 Port CAT 6A Shielded, 1RU Flat Patch Panel with Outlets – Siemon Z6AS-PNL-U24K
 - 4. 48 Port CAT 5e, 2RU Angled Patch Panel, 110 Style – Siemon HD5-48A
 - 5. 48 Port CAT 5e, 2RU Flat Patch Panel, 110 Style – Siemon HD5-48
 - 6. 24 Port CAT 5e, 1RU Angled Patch Panel, 110 Style – Siemon HD5-24A
 - 7. 24 Port CAT 5e, 1RU Flat Patch Panel, 110 Style – Siemon HD5-24
 - 8. 19" Angled Blank Filler Panel, 1U, Black – Siemon PNL-BLNKA-1
 - a. Provide blank fillers where appropriate.
 - 9. 19" Flat Blank Filler Panel, 1U, Black – Siemon PNL-BLNK-1
 - a. Provide blank fillers where appropriate.
- B. PATCH PANELS – FIBER
 - 1. Rack Mount Fiber Enclosure – Siemon RIC3-48E-01
 - 2. Wall Mount Fiber Enclosure – Siemon SWIC3G-AA-01
 - 3. Blank Adapter Plate, Black – Siemon RIC-F-BLANK-01
 - 4. 12F-LCUPC-SM-Loaded-Splice Cassette - Siemon – RSC12-LCUSMA-B1
- C. CABINET PATCH PANEL – FIBER
 - 1. Lightstack Surface Mount Module Enclosure – Siemon – LSE-01
 - 2. Lightstack Surface Mount Splice Enclosure – Siemon – LSS-01
 - 3. Lightstack LC Adapter Plate – Siemon LS-LS12-01C-AQ

PART 3 - EXECUTION

3.1 INSTALLATION

- A. For angled patch panels, the terminations shall cross in the back to the opposite path of the patch panel to maximize available cable bend radius.
- B. See illustration below in this section:



END OF SECTION

SECTION 271300

BACKBONE CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawing and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.
- B. Section 27 05 28 – Pathways for Communications Systems.

1.2 DEFINITIONS

- A. INTRA-BUILDING CABLING
 - 1. Cable that runs between telecommunications rooms (TRs) inside a building. Can be vertical or horizontal in physical orientation. It consists of the backbone transmission media between these locations and the associated connecting hardware terminating this media.
- B. INTER-BUILDING / CAMPUS CABLING
 - 1. Cable that runs between buildings in a campus environment. It is normally a first-level backbone cable beginning at the main cross-connect in the equipment room of the hub building and extending to the intermediate cross-connect in the equipment room of a satellite building. Campus Backbones require optical fiber cable to be installed to support high speed data applications.
 - 2. Customer owned outside plant (OSP) cabling.

PART 2 - PRODUCTS

2.1 PERMITTED BACKBONE MEDIA

- A. Cables allowed for use in the backbone include:
 - 1. CAT 6A F/UTP Riser, Blue, Data – Siemon 9A6R4-A5-06-R1A
 - 2. CAT 6A F/UTP Plenum, Blue, Data – Siemon 9A6P4-A5-06-R1A
 - 3. 50 Pair Category 3 Riser Cable Gray – General Cable 2133161 or equal
 - 4. Fiber Optic Cable, Single-mode, 24 Strand, Armored Indoor/Outdoor Cable, Black – Siemon 9BG8P024L-E201A
 - 5. Fiber Optic Cable, Single-mode, 24 Strand, Armored, Plenum Cable, Yellow – Siemon 9BC8P024L-205A
 - 6. Fiber Optic cable, Multi-mode, OM4, 12 Strand, Armored, Plenum Cable, Aqua – Siemon 9BC5P012G-T512A (Data Centers must be OM4 or better)
- B. The cable shall support voice, data and imaging applications. The bending radius and pulling strength requirements of all backbone cables shall be observed during handling and installation.
- C. Multi-pair twisted pair cable is intended to support analog voice applications and shall be tested for continuity only.
- D. In addition to meeting the applicable performance specifications, all copper and optical fiber cable shall be appropriate for the environment in which it is installed.

2.2 MEDIA PRODUCTS

- A. COPPER

1. The total channel length between the Campus Distributor/Main Cross-connect and to any floor Distributor/Horizontal Cross-connect shall not exceed the following length limits for copper cabling:
 - a. 2,000 m (6,560 ft) for balanced twisted pair for PBX/Class A (100 kHz) applications.
 - b. 200 m (656 ft) for balanced twisted pair for Class B (≤ 1 MHz) applications.
 - c. 100 m (328 ft) for balanced twisted-pair categories 6, 6A & 7 (per Backbone segment when providing a two-level Backbone).
- B. MULTIMODE OPTICAL FIBER
 1. See Siemon website for supportable fiber distances
 - a. Laser qualified 50/125 μ m multimode fiber optical fiber cables shall be in compliance with the following standards ISO/IEC 11801:2002 OM3, ANSI/TIA-568-C.3, ANSI/TIA-568-C.1 and Telcordia GR-409-CORE as well as the guaranteed application distances, attenuation, bandwidth, and group index of refraction requirements.
 - b. Specifications:
 - 1) Shall support 10GBASE-SX for all horizontal workstations, risers and short length backbone (<300 m) locations.
 - 2) Constructed for overfilled launch (OFL) and restricted mode launch (RML) bandwidth to ensure compatibility with both LED and laser light sources.
 - 3) Have an Aqua Outer Jacket and be available in cable ratings including OFNR and OFNP.
- C. SINGLE MODE OPTICAL FIBER
 1. See Siemon website for supportable fiber distances
 2. Single-mode optical fiber cable shall be used for 1st and 2nd Level Backbone applications only.
 3. All fiber is to fusion spliced terminations.

PART 3 - EXECUTION

3.1 TOPOLOGY

- A. The Backbone cabling shall use a conventional hierarchal star topology.
 1. There shall be no more than two (2) levels of cross-connects between the campus distributor/main cross –connect (CD/MC) and any given floor distributor/horizontal cross-connect (FD/HC).
 2. From the FD/HC no more than one cross-connect shall be passed through to reach the CD/MC.
- B. Splicing of UTP, F/UTP and S/FTP copper cables is not permitted.

3.2 TYPICAL TDR BACKBONE

- A. A typical TDR backbone for a hospital campus shall consist of:
 1. Redundant (2 ea.) 24 strand single-mode fiber each routed in a separate path.
 2. One 50 pair copper feed line.

END OF SECTION

SECTION 271500

HORIZONTAL CABLING

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.
- B. Section 27 05 28 - Pathways for Communications Systems

1.2 SUMMARY

- A. This section includes requirements and guidelines for the installation of F/UTP, ScTP, and Fiber horizontal cabling.
 - 1. Horizontal cable and its connecting hardware provide the means of transporting signal between the telecommunications outlet/connector and the horizontal cross-connect located in the communications termination room. This cabling and its connecting hardware are called "permanent link," a term that is used in the testing protocols.

PART 2 - EXECUTION

2.1 HORIZONTAL CABLE

- A. Quantity
 - 1. Two horizontal cables shall be routed to each work area. Cable connected to information outlets shall be CAT6A F/UTP, 4-pair, 100Ω balanced twisted-pair.
 - a. A work area is approximately 100 sq. ft. and includes the components that extend from the telecommunications outlet/connectors to the station equipment.
 - b. Two (2) standard cables shall be run to each wireless access point location per current best practice.
 - c. One (1) standard horizontal cable may be run to the following locations:
 - 1) Each building control system enclosure as directed by the building controls vendor.
 - 2) Each IP Video Surveillance Camera at each of the designated locations.
 - 3) Each wall phone.
 - 4) Each wall monitor/display.
 - 2. For voice or data applications, 4-pair balanced twisted-pair or fiber optic cables shall be run using a star topology from the telecommunications room serving that floor to every individual information outlet. The customer prior to installation of the cabling shall approve all cable routes.
 - 3. Installation interfaces shall be T568B wiring standards.
- B. Maximum Length
 - 1. All horizontal cables, regardless of media type, shall not exceed 90 m (295 ft.) from the telecommunications outlets in the work area to the Floor Distributor/Horizontal Cross connect (FD/HC) located in the Telecommunication Room.
 - 2. Distributor/Horizontal Cross connect (FD/HC) located in the Telecommunication Room.
 - 3. The combined length of jumpers, patch cords inclusive of equipment cables in the Floor Distributor/Horizontal Cross-connect shall not exceed 5m (16 ft.).

4. The maximum length of Work Area equipment cables shall be 5m (16 ft.) If a MuTOA (Multiple User Telecommunication Outlet) environment exists, then the maximum equipment cable shall not exceed 22m (72 ft.) (Lake Park Facility)
 5. Terminate all conductors; no cable shall contain un-terminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
- C. Minimum Length
1. It is recommended that a minimum horizontal cable distance of 15m (49 ft.) shall be maintained between the telecommunications room and the work area. This will provide adequate Insertion Loss/Attenuation for applications over 1 Gig.
 2. For installations with consolidation points, a minimum horizontal cable distance of 15m (49 ft.) shall be maintained between the telecommunications room and consolidation point, and 5m (16 ft.) between the consolidation point and the work area. This will provide adequate Insertion Loss/Attenuation for applications over 1 Gig.
- D. Splice Free
1. Each run of balanced twisted-pair cable between Floor Distributor/Horizontal Cross-connect in the telecommunication room and the information outlet at the Work Area shall not contain splices.
 2. Bridged taps and splices shall not be installed in the horizontal cabling
- E. Protection
1. Horizontal distribution cables shall not be run in under slab raceways that are damp or wet locations unless suitably rated for the environment.
 - a. Under slab conduits that are outside of the building are considered wet locations.
- F. Slack -Service Loop – Routing
1. In the work area, a minimum of 1m (3 ft) should be left for balanced twisted-pair cables and fiber cables.
 2. In telecommunications rooms a minimum of 3m (10 ft) of slack should be left for all cable types. This slack must be neatly managed on trays or other support types

2.2 SEPARATION

- A. Separation from EMI sources
1. Installation shall comply with BICSI TDMM and TIA/EIA-569-B for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
 2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and EMI Source shall be as follows:
 - a. EMI Source Rating Less Than 2 kVA: A minimum clearance of 5 inches.
 - b. EMI Source Rating between 2 and 5 kVA: A minimum clearance of 12 inches.
 - c. EMI Source Rating More Than 5 kVA: A minimum clearance of 24 inches.
 3. Separation between communications cables in grounded metallic raceways and unshielded power lines or EMI Source shall be as follows:
 - a. EMI Source Rating Less Than 2 kVA: A minimum clearance of 2-1/2 inches.
 - b. EMI Source Rating between 2 and 5 kVA: A minimum clearance of 6 inches.
 - c. EMI Source Rating More Than 5 kVA: A minimum clearance of 12 inches.
 4. Separation between communications cables in grounded metallic raceways and power lines and EMI Source located in grounded metallic conduits or enclosures

shall be as follows:

- a. EMI Source Rating Less Than 2 kVA: A minimum clearance of 2 inches.
 - b. EMI Source Rating between 2 and 5 kVA: A minimum clearance of 3 inches.
 - c. EMI Source Rating More Than 5 kVA: A minimum clearance of 6 inches.
5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or 1 HP and Larger: A minimum clearance of 48 inches.
 6. Separation between Communications Cables and Fluorescent Fixtures: A minimum clearance of 5 inches
- B. Other Clearances
1. Horizontal pathways used for telecommunications cabling shall be dedicated for telecommunications use and not shared by other building services.
 2. In a false ceiling environment, a minimum of 75 mm (3 in) shall be observed between the cable supports and the false ceiling.

2.3 PATHWAY

- A. Cable Tie Wraps
1. Cable Tie Wraps are not permitted as a pathway device or support.
 2. Tie Wraps shall only be used to provide strain relief at termination points.
 3. Tie wraps shall not be over tightened to the point of deforming or crimping the cable sheath.
- B. Constraints
1. Horizontal cables shall be installed in "dry" locations that provide protection from moisture levels above the intended operating range of inside plant (ISP) cables.
 - a. If cabling is intentionally or unintentionally exposed to water or otherwise coated with or exposed to direct contact with solvents, paints, adhesives, sealants or other third-party materials, Siemon will not warranty the cabling product or if after the warranty has been issued, it would become void. Therefore, any cabling that has been exposed as listed above, must be removed and replaced.
 2. Horizontal pathways shall be installed or selected such that the minimum bend radius of horizontal cables is kept within manufacturer specifications both during and after installation.
 3. A minimum of a 1" diameter conduit is recommended for new construction. Existing conduits will require the reduction of the number of cables placed in the conduit to meet the required fill ratio.
 - a. The Contractor shall observe the bending radius and pulling strength requirements of the 4-pair balanced twisted-pair and fiber optic cable during handling and installation.
 - 1) 4-Pair UTP, F/UTP, S/FTP bend radius = 4 times outside diameter of cable under no-load conditions. 8 times the outside diameter under load (pulling 110 N/25 lbf.) conditions.
 - 2) Multi-pair or Hybrid cable bend radius = 10 times the outside diameter under all conditions.
 - 3) 2-Fiber and 4 Fiber cables bend radius = 25mm (1 in.) under no-load conditions. 50mm (2 in.) under load (pulling 222 N 50 lbf)
 4. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
 5. Cable that passes through non-Intermountain Healthcare spaces must be installed in conduit.
 6. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.
 7. Do not install bruised, kinked, scored, deformed, abraded cable or otherwise damaged cable. Do not splice cable between termination, tap, or junction points.

Remove and discard cable if damaged during installation and replace it with new cable.

8. During Cold-Weather Installation, bring cable to room temperature before de-reeling. Heat lamps shall not be used for heating.

C. Capacity

1. The number of horizontal cables placed in a cable support or pathway shall be limited to the number of cables that will not alter the geometric shape of the cables.
2. Maximum pathway (cable tray/basket tray/wireway) capacity shall not exceed a calculated fill ratio of 50% to a maximum of 75 mm (3 in) inside depth.
3. Maximum conduit pathway capacity shall not exceed a 40% fill. However, perimeter and furniture fill are limited to 60% fill for move and changes. A 40% fill ratio is the maximum fill for CAT6A F/UTP cables.
4. All unused cables shall be removed
 - a. Or labeled at both ends designating future purpose and locations of each end.

END OF SECTION

SECTION 271513

COPPER CABLE

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 PALLETTE

- A. Color palette shall be in accordance with Section 27 05 53

1.3 SUMMARY

- A. This Section covers approved F/UTP cable types
- B. Systems shall be CAT6A F/UTP unless a written deviation has been approved.
- C. CAT6A UTP and CAT6A F/UTP shall not be mixed on the same campus.
- D. This cable shall be used for both voice and data applications and shall be plenum rated where required by code

PART 2 - PRODUCT

2.1 APPROVED PRODUCT

- A. TYPE 6A F/UTP (foil over unshielded twisted pair) - Siemon
 - 1. CAT 6A F/UTP Riser, (CMR) – Siemon 9A6R4-A5-(XX)-R1A
 - 2. CAT 6A F/UTP Plenum, (CMP) – Siemon 9A6P4-A5-(XX)-R1A
 - a. (XX) = Color – 06, Blue – 05, Yellow – 09, Orange

END OF SECTION

SECTION 271543

FACEPLATES AND CONNECTORS

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 DEFINITION

- A. Work-Area Cabling
 - 1. The work area is comprised of work area outlet/connectors, faceplates, outlet boxes and equipment cords. It acts as the interface to the horizontal cabling from the horizontal cross-connect (HC) to telephone, network equipment, wireless access points (WAP) and OIP devices.

PART 2 - PRODUCT

2.1 OUTLETS

- A. Category 6A Jack – Siemon Z6A-S(XX)
 - 1. Use (XX) to specify color.
 - 2. Universal design allows the same outlet to be mounted in a flat or angled orientation.
- B. Category 6A Z-Plug WO Latch Protector – Siemon ZP1-6AS-(00)S
- C. Voice Outlet, Single Gang Faceplate, White W/Wall Hung Phone W/6A Insert – Siemon MX-WP-Z6AS-SS

2.2 FACEPLATES/BOXES

- A. 10G Single Gang Faceplate, White, 4 Position – Siemon 10GMX-FP-04-02
- B. MAX Single Gang Faceplate, White – Siemon MX-FP-S-(XX)-02
 - 1. USE (XX) to specify the number of ports.
- C. MAX Single Gang Faceplate, Stainless Steel, 4 Position, with Label Holder – Siemon MX-FP-S-04-SS-L
 - 1. To be used in the Operation Rooms
- D. Surface Mount Box, White, 2 Position – Siemon MX-SMZ2-02
- E. Furniture Faceplate, Black – Siemon MX-UMA-01
- F. Conference Room Table Inserts shall include an HDMI port.

PART 3 - EXECUTION

3.1 WORK AREA TERMINATION

- A. All balanced twisted-pair cables wired to the telecommunications outlet/connector, shall have 4-pairs terminated in eight-position modular outlets in the work area. All pairs shall be terminated.
- B. Outlet/connector back boxes shall be a minimum 4-11/16 square box (4-11/16" x 4-11/16" x 3") with a minimum single gang 5/8" mud ring for new construction to accommodate the CAT6A connectors.

- C. Existing back boxes will require a faceplate stand-off and/or a faceplate that can accommodate a bezel to extend the CAT6A jack out to allow the installation of the CAT6A connectors.
- D. All outlets need to be installed in the angled position.

END OF SECTION

SECTION 271619

PATCH CABLES

PART 1 - GENERAL

1.1 SUMMARY

- A. This section is issued as a guide for patch cable installations in the Data Center, wiring closets (TDR) and user areas where patch cables are required for connectivity to IP and TDM phones, and IP data connectivity needs for Intermountain Healthcare. All patch cables will support voice, data, and imaging applications within the Intermountain Healthcare Enterprise.

PART 2 - PRODUCTS

2.1 APPROVED PRODUCT

- A. Patch Cable, CAT 6A Shielded - Siemon SP6A-S (XX)-(XX)
1. Use 1st (xx) to specify length. Use 2nd (xx) for color.
- B. Patch Cable, CAT 5e, Orange – Siemon MC5-(XX)-0909
1. Use (xx) to specify length. For use with NURSE CALL only.
- C. Patch Cable, CAT 5e, White – Siemon MC5-(XX)-0202
1. Use (xx) to specify length.
2. For use in the TEC for the Copper Backbone Patch only.
- D. Patch Cable, Fiber, Singlemode Duplex W/LC Connectors, Yellow – Siemon FJ2-LCULCUL-(xx)
1. Use (xx) to specify length.
- E. Patch Cable, Fiber, Multimode Duplex W/LC Connectors, Aqua – Siemon FJ2-LCLC5V-(xx)AQ
1. Use (xx) to specify length. For use in the Data Center.

PART 3 - EXECUTION

3.1 PALLETTE

- A. Patch Cable Color Codes
1. The Intermountain Healthcare Enterprise standard for patch cable color is in Section 27 05 53.
2. The patch cable color shall match the feed cable color to identify the service provided.
- B. Contractor furnished
1. All patch cables for the TEC, TDR's shall be included in the low voltage contract and will be required to match or exceed the existing level of the installed structured cabling system.
2. All patch cables for the user areas shall be Owner furnished and will be required to match or exceed the existing level of the installed structured cabling system.
3. All patch cables shall be Owner installed.
4. The quantity of patch cables to be provided by the low voltage contractor shall be specified in the plans.
a. 50% 5ft – 30% 7ft – 15% 10ft – 5% 15ft

END OF SECTION

SECTION 275113

OVERHEAD PAGING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Primary Division 27 subcontractor shall be accountable to closely coordinate the Overhead Paging system with the General Contractor.
 - 1. Division 27 is accountable for including the cabling, equipment, and installation thereof in their work; based upon the project drawings.
- B. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- C. Requirements of the following Division 26 Sections apply to this Section:
 - 1. Basic Electrical Requirements.
 - 2. Basic Electrical Materials and Methods.

1.2 SUMMARY

- A. This Section includes the installation of an overhead paging system that shall be accessible through the telephone system. It includes requirements for paging system components including, but not limited to, the following:
 - 1. Speaker systems.
 - 2. Wiring
- B. This section requires that rough-in materials for this section be provided by the Division 26 installer for installation under Division 26. Rough-in materials include but are not limited to conduit, junction boxes, alternative raceway, and device enclosures. Cable for this section is to be provided by the Division 27 installer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following (for each type of product) as listed in the drawings and these specifications:
 - 1. Atlas Sound
 - 2. Bogen
 - 3. Quam

2.2 SYSTEM REQUIREMENTS

- A. General: Provide complete and fully functional overhead paging systems using materials and equipment of types, sizes, ratings, and performances as indicated. Use materials and equipment that comply with referenced standards and manufacturers' standard design and construction in accordance with published product information. Coordinate the features of materials and equipment so they form an integrated system with components and interconnections matched for optimum performance of specified functions.

2.3 EQUIPMENT AND MATERIALS

- A. General: Provide all solid-state components fully rated for continuous duty at the ratings indicated or specified. Select equipment for normal operation on input power supplied at 105-130 V, 60 Hz.

- B. Loudspeakers shall be an 8" dual cone type with a 10-ounce, ceramic magnet. Power handling rating shall be 5 watts continuous with a sensitivity of 94 dB at 1 meter/1 watt and frequency response of +/- 5 dB from 80 to 15,000 Hz. The speaker shall have an impedance of 8 ohms and be equipped with a 70-volt matching transformer with power taps from 0.5 to 4 watts. Recessed ceiling mounted speaker assemblies shall mount on an Atlas Sound T720-8-A or similar baffle on a T95-8 series or similar enclosure.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with the Installer present, for compliance with requirements and other conditions affecting the performance of the Overhead Paging System work.
- B. Do not proceed until unsatisfactory conditions have been corrected.
- C. Verify compliance of the following items before beginning sound equipment installation.
 - 1. No cables spliced except at standard barrier terminal blocks inside equipment cabinet.
 - 2. Cables marked at each end with permanent wire labels such as Brady or equal.
 - 3. Isolated ground run back to main electrical panel from paging equipment cabinet.
 - 4. Specified conduit, cables, speaker enclosures and equipment cabinets are properly installed.

3.2 INSTALLATION

- A. General: Install system in accordance with NFPA 70 and other applicable codes. Install equipment in accordance with manufacturer's written instructions.
- B. Speakers:
 - 1. Confirm polarity of speaker before installation and wire to maintain uniform polarity.
 - 2. Mount transformers with screws securely to speaker brackets or enclosures.
 - 3. Neatly mount speaker grilles, panels, connector plates, etc., tight, plumb, and square unless indicated otherwise on drawings.
 - 4. Provide brackets, screws, adapters, springs, rack mounting kits, etc., recommended by manufacturer for correct assembly and installation of speaker assemblies and electronics components.
 - 5. Identification:
 - a. Legibly identify user operated system controls and system input/output jacks using engraved, permanently attached laminated plastic plates or imprinted Lexon labels. Label equipment and controls within equipment cabinet using similar labels or "Kroy" type labels.
- C. Repairs: Wherever walls, ceilings, floors, or other building finishes are cut for installation, the contractor shall be responsible to repair, restore, and refinish to original appearance.

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services: Provide services of a factory authorized service representative to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the system.
- B. Pre-testing: Upon completing installation of the system, align, adjust, and balance the system and perform a complete pretest. Determine the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed. Replace malfunctioning or damaged items with new, and retest until materials satisfactory performance and conditions are achieved.

3.4 COMMISSIONING

- A. Occupancy Adjustments: When requested by the Architect or the Sound/Acoustical Consultant within one year of date of substantial completion, provide on-site assistance in adjusting sound levels, resetting matching transformer taps, and adjusting controls to suit actual occupied conditions. Provide two trips for this purpose.

3.5 CLEANING AND PROTECTION

- A. Prior to final acceptance, clean system components and protect from damage and deterioration.

END OF SECTION

SECTION 275319

INTERNAL CELLULAR, PAGING AND ANTENNA SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Requirements of the following Division 26 Sections apply to this Section:
 - 1. Basic Electrical Requirements.
 - 2. Basic Electrical Materials and Methods.

1.2 SUMMARY

- A. The DAS system is provided and installed as an Owner-provided, Owner installed (OFOI) system by a 3rd-party vendor, contracted and managed by Intermountain CTIS/Telecom Team.
- B. A/E to coordinate DAS requirements with the Owner's vendor to incorporate necessary infrastructure on their drawings to support a fully functional DAS system.

PART 2 - EXECUTION

2.1 INSTALLATION

- A. DAS contractor is to install their equipment located in the TDRs in the assigned rack location as noted in the ET Rack Elevation Drawings.
- B. DAS contractor is to install any wall mounted equipment in the TDRs in the assigned location as noted in the ET TDR Room Elevation drawings.
- C. Specific power requirements will need to be provided in the design phase of the project by the CTIS/Telecom team.
- D. Cable installation will follow Division 27 installation specifications.

END OF SECTION

SECTION 276001

APPENDIX 01 – DEVIATION REQUEST PROCESS

PART 1 - GENERAL

1.1 DEFINITIONS

- A. Cable Plant Deviation
 1. A business need to not fully comply with the requirements of the “Division 27 – Communications and Structured Cabling Specification document”
- B. Cable Plant Deviation Request form.
 1. The document is available from the Facilities Planning team, the Data Center Ops team, or the Infrastructure Cabling team.
 2. Usage:
 - a. The deviation request form shall be used if there is a business need to not comply with the requirements of the “Division 27 – Communications and Structured Cabling Specification document”
 - b. The deviation request form should also be used to propose a change to that document. Always verify that you are using the current version of the Standard before requesting a modification.

PART 2 - PROCESS

2.1 STANDARDS MODIFICATION

- A. Check the box and explain why the standard should be modified.

2.2 ALTERNATE PRODUCT

- A. The deviation form must be completed, submitted through channels, and approved prior to any deviation from the specifications. This includes issuing change orders.

2.3 AUTHORIZED SIGNATURES

- A. Both the Standards Holder and the DCO Manager signatures are required for a deviation to be valid.

2.4 DEVIATION REVIEW PROCESS STEPS

- A. First be sure that there is an actual need. Then be certain that your manager, supervisor, or project manager agrees with the requested deviation. Be sure to state this or obtain their signature on the deviation form. By doing so you are confirming that your supervisor or project manager has approved.
- B. The requestor will then complete sections 1, 2, and 3 of the deviation form.
 1. The requestor should then digitally sign in the designated location at the end of Section 3. Do not write in the sections below 3.
- C. Forward the saved copy of this form to the Standards Holder via email.
 1. Email to: melissa.lopez2@imail.org
- D. The Standards Holder will then review and evaluate the request. The requestor should be prepared to provide plans, specifications, and competitive bids if requested. Any email threads or meeting discussions regarding the issue will be taken into consideration.

- E. The Standards Holder will then cast an Approve or Deny vote and forward the request to the DCO Manager for a decision.
- F. When the decision has been made by the Operations Manager, the Standards Holder will then notify the requestor by returning the completed and signed form via email.
- G. An approved deviation will have the final disposition button 'Approved' and be signed by at least 2 people. One will be from the Standards Holder, and the other the DCO Manager. Other signatures may be required for specific features and areas such as Safety, Security, Print, Medical group, etc.

PART 3 - EXECUTION

3.1 POST DECISION EXECUTION

- A. DENIED
 - 1. If the requester is not satisfied with the decision, they may file an appeal with the Data Center Operations manager (shawn.folkman@imail.org), who will then escalate the issue to the appropriate business leaders as needed. The decision from the appeal is final.
- B. APPROVED
 - 1. If a deviation is approved for contracted material, labor, or method; the facilities project manager will arrange for fulfillment or contract adjustment as needed via appropriate contract channels such as change orders.

END OF SECTION

SECTION 276002

APPENDIX 02 – DOCUMENT
REFRESH PROCESS

PART 1 - GENERAL

1.1 NOT USED

PART 2 - PRODUCTS

2.1 APPROVED PRODUCT

- A. The purpose of this section is to help ensure a current standards document.
- B. The product delivered will be a current revision or version of the Cable Plant Standards Document.
- C. All changes must be approved by Enterprise Infrastructure Cabling team.

PART 3 - EXECUTION

3.1 REVIEWS AND UPDATES

- A. Minor updates
 - 1. Changes that do not significantly affect scope of work, or contract pricing will be made, and the Rev number will be updated. (i.e. updated part numbers, etc.)
 - 2. Significant changes will be added to the Change Log for review and approval from the DCO/Infrastructure Cabling Team.
 - a. When approved, they will be submitted for approval; and then implemented in the new Version.
- B. Major updates
 - 1. The DCO/Infrastructure Cabling Team will review the entire document at least once every three years.
 - 2. This review will coincide with the release of new versions of NFPA70 (National Electrical Code) (2017, 2020, etc. - to be completed by the end of each designated year).
 - 3. The review will cover standards adjustments that may be deemed necessary and ensure compliance with applicable codes and standards.
 - 4. Upon completion of the reviews and updates, the standards document will be submitted for approval.

END OF SECTION

SECTION 276003

APPENDIX 03 – DATA CENTER, TEC, TDR PART NUMBERS

ITEM	MANUFACTURER	PART NO.	DESCRIPTION
Blanking Panel	Upsite Hotlok	10031	Blanking Panel 1U
Blanking Panel	Upsite Hotlok	10033	Blanking Panel 2U
UPS	Eaton	9PX1500R	Eaton Powerware 9PX-1500V
UPS Network Card	Eaton	NETWORK-M	Card for 9PX-1500VA
PDU	Eaton	ePBZ79	Horizontal Mount ePDU 208vac
PDU	Eaton	ePBZ82	Horizontal Mount ePDU 120vac
PDU	Server Technology	C1S24VS-YCFA13C9	Vertical 30A PDU (Blue) for TEC
PDU	Server Technology	C1L24VS-YCFA13C9	Vertical 30A PDU (Red) for TEC
PDU	Server Technology	C2SG36TE-YCMFAM66/C	Vertical 30A PDU (Blue) for Data Centers
PDU	Server Technology	C2LG36TE-YCMFAM66/C	Vertical 30A PDU (Red) for Data Centers
PDU	Server Technology	C2SG36TE-DQME2M66/ZB	Vertical 60A PDU (Blue) for Data Centers
PDU	Server Technology	C2LG36TE-DQME2M66/ZR	Vertical 60A PDU (Red) for Data Centers
UPS	Eaton	K41512000000000	Eaton 9155-15kVA UPS
Modbus Card	Eaton	103005425-5591	Eaton Modbus Card X-Slot
Reverse Transfer UPS System	Eaton	9GPV15C0009E00R2	Eaton 93PM-150kW Reverse Transfer UPS System
CRAC Cooling Unit	Liebert	DE363G	
Vertical Wall Mount Cabinets	Legrand	VWMSD-4RU-42-B	42" 12" 4RU Fixed
Vertical Wall Mount Cabinets	Legrand	VWMSD-8RU-42-B	42" 18" 8RU Fixed
Rail Accessories	Legrand	VWM-RR-4RU	Fixed Mounting Rail Kit, 4RU
Rail Accessories	Legrand	VWM-RR-8RU	Fixed Mounting Rail Kit, 8RU
Rail Accessories	Legrand	VWM-PIV-4RU	Pivoting Mounting Rail Kit, 4RU
Fan Kit	Legrand	VWMFK-115	VWM Fan Kit w/115 VAC Fans (includes 2 fans and mounting hardware) (2 kits needed for 8RU cabinet)
VWM Top Brush Grommet Kit	Legrand	VWMBGK	VWM Top Brush Grommet Kit
Circular Knockout Grommet Kit	Legrand	VWMGR-30	Circular Knockout Grommet Kit
Vertical Wall-Mount Cabinets	Hubbell	IR221APG	Refrigerated cabinet 24"
Vertical Wall-Mount Cabinets	Hubbell	IR321APG	Refrigerated cabinet 36"
Vertical Wall-Mount Cabinets	Hubbell	IR421APG	Refrigerated cabinet 48"
Air Conditioners	Hubbell	IRAC1	Air conditioner for Hubbell refrigerated cabinets
Cylinder	Medeco	100500 G	1 ¼" Mortise Cylinder
Cylinder	Medeco	100400H G	Rim Cylinder, Horizontal Tailpiece

Cylinder	Medeco	EA-100108	Small Format Interchangeable Core (SFIC) Cylinder
Cylinder	Medeco	20200S1 G	Cylinder Package for Schlage
Cam Lock	Medeco	EN-150002-219	7/8" Cam Lock Assembly, Key Retaining
Cam Lock	Medeco	EN-150003-219	1 1/8" Cam Lock Assembly, Key Retaining
Cylinder for Legrand cabinet front door	Medeco	232301S 800 G	Modular Profile Cylinder – 30mm Half Profile - Assembled
Electronic Key	Medeco	94-0271	Medeco Slim Line Key (G2) & Charger Bundle
Programming Station for Small Locations	Medeco	EA-100109	Medeco XT Desktop USB Programming Station (not preferred)
Programming Station for Large Locations	Medeco	EA-100158	Medeco XT Wall USB Programming Station (preferred)
Wall Mount for Wall Programmer	Medeco	94-0294	Medeco XT Remote Wall Programmer Wall Mount Kit
Padlock for use with Electronic Cylinder	Master	6842D045KZ	Padlock
Red C20 C19 Dual Lock 12 gauge 6'	Stay Online	5914	Red C20 C19 Dual Lock 12 gauge 6'
Blue C20 C19 Dual Lock 12 gauge 6'	Stay Online	6766	Blue C20 C19 Dual Lock 12 gauge 6'
Red C14 Locking C15 Notched 14 gauge 6'	Stay Online	9144	Red C14 Locking C15 Notched 14 gauge 6'
Blue C14 Locking C15 Notched 14 gauge 6'	Stay Online	9138	Blue C14 Locking C15 Notched 14 gauge 6'
Red C14 C13 Dual Lock 18 gauge 6'	Stay Online	5656	Red C14 C13 Dual Lock 18 gauge 6'
Blue C14 C13 Dual Lock 18 gauge 6'	Stay Online	6694	Blue C14 C13 Dual Lock 18 gauge 6'

SECTION 276004

APPENDIX 04 – REFERENCE STANDARDS

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

- A. Codes and Standards (Most recent editions with addenda/TSB, etc.) All materials, installation and workmanship shall meet or exceed the applicable requirements and standards addressed within the references listed below:
1. ANSI/TIA-568.0-D and addenda "Generic Telecommunications Cabling for Customer Premises
 2. ANSI/TIA-568.1-D and addenda "Commercial Building Telecommunications Cabling Standard
 3. ANSI/TIA-568.2-D and addenda "Balanced Twisted-Pair Telecommunications Cabling and Components
 4. ANSI/TIA-568.3-D and addenda "Optical Fiber Cabling Components Standard"
 5. ANSI/TIA-568.4-D and addenda "Broadband Coaxial Cabling and Components Standard"
 6. ANSI/TIA-569-D and addenda "Telecommunications Pathways and Spaces"
 7. ANSI/TIA-606-C and addenda "Administration Standard for Commercial Telecommunications Infrastructure"
 8. ANSI/TIA-607-D and addenda "Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises"
 9. ANSI/TIA-758-B "Customer-Owned Outside Plant Telecommunication Infrastructure Standard"
 10. IEEE 802.3at PoE Plus and Next Gen PoE CFI March 2013 and IEEE P802.3ba latest draft revision and amendments.
 11. "Media Access Control Parameters, Physical Layers and Management Parameters for 40 Gbp/s and 100 Gbp/s Operation".
 12. ANSI/TIA-526-7-A "Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant"
 13. ANSI/TIA/EIA-526-14-C "Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant"
 14. ANSI/TIA-942-B "Telecommunications Infrastructure Standard for Data Centers"
 15. ANSI/TIA – 1179-A "Healthcare Facility Telecommunications Infrastructure Standard"
 16. IEC/TR3 61000-5-2 - Ed. 1.0 and amendments "Electromagnetic compatibility (EMC) - Part 5: Installation and mitigation guidelines - Section 2: Earthing and cabling"
 17. ISO/IEC 11801-1 (2017) and amendments "Information technology - Generic cabling for customer premises – PART 1: General Requirements"
 18. EN 50173-1 and amendments "Information Technology - Generic cabling systems – PART 1 General Requirements"
 19. AIA Guidelines for Design and Construction of Hospital and Healthcare Facilities
 20. Construction Specification Institute Master Format
 21. BICSI: Comply with the most current editions of the following BICSI manuals:
 - a. BICSI - Telecommunications Distribution Methods Manual
 - b. BICSI – Installation Transport Systems Information Manual
 - c. BICSI – Network Design Reference Design Manual
 - d. BICSI – Outside Plant Design Reference Manual
 - e. BICSI – Wireless Design Reference Manual

- f. BICSI -Electronic Safety and Security Design Reference Manual
- g. Infocomm/BICSI – AV Design Reference Manual
- 22. Underwriters Laboratories (UL) Cable Certification and Follow-Up Program.
- 23. National Electrical Manufacturers Association (NEMA)
- 24. American Society for Testing Materials (ASTM)
- 25. National Electrical Code (NEC) NFPA70 2020
- 26. National Electrical Safety Code (NESC) 2017
- 27. Institute of Electrical and Electronic Engineers (IEEE)
- 28. UL Testing Bulletin
- 29. Building Industry Consulting Services International (BICSI) Information Transport Systems Methods Manual (ITSMM)
- 30. Local, county, state and federal regulations and codes in effect as of date of installation.
- 31. Equipment of foreign manufacture must meet U.S. codes and standards. It shall be indicated in the proposal the components that may be of foreign manufacture, if any, and the country of origin.

END OF SECTION

SECTION 276005

APPENDIX 05 – DEFINITIONS AND ABBREVIATIONS

PART 1 - GENERAL

1.1 RELATED TERMS

- A. Codes and Standards (Most recent editions with addenda/TSB, etc.) All materials, installation and workmanship shall meet or exceed the applicable requirements and standards addressed within the references listed below:
1. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.
 2. BICSI: Building Industry Consulting Service International.
 3. CBC: Coupled Bonding Conductor
 4. CFCI: Customer Furnished Customer Installed
 5. Cable Run - A single cable to a single location
 6. Cable Drop - Two cables to a single location
 7. Cable Tri Drop - Three cables to a single location
 8. CT Coupler A type of wall connector made by the Siemon Company
 9. DCO: Data Center Operations
 10. Div.1: Division 1 General and Performance Requirements
 11. Div. 23: Division 23 Heating, Ventilating, and Air Conditioning
 12. Div. 22: Division 22 Plumbing
 13. Div. 26: Division 26 Electrical
 14. Div. 27: Division 27 Communications and Audio Visual
 15. Div. 28: Division 28 Electronic Safety and Security
 16. E.E.: Electrical Engineer
 17. EMI: Electromagnetic Interference
 18. F/UTP: Foil over Unshielded Twisted Pair. Individual pairs are unshielded.
 19. GC: General Contractor
 20. GE: Ground Equalizer
 21. Horizontal Cabling: The cable and connecting hardware utilized to transport communications signals
 22. ICT: Infrastructure Cabling Team
 23. LAN: Local Area Network
 24. N/A: Not Applicable
 25. NIC: Not in Contract
 26. OFCI: Owner Furnished Contractor Installed
 27. OFOI: Owner Furnished Owner Installed
 28. OTDR: Optical Time Domain Reflectometer
 29. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.
 30. RCDD: Registered Communications Distribution Designer
 31. RFI: Radio Frequency Interference
 32. TBA or TBD: To Be Determined
 33. TDR: Technology Distribution Room
 34. TEC: Technology Equipment Center
 35. TGB: Telecommunications Ground Bus Bar
 36. TMBC: Telecommunications Main Bonding Conductor
 37. TMGB: Telecommunications Main Grounding Bus Bar
 38. TSER: Telecommunications Service Entrance Room
 39. UTP: Unshielded Twisted Pair
 40. Work Area: approx. 100 sq. ft. equipped for workstation equipment

- 41. DCO = Data Center Operations – Boe.Sausedo@imail.org
- 42. ICT = Information and Communications Technology – Melissa.Lopez2@imail.org

END OF SECTION

SECTION 276006

APPENDIX 06 – MATERIAL SUPPLIERS

PART 1 - GENERAL

1.1 RELATED TERMS

- A. Siemon Authorized Suppliers are listed below. To help prevent counterfeiting and support warranties, known, factory authorized distributors are recommended.

1. Approved Suppliers of Siemon cable, patch panels, jacks, and parts:

Anixter

Randi Whittaker

Inside Sales

Main Phone: (801) 973-2121

3775 W. California Ave. Ste 400 Fax: (801) 973-4472

Salt Lake City, UT 84104 US

Email: randi.whittaker@anixter.com

Karl Bartlam

End User/Outside Sales

Main Phone: (801) 973-2121

3775 W. California Ave. Ste 400 Fax: (801) 973-4472

Salt Lake City, UT 84104 US

Email: karl.bartlam@anixter.com

Graybar Electric

Elizabeth Vaughn

Inside Sales

Main Phone: (801) 656-3016

2841 South 900 West

Fax: (801) 973-4314

Salt Lake City, UT 84119 US

Email: Elizabeth.Vaughn@graybar.com

Erika Morrison

Contractor Outside Sales

Main Phone: (801) 656-3014

2841 South 900 West

Fax: (801) 973-4314

Salt Lake City, UT 84119 US

Email: Erika.Morrison@graybar.com

WESCO / CSC

Brian Walters

Inside Sales

Main Phone: (801) 975-0600

3210 South 900 West

Fax: (801) 907-4450

Salt Lake City, UT 84119 US

Email: Bwalters@gocsc.com

Adam Tueller

Contractor Outside Sales

Main Phone: (801) 975-0600

3210 South 900 West

Direct: (801) 618-6665

Salt Lake City, UT 84119 US

Email: Atueller@wesco.com

- B. The Siemon Company is represented locally by: Marc.Lovestrand@Siemon.com

END OF SECTION

SECTION 276007

APPENDIX 07 – SIEMON CERTIFIED
INSTALLATION FIRMS

PART 1 - GENERAL

1.1 RELATED TERMS

- A. NOTE: Cable installers have rigorous requirements to be certified for Siemon cables and products. Validation of certification is required prior to accepting a bid.
- B. The firms selected to bid must be pre-approved by the local facility IT manager. Installation firms desiring to do work for Intermountain Healthcare must be selected from the official CI list below.
- C. Current Siemon Approved/Certified Cable Installers for Siemon Network Cable. This list is up to date as of 2020-06-01.
1. **Orion Integration Group:** 8880 W. Barnes Street, Boise, ID 83709 / Phone 208 321 8000
 2. **ACS Systems:** 925 North Main St. Meridian, ID 83642 / Phone 208 331 8554
 3. **IES Commercial:** 1960 S. Milestone, Suite D, Salt Lake City, UT 84104
 - a. Jason King – Branch Manager // Phone 801 975 8182 / Fax 385 242 7366 / Mobile 801 381 1508 // Jason.King@iescomm.com / www.iescomm.com
 - b. Boyd Evans – Project Manager // Phone 801 975 8191 / Fax 385 242 7366 Mobile 801 381 1518 // Boyd.Evans@iescomm.com / www.iescomm.com
 4. **Cache Valley Electric:** 1338 S. Gustin Rd., Salt Lake City, UT 84104
 - a. Travis Grant – Acct. Manager // Phone 801 908 4170 / Fax 801 908 7401 Mobile 801 870 7226 // Travis.Grant@cve.com / www.cve.com
 - b. Brad Readicker – Acct. Manager // Phone 801 908 2686 / Fax 801 908 7401 // Brad.Readicker@cve.com / www.cve.com
 5. **Data Tech Professionals:** 1199 S 520 W, Payson, UT 84651
 - a. Jesse Pierce – President // Phone 801 960 2202 / Mobile 801 420 0463 Jesse@datatechprofessionals.com / www.datatechprofessionals.com
 6. **Hunt Electric, Inc.:** 1863 W. Alexander St., Salt Lake City, UT 84119
 - a. Darrin Guevara – Division Manager // Phone 801 975 8844 Darrin@huntelelectric.com / www.huntelelectric.com
 7. **NCNS Communications:** 419 West Universal Circle, Sandy, UT 84070
 - a. Jayson Nosack – Owner // Phone 801 361 4572 Jnosack@ncns-co.com / www.ncns-co.com
 8. **Data Plus:** 769 Middlegate Road, Henderson, NV 89118
 - a. Chris Tettamanti – Project Manager // Phone 702 795 3282 Chris@dpcnv.com
 9. **Bombard Electric:** 4380 West post Road, Las Vegas, NV 89118
 - a. Bob Reese – Project/Division Manager // Phone 702 263 3570 Bob.reese@bombardelec.com / www.bombardelectric.com
 10. **Rosendin Electric:** 7470 Dean Martin Dr. #112, Las Vegas, NV 89139
 - a. Cora Shadbolt – Assistant Project Mgr. // Phone 702 258 1443 cshadbolt@rosendin.com
 - b. Adrian Youngblood – Sr. Estimator // Phone 702 258 1455 ayoungblood@rosendin.com
 - c. Breck Hardesty – Sr. Project Mgr. // Phone 702 258 1428 bhardesty@rosendin.com / www.rosendin.com
 11. **Mojave Electric:** 3755 W. Hacienda Ave., Las Vegas, NV 89118 Phone 702 798 2970

12. **The Morse Group:** 3874 Silvestri Lane, Las Vegas, NV 89120
Phone 702 257 4400

END OF SECTION

SECTION 276008

APPENDIX 08 – LEAD WALL PENETRATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Sections 13090 & 134900

1.2 RELATED TERMS

Procedure Name: New Port and Electrical Box Installation Lead Lined Walls

Document Detail Information: (This section must be completed in full.)

Implements Policy:	Click here to enter policy title		
Content Owner	Craig Allen, Safety Security Environment Health Director, Central Office Jeremy Hawk Medical Physicist Radiation Safety Coordinator	Content Consultant(s):	Jeremy Hawk, Radiation Safety Officer, Medical Physicist Imaging John Ellis, Facilities Management Director, Central Office Steve Kelly, System Project Facility Design Manager, Planning Melissa Lopez, Cabling, IS
Date of Final Draft:	12/29/2015	Who Reviewed Content?	<Name, Title, Dept> <Name, Title, Dept> <Name, Title, Dept> <Committee Name>
Keywords (must have at least 3):	Searchable Keywords (e.g., PHI, EMTALA, Coding)		

1.3 PURPOSE

- A. Maintain radiation safety controls in lead lined walls during installation of new power and data outlets in existing lead lined walls.

1.4 SCOPE

- A. Intermountain Hospitals, Intermountain Clinics Medical Group

1.5 DEFINITIONS

- A. Lead lined Walls – Structured element designed to provide a barrier to block radiation penetration beyond the designated space.
- B. Maintenance Manager – The person responsible for plant maintenance operations or his/her delegate.

- C. Radiation Safety Coordinator – The person responsible for Radiation Safety or his/her Delegate. Medical Physicist.
- D. Worker – The person responsible for completing work with the lead lined wall. This includes Intermountain Employees as well as any outside supplier or contractor.

1.6 PROVISIONS

- A. The Radiation Safety Program is following Utah regulation R313-15-101, R313-28 and U.S. Nuclear Regulatory Commission Regulation 1- CFR Part 20-1101.

1.7 PROCEDURE

- A. Prior to any work within a lead lined wall, the Worker reports to the Radiation Safety Coordinator, Maintenance Manager and completed a review of planned work “ACWP” Identification of specific description related to the lead lined wall planned work.
 - 1. Intermountain workers, outside suppliers or contractors hired to work in any Intermountain facility must contact the Maintenance Manager and Radiation Safety Coordinator prior to beginning work to discuss the project and ensure that the planned work will not interfere with facility operations, maintenance, or other projects.
 - 2. Failure to scheduled and complete the planning meeting described above may results in the delay or rescheduling of work. Outside suppliers or contractors are responsible for any costs incurred because of their failure to schedule and complete this meeting.
- B. The Radiation Safety Coordinator, Maintenance Manager and the worker conduct a pre-work inspection of the areas in which work is to be performed. This inspection identified the following:
 - 1. Areas of special concern or sensitivity, including those noted or described on the facility Life Safety records and drawings, and Radiation Safety records and drawings.
 - 2. Appropriate areas or structures to use for support of any work, as applicable.
 - 3. Existing deficiencies in Barriers.
 - 4. The as act assemblies impacted by the work.
 - 5. The type of shielding material acceptable in the area.
 - a. Lead lined boxes
 - b. Lead lined wall “inside wall” installation, and OR
 - c. Lead shielding for wall installation of “outside wall” maintaining radiation safety barriers.
 - 6. The exact condition of the areas upon completion of work.
- C. Upon completion of the work and before closing the wall, the worker, Radiation Safety Coordinator and Maintenance Manager conduct a post-work inspection of the area in which the work was performed, this inspection verifies the following:
 - 1. No Tools, Supplies or debris are left within the walls.
 - 2. Lead lining is installed to maintain radiation safety protection according to regulatory requirements.
 - 3. All work affecting Radiation Safety Lead Barriers has been properly sealed.
 - 4. The overall condition of the area meets the expectation outline in the per-work inspection.
- E. The Maintenance Manager and Radiation Safety Coordinator signs and logs the completed “ACWP”

1.8 EXCEPTIONS

- A. None.

1.9 PRIMARY SOURCES

- A. List the regulatory references upon which the procedure is based (cite the code, the title, and the statute).

1.10 SECONDARY MATERIALS

- A. Radiation Safety Policy
- B. Above Ceiling Work Permit
- C. Lead lined wall requirements as defined by Radiation Safety Building Requirements



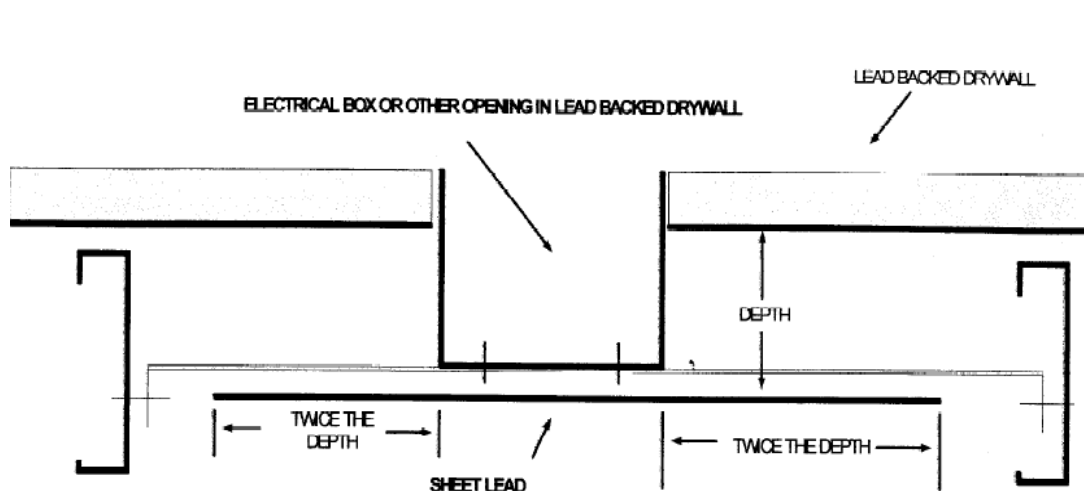
Option 1: worker to install new power utility wall box and add Lead Lining to wall behind box
If worker can access posterior wall entry



Option 2: worker to install new power utility wall box – box is lead Lined by manufacturer



Option 3: worker to install new power utility wall box - no additional lead lining required if installation does not disrupt the existing shielding



TYPICAL BACKING OF ELECTRICAL OR OTHER OPENINGS

END OF SECTION

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

28 0500 COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY
28 3111 DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

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SECTION 28 0500 - COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY

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. Electronic safety and security equipment coordination and installation.
 - 2. Sleeves for raceways and cables.
 - 3. Sleeve seals.
 - 4. Grout.
 - 5. Common electronic safety and security installation requirements.

1.3 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

1.4 COORDINATION

- A. Coordinate arrangement, mounting, and support of electronic safety and security equipment:
 - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 - 3. To allow right of way for piping and conduit installed at required slope.
 - 4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- C. Coordinate location of access panels and doors for electronic safety and security items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

- 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.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel.
 - 1. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
 - b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 - 1. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 - 2. Pressure Plates: Carbon steel or Stainless steel. Include two for each sealing element.
 - 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electronic safety and security equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRONIC SAFETY AND SECURITY PENETRATIONS

- A. Electronic safety and security penetrations occur when raceways, pathways, cables, wireways, or cable trays penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable, unless indicated otherwise.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
 - 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
- I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."
- J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."
- K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using **[steel]** **[cast-iron]** pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

- A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electronic safety and security installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration

Firestopping."

END OF SECTION

SECTION 283111 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

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. Fire-alarm control unit.
 - 2. Manual fire-alarm boxes.
 - 3. System smoke detectors.
 - 4. Heat detectors.
 - 5. Notification appliances.
 - 6. Magnetic door holders.
 - 7. Remote annunciator.
 - 8. Addressable interface device.

1.3 DEFINITIONS

- A. LED: Light-emitting diode.
- B. NICET: National Institute for Certification in Engineering Technologies.

1.4 SYSTEM DESCRIPTION

- A. Noncoded, FMG-placarded addressable system, with multiplexed signal transmission, dedicated to fire-alarm service only.
 - 1. Integrate to and upgrade existing clinic system for remodel and expansion areas.

1.5 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Fire-alarm control unit and raceways shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.6 SUBMITTALS

- A. General Submittal Requirements:
 - 1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
 - 2. Shop Drawings shall be prepared by persons with the following qualifications:
 - a. Trained and certified by manufacturer in fire-alarm system design.
 - b. NICET-certified fire-alarm technician, Level III minimum.
 - c. Licensed or certified by authorities having jurisdiction.
- B. Product Data: For each type of product indicated.

- C. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.
1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
 2. Include voltage drop calculations for notification appliance circuits.
 3. Include battery-size calculations.
 4. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
 5. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
 6. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
 7. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.
- D. Delegated-Design Submittal: For smoke and heat detectors 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. Drawings showing the location of each smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the detector.
 2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72.
- E. Qualification Data: For qualified Installer.
- F. Seismic Qualification Certificates: For fire-alarm control unit, accessories, and components, from manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- G. Field quality-control reports.
- H. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
 3. Record copy of site-specific software.
 4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:
 - a. Frequency of testing of installed components.
 - b. Frequency of inspection of installed components.
 - c. Requirements and recommendations related to results of maintenance.
 - d. Manufacturer's user training manuals.
 5. Manufacturer's required maintenance related to system warranty requirements.
 6. Abbreviated operating instructions for mounting at fire-alarm control unit.

7. Copy of NFPA 25.

- I. Software and Firmware Operational Documentation:
 1. Software operating and upgrade manuals.
 2. Program Software Backup: On magnetic media or compact disk, complete with data files.
 3. Device address list.
 4. Printout of software application and graphic screens.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- B. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer. Components shall be compatible with, and operate as, an extension of existing system.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. NFPA Certification: Obtain certification according to NFPA 72 in the form of a placard by an FMG-approved alarm company.

1.8 PROJECT CONDITIONS

- A. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:
 1. Notify Owner no fewer than two days in advance of proposed interruption of fire-alarm service.
 2. Do not proceed with interruption of fire-alarm service without Owner's written permission.

1.9 SEQUENCING AND SCHEDULING

- A. Existing Fire-Alarm Equipment: Maintain existing equipment 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 new fire-alarm system, remove existing disconnected fire-alarm equipment and wiring.

1.10 SOFTWARE SERVICE AGREEMENT

- A. Comply with UL 864.
- B. Technical Support: Beginning with Substantial Completion, provide software support for two years.
- C. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.

1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

1.11 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but no fewer than 1 unit.
 2. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but no fewer than 1 unit.
 3. Smoke Detectors, Fire Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than 1 unit of each type.
 4. Detector Bases: Quantity equal to 2 percent of amount of each type installed, but no fewer than 1 unit of each type.
 5. Keys and Tools: One extra set for access to locked and tamperproofed components.
 6. Audible and Visual Notification Appliances: One of each type installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. MIRCOM

2.2 SYSTEMS OPERATIONAL DESCRIPTION

- A. Fire-alarm signal initiation shall be by one or more of the following devices:
 1. Manual stations.
 2. Heat detectors.
 3. Smoke detectors.
 4. Duct smoke detectors.
 5. Automatic sprinkler system water flow.
- B. Fire-alarm signal shall initiate the following actions:
 1. Continuously operate alarm notification appliances.
 2. Identify alarm at fire-alarm control unit and remote annunciators.
 3. Transmit an alarm signal to the remote alarm receiving station.
 4. Unlock electric door locks in designated egress paths.
 5. Release fire and smoke doors held open by magnetic door holders.
 6. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
 7. Recall elevators to primary or alternate recall floors.
 8. Record events in the system memory.
- C. Supervisory signal initiation shall be by one or more of the following devices and actions:
 1. Valve supervisory switch.
- D. System trouble signal initiation shall be by one or more of the following devices and actions:
 1. Open circuits, shorts, and grounds in designated circuits.
 2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
 3. Loss of primary power at fire-alarm control unit.
 4. Ground or a single break in fire-alarm control unit internal circuits.
 5. Abnormal ac voltage at fire-alarm control unit.

6. Break in standby battery circuitry.
 7. Failure of battery charging.
 8. Abnormal position of any switch at fire-alarm control unit or annunciator.
- E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators. Record the event on system printer.

2.3 FIRE-ALARM CONTROL UNIT

- A. Existing control panel to remain.
- B. Circuits:
1. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class A.
 - a. Initiating Device Circuits: Style E.
 - b. Notification Appliance Circuits: Style Z.
 - c. Signaling Line Circuits: Style 7.
 - d. Install no more than 50 addressable devices on each signaling line circuit.
- C. Notification Appliance Circuit: Operation shall sound in a repeating pattern.
- D. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke barrier walls shall be connected to fire-alarm system.
- E. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory and digital alarm communicator transmitters shall be powered by 24-V dc source.
1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.
- F. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
1. Batteries: Sealed lead calcium.

2.4 NOTIFICATION APPLIANCES

- A. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections.
1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.
- B. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet (3 m) from the horn, using the coded signal prescribed in UL 464 test protocol.
- C. Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.
1. Rated Light Output:
 - a. 15/30/75/110 cd, selectable in the field.
 2. Mounting: Wall mounted unless otherwise indicated.
 3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.

4. Flashing shall be in a temporal pattern, synchronized with other units.
5. Strobe Leads: Factory connected to screw terminals.
6. Mounting Faceplate: Factory finished white

2.5 FIRE ALARM WIRE AND CABLE

- A. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.
- B. Signaling Line Circuits: Twisted, shielded pair, size as recommended by system manufacturer , but not less than No. 18 AWG.
- C. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.
 1. Low-Voltage Circuits: No. 16 AWG, minimum.
 2. Line-Voltage Circuits: No. 12 AWG, minimum.
 3. Multiconductor Armored Cable: NFPA 70, Type MC, copper conductors, Type TFN/THHN conductor insulation, copper drain wire, copper armor with outer jacket with red identifier stripe, NRTL listed for fire alarm and cable tray installation, plenum rated, and complying with requirements in UL 2196 for a 2-hour rating.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72 for installation of fire-alarm equipment.
- B. Equipment Mounting: Install fire-alarm control unit on finished floor with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.
 1. Comply with requirements for seismic-restraint devices specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
 2. Comply with requirements for seismic-restraint devices specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- C. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.
 1. Connect new equipment to existing control panel in existing part of the building.
 2. Connect new equipment to existing monitoring equipment at the supervising station.
 3. Expand, modify, and supplement existing control equipment as necessary to extend existing control functions to the new points. New components shall be capable of merging with existing configuration without degrading the performance of either system.
- D. Smoke- or Heat-Detector Spacing:
 1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
 2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
 3. Smooth ceiling spacing shall not exceed 30 feet (9 m).
 4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix A in NFPA 72.
 5. HVAC: Locate detectors not closer than 3 feet (1 m) from air-supply diffuser or return-air opening.
 6. Lighting Fixtures: Locate detectors not closer than 12 inches (300 mm) from any part of a lighting fixture.

- E. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.
- F. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.
- G. Audible Alarm-Indicating Devices: Install not less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.
- H. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches (150 mm) below the ceiling.
- I. Device Location-Indicating Lights: Locate in public space near the device they monitor.

3.2 CONNECTIONS

- A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Division 08 Section "Door Hardware." Connect hardware and devices to fire-alarm system.
 - 1. Verify that hardware and devices are NRTL listed for use with fire-alarm system in this Section before making connections.
- B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet (1 m) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
 - 1. Smoke dampers in air ducts of designated air-conditioning duct systems.
 - 2. Alarm-initiating connection to activate emergency lighting control.
 - 3. Supervisory connections at valve supervisory switches.

3.3 FIRE ALARM WIRING INSTALLATION

- A. Comply with NECA 1 and NFPA 72.
- B. Wiring Method: Install wiring in metal raceway according to Division 26 Section "Raceway and Boxes for Electrical Systems."
 - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
 - 2. 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.
 - 3. Fire-Rated Cables: Use of 2-hour, fire-rated fire alarm cables, NFPA 70, Types MI and CI, is not permitted.
 - 4. Signaling Line Circuits: Power-limited fire alarm cables shall not be installed in the same cable or raceway as signaling line circuits.
- C. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by 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.

- D. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.
- E. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another 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.

3.4 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
- B. Install framed instructions in a location visible from fire-alarm control unit.

3.5 GROUNDING

- A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

3.6 FIELD QUALITY CONTROL

- A. Field tests shall be witnessed by owner and authorities having jurisdiction.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Tests and Inspections:
 - 1. Visual Inspection: Conduct visual inspection prior to testing.
 - a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
 - b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
 - 2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 - 3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
 - 4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
 - 5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
 - 6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

- E. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
- F. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- G. Prepare test and inspection reports.
- H. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.
- I. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

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