



Intermountain Healthcare

LRH PET/CT



Project Manual

100% Construction Documents

June 28, 2024

HDR Project No. 10394230



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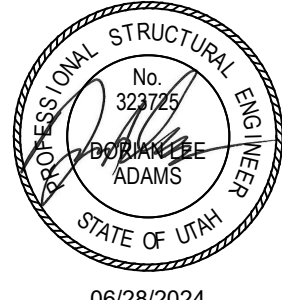

DIVISION 00

PROCUREMENT AND CONTRACTING
REQUIREMENTS



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SECTION 00 01 07
SEALS PAGE

<p>I hereby certify that the portion of this technical submission described below was prepared by me or under my direct supervision and that I am a duly registered architect under the laws of the State of _____.</p> <p><u>Todd Tierney</u> <u>6/28/2024</u> (INSERT NAME) Date</p> <p>My license renewal date is <u>5/31/2026</u></p> <p>Pages or sheets covered by this seal: <u>General (G), Architectural (A), Interiors (I), Equipment (Q) Sheets.</u></p>	
<p>I hereby certify that the portion of this technical submission described below was prepared by me or under my direct supervision and that I am a duly registered engineer under the laws of the State of <u>Utah</u>.</p> <p><u>Scot E. Muir</u> <u>6/27/2024</u> (INSERT NAME) Date</p> <p>My license renewal date is <u>3/31/2025</u></p> <p>Pages or sheets covered by this seal: <u>Mechanical "M" Sheets; and Plumbing "P" Sheets.</u></p>	
<p>I hereby certify that the portion of this technical submission described below was prepared by me or under my direct supervision and that I am a duly registered engineer under the laws of the State of _____.</p> <p><u>Dorian Adams</u> <u>6/28/2024</u> (INSERT NAME) Date</p> <p>My license renewal date is <u>3/31/2025</u></p> <p>Pages or sheets covered by this seal: <u>Structural "S" Sheets.</u></p>	
<p>I hereby certify that the portion of this technical submission described below was prepared by me or under my direct supervision and that I am a duly registered engineer under the laws of the State of _____.</p> <p><u>Carlton Getz</u> <u>6/28/2024</u> (INSERT NAME) Date</p> <p>My license renewal date is <u>3/31/2025</u></p> <p>Pages or sheets covered by this seal: <u>Electrical "E" Sheets</u></p>	



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SECTION 00 01 09

PROJECT MANUAL - PREFACE

- A. The Project Manual is the volume usually assembled for the Work which may include the Procurement Requirements, Contracting Requirements, and Specifications.
- B. Project Manual: Volume or volumes which includes but is not limited to the following distinct parts:
 - 1. Introductory Requirements:
 - a. Division 00.
 - b. Not part of the construction contract unless incorporated by reference in a contracting requirements document.
 - c. Not specifications.
 - 2. Procurement Requirements, instruct bidders about procedures for preparing and submitting their bids:
 - a. Division 00.
 - b. Not part of the construction contract unless incorporated by reference in a contracting requirements document.
 - c. Not specifications.
 - 3. Contracting Requirements, General Conditions define processes, rights, responsibilities, and relationships of parties to the contract:
 - a. Division 00.
 - b. Part of the construction contract.
 - c. Not specifications.
 - 4. Specifications (6-digit format), establish the quality levels of materials and systems required for the project:
 - a. Division 01, General Requirements.
 - b. Division 02 – 19, Facility Construction.
 - c. Division 20 – 29, Facility Services.
 - d. Part of the construction contract.
- C. Project Manual is formatted based on guidelines established by the Construction Specifications Institute.
 - 1. Division:
 - a. Standard category of construction information.
 - b. Divisions form basic framework of project specification.
 - c. Division titles appear in table of contents of project manual.
 - 2. Section:
 - a. Individual sections dealing with Procurement Requirements, Contracting Requirements, and Specifications.
 - b. Sections are included in project manual as needed to meet requirements.
 - c. Section titles appear in table of contents of project manual.
 - 3. Part: Organizational device to divide specification section into three distinct groupings of related information.
 - a. PART 1 - GENERAL: Defines specific administrative and procedural requirements unique to the section.
 - b. PART 2 - PRODUCTS: Describes quality of items that are required for incorporation into project under the section.
 - c. PART 3 - EXECUTION: Describes preparatory actions and how products are to be incorporated into project.
 - 4. Article: Major subject consisting of related paragraphs within part of specification section.



5. Paragraph: One or more sentences, dealing with particular item or point, separated from preceding text by beginning on new line. Groups of paragraphs of related information constitute an article.
- D. Specification Language:
1. Basic grammatical moods of sentences can be used to clearly and concisely convey specification requirements.
 2. The simple imperative mood is method for instructions covering installation of products and equipment. The verb which clearly defines action becomes first word in the sentence. The imperative sentence is concise and readily understandable. Example: “a. Spread adhesive with notched trowel.”
 3. Streamlining is used to list products, materials, reference standards, and other itemized specifications. This technique places subject first and hence provides key words for quick reference. Example: “a. Sealant: Silicone.”
 4. These specifications are written in imperative mood and streamlined form. This imperative language is directed to the Contractor, unless specifically noted otherwise. The words “shall be” shall be included by inference where colon (:) is used within sentences or phrases.
 5. In the interest of brevity the Contract Documents frequently omit modifying words such as “all” and “any” and articles such as “the” and “an”, but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.
- E. Definitions:
1. Definition of “Base” and “Optional” manufacturers: See Section 01 61 00.

REFERENCES

AIA Document A201, General Conditions of the Contract for Construction.
Construction Specifications Institute, Manual of Practice.

END OF SECTION

SECTION 00 21 13

INSTRUCTIONS TO BIDDERS

PART 1 - GENERAL

1.1 RECEIPT AND OPENING OF BIDS

- A. Intermountain Healthcare, herein called Owner, invites bids for coordination and construction.
- B. For following Project: **Logan Regional Hospital – PET/CT**
- C. Bids will be received at place and time indicated in Advertisement to Bid.
- D. Bids received late will not be opened.
- E. Bids will be privately opened.

1.2 METHOD OF BIDDING

- A. Owner invites bids on general construction work to include work of all trades.
- B. See section 004000 Bid Form for specific requirements regarding bids and cost breakdown.

1.3 PREPARATION OF BID

- A. Submit on Bid Form included in bid documents.
- B. Fill out in ink or typewritten, without erasure, interlineation or changes.
- C. Make bid in name of principal and if co-partnership, give names of all parties.
- D. Give bidder's complete address.
- E. For bids submitted by an agent, provide satisfactory evidence of agency authority.
- F. Delete calendar days if not required.
- G. Indicate number of consecutive calendar days for construction **leading to** Substantial Completion of Work.
- H. Fill in bid prices in both words and **numbers**.
- I. Submit bid in sealed envelope.
- J. Indicate on outside of envelope, name of bidder, bidders address, and name of Project for which bid is submitted.
- K. Indicate bidder's state license number and expiration date on Bid Form and on envelope.
 - 1. Bids without state license information will not be opened.
- L. If forwarded by mail, enclose sealed envelope containing Bid Form in another envelope addressed as indicated.

1.4 BID SECURITY

- A. Each bid shall be accompanied by a bid security in the form and amount required if so stipulated in the Instructions to Bidders.
- B. Bidder pledges to enter into a Contract with Owner on the terms stated in the bid and will, if required, furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder.



1. 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 Owner as liquidated damages, not as a penalty.*
- C. Submit bid with cash, certified check or bid bond, in amount of five (5) percent of highest total base bid combination, including all Add Alternates.
 1. Bid bond shall be on AIA Document A310, duly executed by bidder as principal and having a surety thereon, by company authorized to issue bond.
 2. Agent signing bid bond must file with bond; certified and effectively dated copy of power of attorney showing any limitation in regard to total amount for which any single bond can be issued.

1.5 MODIFICATION OR WITHDRAWAL OF BID

- A. Bid may be withdrawn or modified prior to scheduled time for opening, under following terms:
 1. Bidder may, without prejudice to self, withdraw bid after it has been deposited, provided request for such withdrawal is received in writing or by telegram, before time set for opening.
 2. Telephonic communications not acceptable.
 3. Bidder may modify bid by telegraphic communication at any time prior to scheduled time for opening, provided such telegraphic communication is received prior to opening, and, provided further, Owner is satisfied that written confirmation signed by bidder was mailed prior to opening.
 - a. Do not reveal bid price in telegraphic communication.
 - b. No consideration will be given by telegraphic communication if written confirmation is not received within two (2) days after scheduled time for opening.
- B. After opening, no bid may be withdrawn or modified for period indicated in Bid Form.
- C. Provide addition, subtraction or modification so that final prices or terms will not be known until sealed Bid Form is opened.

1.6 INTERPRETATIONS

- A. Bidder shall carefully study and compare Bidding Documents with each other, and with other work being bid concurrently or presently under construction to the extent that it relates to the Work for which Bid is submitted, shall examine site and local conditions for errors, inconsistencies or ambiguities discovered. *
- B. In event of errors, inconsistencies or ambiguities discovered between portions of Bidding Documents or within Bidding Documents or bidder is in doubt of meaning of any part of Bidding Documents, bring to Architect's attention by, submitting Bid Document Request for Interpretation:
 1. Use attached form to address on form.
 - a. Bidder submitting request is responsible for prompt delivery of such requests.
 - b. Request must be received AT LEAST 10 DAYS PRIOR to date fixed for opening of bids.
 2. Interpretations, corrections and changes of Bidding Documents will be made by Addendum. Interpretations, corrections and changes of the Bidding Documents made in any other manner will not be binding, and Bidders shall not rely upon them. *
 - a. Copy of such Addendum will be made available for inspection wherever Bidding Documents are on file for that purpose, and will be transmitted to all who are known by issuer to have received a complete set of Bidding Documents, prior to date fixed for opening of bids.
 - b. Failure to receive such Addendum does not relieve bidder from any obligation under bid as submitted.



- c. All Addenda become part of Bidding Documents and Contract Documents.
 - d. Each Bidder shall ascertain prior to submitting a Bid that Bidder has received all Addenda issued, and Bidder shall acknowledge their receipt on Bid Form.
- C. Bidder shall carefully study and compare Bidding Documents with each other, and with other work being bid concurrently or presently under construction to extent that it relates to Work for which Bid is submitted, shall examine site and local conditions for errors, inconsistencies or ambiguities discovered. *
- D. In event of errors, inconsistencies or ambiguities between portions of Bidding Documents or within Bidding Documents or bidder is in doubt of meaning of any part of Bidding Documents, bring to Architect's attention by, submitting Request for Information (RFI).
- 1. Use Newforma Contract Management System (Newforma)
- E. Oral interpretations will not be binding.
- F. Owner or Architect is not responsible for any other explanations or interpretations which anyone presumes to make.
- G. Bidder desiring approval of material or equipment not specified must comply with Section 00 26 00.

1.7 BASE BIDS AND ALTERNATES

- A. General: Bid must include Base Bid and all Alternates.
- B. In event Alternate does not affect bidder's work, enter "No Change."
- C. Absence of any entry will be assumed to indicate zero price or time change.
- D. Order of Alternates: Owner reserves right to accept any or all Alternates.
- E. Description of Alternates: See Section 00 40 00.

1.8 UNIT PRICES

- A. Bid must include all Unit Prices.
- B. Absence of any entry will be assumed to indicate zero price.
- C. See Section 01 40 00.

1.9 IRREGULAR BID AND REJECTION OF BIDS

- A. Bid is considered irregular and may be rejected for following reasons unless otherwise provided by law:
 - 1. If Bid Form furnished is not used or is altered.
 - 2. If there are unauthorized additions, conditional bids, or irregularities of any kind which may tend to make bid incomplete, indefinite, or ambiguous.
 - 3. If bidder adds any provisions reserving right to accept or reject any award, or to enter into contract pursuant to an award.
 - 4. If unit or lump sum prices contained in bid schedule are obviously unbalanced either in excess of, or below, reasonable cost analysis values.
 - 5. If bidder fails to insert Alternate and Unit Prices for every such item indicated.
 - 6. If bidder fails to complete Bid Form where information is requested, so bid may be properly evaluated.
- B. Owner reserves right to reject any or all bids and to waive irregularities or informalities as may be in Owner's interest.



1.10 ACCEPTANCE AND AWARD OF BID

- A. It is intent of Owner to award a Contract to lowest qualified Bidder provided Bid has been submitted in accordance with requirements of Bidding Documents and does not exceed funds available. *
- B. If Base Bid exceeds such amount, Owner may reject all bids.
- C. Owner shall have right to accept Alternates in any order or combination, unless otherwise specifically provided in Bidding Documents, and to determine low Bidder on basis of sum of Base Bid and Alternates accepted.*
- D. Owner may award contract based on time to obtain Substantial Completion.
- E. Owner may award contract based on combination of price, time, and qualifications.
- F. Owner shall have right to waive informalities and irregularities in a Bid received and to accept Bid which, in Owner's judgment, is in Owner's own best interests.

1.11 DEFINITIONS*

- A. Bidding Documents include Bidding Requirements and proposed Contract Documents. Bidding Requirements consist of Advertisement or Invitation to Bid, Instructions to Bidders, Supplementary Instructions to Bidders, the Bid Form, and other sample bidding and contract forms. The proposed Contract Documents consist of the form of Agreement between the Owner and Contractor, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications and Addenda and clarifications issued prior to execution of Contract.
- B. Definitions set forth in General Conditions of the Contract for Construction or in other Contract Documents are applicable to Bidding Documents.
- C. Addenda are written or graphic instruments issued by Architect prior to execution of Contract which modify or interpret Bidding Documents by additions, deletions, clarifications or corrections.
- D. A Bid is a complete and properly executed proposal to do the Work for sums stipulated therein, submitted in accordance with Bidding Documents.
- E. The Base Bid is the sum stated in the Bid for which Bidder offers to perform the Work described in Bidding Documents as the base, to which Work may be added or from which Work may be deleted for sums stated in Alternate Bids.
- F. An Alternate Bid (Alternate Bid) is an amount stated in the Bid to be added to or deducted from the amount of Base Bid if the corresponding change in the Work, as described in the Bidding Documents, is accepted.
- G. A Bid is a complete and properly executed proposal to do the Work for the sums stipulated therein, submitted in accordance with Bidding Documents.
- H. 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 Bidding Documents.
- I. A Bidder is a person or entity who submits a Bid and who meets the requirements set forth in Bidding Documents.
- J. 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.

1.12 BIDDER'S REPRESENTATIONS*

- A. Bidder by making a Bid represents that:



1. Bidder has read and understands the Bidding Documents or Contract Documents, to the extent that such documentation relates to the Work for which Bid is submitted, and for other portions of the Project, if any, being bid concurrently or presently under construction.
2. Bid is made in compliance with Bidding Documents.
3. Bidder has visited the site, become familiar with local conditions under which the Work is to be performed and has correlated the Bidder's personal observations with the requirements of proposed Contract Documents. **The Bidder shall notify the General Contractor if any errors or omissions are discovered.**
4. Bid is based upon the materials, equipment and systems required by the Bidding Documents without exception.

1.13 BIDDING DOCUMENTS*

- A. Bidders may obtain complete Bidding Documents as designated in Advertisement or Invitation to Bid.
- B. Bidders shall use complete sets of Bidding Documents in preparing Bids; neither Owner nor Architect assumes responsibility for errors or misinterpretations resulting from use of incomplete sets of Bidding Documents.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

Provisions followed by an asterisk () include some or all provision obtained from AIA Document A701-1997.*

END OF SECTION



BID DOCUMENT
REQUEST FOR INTERPRETATION

Project: _____	Project No: _____
----------------	-------------------

For Contractor / Subcontractor / Vendor Routing: Firm: _____	BD-RFI No.: _____ Transmittal No.: _____ Date: _____
---	--

To: Attn: _____ HDR Architecture, PC.	Email to: _____
--	-----------------

Provide references and complete description of request with sketches or copy of document if necessary. (Please type or print legibly)		
Spec. Section: _____	Dwg. No.: _____	Rm. No.: _____
Request: _____ _____		
CM / Contractor / Supplier: _____		
Address: _____		
Phone No.: _____	FAX No.: _____	
By: _____	Date: _____	

Request must be received AT LEAST 10 DAYS PRIOR to bid opening. If response is necessary, interpretations or supplemental instructions will be issued in the form of written addenda or clarification.
--

Architect's Routing: (for A/E use only)	A/E BD-RFI No.: _____
To: _____	
Date: _____	
<input type="checkbox"/> Proj. Mgr. _____	<input type="checkbox"/> Equip./Casework _____
<input type="checkbox"/> Coordinator _____	<input type="checkbox"/> Civil / Landscape _____
<input type="checkbox"/> Structural _____	<input type="checkbox"/> Interior Designer _____
<input type="checkbox"/> Mechanical _____	<input type="checkbox"/> Specification Writer _____
<input type="checkbox"/> Electrical _____	<input type="checkbox"/> Project C.C.A. _____
ACTION: <input type="checkbox"/> Review and initiate addendum item if appropriate	<input type="checkbox"/> other _____
<input type="checkbox"/> Review and initiate change document if appropriate	<input type="checkbox"/> Review & provide input <input type="checkbox"/> Info only
	<input type="checkbox"/> Other: _____

END OF FORM

SECTION 00 22 13

SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

- A. The Supplementary Instructions to Bidders herein describe, contain changes and additions to 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. **Refer to section 002600.**

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 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 26 00
SUBSTITUTIONS PRIOR TO BIDDING

PART 1 - GENERAL

1.1 DEFINITION

- A. Acceptable Manufacturers and Products: See Section 01 61 00.
- B. Section includes administrative and procedural requirements for handling requests for substitutions made prior to bid.
- C. Any product proposed by Contractor which does not meet requirements of Contract Documents, whether in product characteristics, performance, quality, manufacturer, or brand name is considered a substitution.
- D. In case of non-availability of materials contact Architect for review and action.
- E. For bidding purposes, base all bids on materials, equipment, and procedures specified, or approved by Addenda.

1.2 SUBSTITUTION PRIOR TO BIDDING REQUEST

- A. Submit complete data substantiating compliance of proposed substitution with Contract Documents.
- B. For products and systems:
 - 1. Product identification, including manufacturer's name.
 - 2. Manufacturer's literature marked to indicate specific model, type, size, and options to be considered:
 - a. Product description.
 - b. Performance and test data.
 - c. Reference standards.
 - d. Difference in power demand, air quantities, etc.
 - e. Dimensional differences from specified unit.
 - 3. Samples:
 - a. Architect reserves right to retain sample until physical units are installed on project for comparison purposes.
 - b. Requester shall pay all costs of furnishing and return of samples.
 - c. Architect is not responsible for loss of, or damage to samples.
 - 4. Name and address of at least five similar projects that proposed product has been in use on for at least four years, and name and phone number of owner's and architect's or engineer's representative, which Owner or Architect can contact to discuss product, installation, and field performance data.
- C. For construction methods:
 - 1. Detailed description of proposed method.
 - 2. Illustrate with drawings.
- D. Itemized comparison of proposed substitute to specified item; indicate variations.
- E. Effect and changes required on other trades, subcontractors or contracts.
- F. Data related to change in construction time.
- G. Cost of proposed substitution in comparison with product, system or method specified.



- H. Availability of maintenance and repair services, and sources of repair or replacement items.
- I. Warranty comparison with specified product or system.

1.3 PRODUCT SELECTION - GENERAL

- A. Certain types of products are described in Project Manual by means of trade names, catalog numbers or manufacturer's names, or both. This is not intended to exclude other products from consideration which may be capable of accomplishing purpose indicated.
- B. Other types of products may be considered acceptable to Owner and Architect in place of those specified.
- C. Listing of a manufacturer implies acceptance of them only as supplier of a product which complies with specified item.
 - 1. See Section 01 61 00 for definition of Base and Optional manufacturers.
- D. No substitution permitted after execution of contract, unless allowed by Contract Documents.
- E. Conditional bids and voluntary alternates will not be considered unless allowed by Instructions to Bidders.

1.4 SUBSTITUTION REQUESTS

- A. Only written requests with complete data for evaluation will be considered.
 - 1. Request must be received at least 7 calendar days prior to bid date.
 - 2. Requests received late will not be considered.
 - 3. Submit evaluation data with attached form to Architect.
- B. In making request for substitution, supplier and Contractor represent:
 - 1. Personal investigation of proposed product, system or method, has been conducted and determined it equal or superior in all respects to that specified, and will perform intended function.
 - 2. Product, system or method is in full compliance with applicable codes.
 - 3. Warranty for substitute item as for product, system or method specified meets or exceeds specified product.
 - 4. Finish products shall comply color wise and pattern wise with base specified items. Contractor will coordinate installation of accepted substitution into Work, to include building modifications if necessary, and be responsible for such modifications as may be required for Work to be complete and functional in all respects.
 - 5. Certified cost data is complete and includes all related costs, excluding Architect's review and redesign cost.
 - 6. Waives all claims for additional costs or time extensions related to substitution which subsequently become apparent or are caused by substitution.
 - 7. Pay additional costs to other trades, subcontractors or contracts caused by substitution.
 - 8. Pay all Architect's review and redesign cost, special inspections, and other costs incurred by substitutions or revisions made necessary by acts or omissions of Contractor, due to product submittal or product not being ordered in a timely manner, due to ease of construction progress or Work, or which are in interest of or are for convenience of supplier, subcontractor or Contractor.
 - 9. Acknowledge acceptance of these provisions.
- C. Supplier to sign substitution request in space provided on form acknowledging acceptance of terms.
- D. Contractor sign request in space provided on form acknowledging it's acceptance of terms.



1.5 APPROVAL OF SUBSTITUTION REQUEST

- A. No verbal or written approvals other than by Addenda will be valid.
 - 1. Addendum listing approved substitutions will be published prior to Bid date.

1.6 REJECTION OF SUBSTITUTION REQUESTS

- A. Substitutions may not be considered if:
 - 1. Submitted after stipulated date or time period.
 - 2. Not submitted in accord with this Section.
 - 3. Acceptance will require substantial revision of Contract Documents, building or system.
 - 4. Substitution request does not indicate specific item for which request is submitted.
 - 5. Substitution Request form is not properly executed and signed.
 - 6. Substitution request for manufacturer acceptance only.
 - 7. Insufficient information submitted.
 - 8. Substitution color or pattern wise does not comply with base specified item.
 - 9. Substitution does not appear to comply with requirements of specifications for base item.

END OF SECTION

SUBSTITUTION REQUEST

PROJECT: **Logan Regional Hospital – PET/CT**

PROJECT NUMBER: 10394230

TO: Office of Architect:

HDR Architecture, P.C.

201 California, Suite 1500

San Francisco, CA 94111

Attention: Ben Hickman (Project Manager), Dave Beardsley (CA Architect)

SPECIFIED PRODUCT:

Substitution request for: _____

Specification Section number: _____

Article(s)/paragraph(s): _____

REASON FOR SUBSTITUTION REQUEST:

- | | |
|--|---|
| <input type="checkbox"/> Fails to comply with building code requirements | <input type="checkbox"/> Not available |
| <input type="checkbox"/> Unavailable to meet Project schedule | <input type="checkbox"/> Reduce Project construction time |
| <input type="checkbox"/> No qualified installer for specified item | <input type="checkbox"/> Project cost savings |
| <input type="checkbox"/> Supplier refuses to warrant item or installation | <input type="checkbox"/> Unsuitable for application |
| <input type="checkbox"/> Supplier, Subcontractor or Contractor convenience | <input type="checkbox"/> Constructability issue |
| <input type="checkbox"/> Other: | |

Explanation in Detail: ☐ See attached: _____

SUPPORTING DATA:

Attach product description, specifications, drawings, photographs, performance data, test data, environmental criteria, and any additional data or information for evaluation of the proposed substitution in accord with requirements of Section 00 26 00.

Sample is included: Yes ☐ No ☐

Sample will be sent if requested: Yes ☐ No ☐

Maintenance Service Available: Yes ☐ No ☐

If yes, location: _____

Spare Parts Source: _____



Provide a one-to-one comparison of proposed substitution with ALL specified attributes and qualities of specified item(s)

Intermountain[™] Healthcare

REFERENCES:

LIST MINIMUM OF FIVE PREVIOUS INSTALLATIONS, WHICH PROPOSED PRODUCT HAS BEEN INSTALLED FOR AT LEAST FOUR YEARS:

Project: _____
Address: _____
Architect (name & phone): _____
Owner (name & phone): _____
Contractor: _____
Date Installed: _____
Dollar Value this Work: \$ _____

Project: _____
Address: _____
Architect (name & phone): _____
Owner (name & phone): _____
Contractor: _____
Date Installed: _____
Dollar Value this Work: \$ _____

Project: _____
Address: _____
Architect (name & phone): _____
Owner (name & phone): _____
Contractor: _____
Date Installed: _____
Dollar Value this Work: \$ _____

Project: _____
Address: _____
Architect (name & phone): _____
Owner (name & phone): _____
Contractor: _____
Date Installed: _____
Dollar Value this Work: \$ _____

Project: _____
Address: _____
Architect (name & phone): _____
Owner (name & phone): _____
Contractor: _____
Date Installed: _____
Dollar Value this Work: \$ _____

Project: _____
Address: _____
Architect (name & phone): _____
Owner (name & phone): _____
Contractor: _____
Date Installed: _____
Dollar Value this Work: \$ _____



EFFECT OF SUBSTITUTION:

Substitution affects other parts of Work: No ☐ Yes ☐ (If yes, explain below)
Substitution requires dimensional revision or redesign of structure or mechanical and electrical Work: No ☐ Yes ☐ (If yes, explain below)
Same warranty provided as specified base product: No ☐ Yes ☐ (If no, explain below)
Explanation: _____

Cost difference: \$ _____ (add / deduct).
Total cost implications of substitution on Project: \$ _____ (add / deduct).
Total time implications: \$ _____ (add / deduct) calendar days.

STATEMENT OF CONFORMANCE OF REQUEST TO CONTRACT REQUIREMENTS:

Supplier, Subcontractor and Contractor in making substitution request or in using an approved substitution represent:

- ☐ Has personally investigated the proposed substitution and determined it is equal or superior in all respects to specified product or system and will perform intended function, except as stated above.
- ☐ Is in full compliance with applicable code requirements.
- ☐ Will provide same warranty for substitute item as for product, system or method specified.
- ☐ Will coordinate installation of accepted substitution into Work, to include building modifications if necessary, making such changes as may be required for Work to be complete in all respects.
- ☐ Waive all claims for additional costs or time extensions related to substitution that subsequently become apparent or are caused by substitution.
- ☐ If a finish product, color wise and pattern wise complies with base specified items.
- ☐ Certifies cost data presented is complete and includes all related costs under this Contract, excluding Architect's review and redesign cost.
- ☐ Will pay Architect's review and redesign cost, special inspections, and other costs caused by substitution.
- ☐ Will pay additional costs to other contractors caused by substitution.
- ☐ Will modify other parts of Work as may be needed, to make all parts of Work complete and functioning.
- ☐ Acknowledge acceptance of these provisions.

List of Attachments: _____**ACKNOWLEDGEMENTS:**

FOLLOWING FIRM HEREBY REQUESTS CONSIDERATION OF FOLLOWING PRODUCT OR SYSTEMS AS A SUBSTITUTION IN ACCORD WITH PROVISIONS OF CONTRACT DOCUMENTS:

Supplier/Vender: _____
Acknowledged by (print & sign): _____ Date: _____
Position: _____ Phone: _____

Subcontractor: _____
Acknowledged by (print & sign): _____ Date: _____
Position: _____ Phone: _____

Contractor: _____
Acknowledged by (print & sign): _____ Date: _____
Position: _____ Phone: _____



END OF SUBSTITUTION REQUEST

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SECTION 00 62 76.13

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.



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SECTION 00 70 00

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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DIVISION 01

GENERAL REQUIREMENTS



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SECTION 01 10 00
SUMMARY OF WORK

PART 1 - - GENERAL

1.1 SUMMARY

- A. Requirements of Division 0 - Procurement and Contracting Requirements and Division 1 - General Requirements apply to every section contained in the Project Manual, and shall govern the execution of Work required by the Contract Documents.
- B. Provide everything necessary for and incidental to proper and satisfactory completion of all Work specified and indicated or shown in the Contract Documents.

1.2 PROJECT LOCATION

- A. Project Site: Logan Regional Hospital 500E 1400N Logan, UT 84341

1.3 SEPARATE CONTRACTS

- A. Owner will enter into multiple contracts for construction. Each contractor shall be responsible to coordinate efforts with other trade contractors to ensure timely completion of the work.
- B. Coordinate the Work of this contract with the work of separate contractors to ensure timely completion of the work.

1.4 PURCHASE CONTRACTS

- A. General: Owner has negotiated purchase contracts with suppliers of material and equipment to be incorporated into the Work. Owner will assign these purchase contracts to Contractor. Include costs for purchasing, receiving, handling, storage if required, and installation of material and equipment in the Contract Sum, unless otherwise indicated.
 - 1. Contractor's responsibilities are same as if Contractor had negotiated purchase contracts, including responsibility to renegotiate purchase and to execute final purchasing agreements.

1.5 CODES

- A. Law of place of building governs. Conform to applicable requirements of the latest editions of the International Building Code, International Building Code Standards, International Mechanical Code, International Plumbing Code, National Electrical Code, National Fire Protection Association requirements, local ordinances, and OSHA requirements applicable to this project, unless a higher standard is called for, without additional cost to the Owner.
- B. Comply with CABO/ANSI A117.1, American National Standard, "Accessible and Usable Buildings and Facilities" latest edition which is in force for the project location, for handicapped accessibility.
- C. Comply with Intermountain Healthcare Construction Standards, dated April 15, 2019

1.6 CONTRACTOR USE OF PREMISES

- A. General: During the construction period the Contractor shall have use of the premises for construction operations, including:
 - 1. The Contractor's use of the premises is limited only by the Owner's right to perform work or to retain other contractors on portions of the Project.



- B. Use of the Site: Limit use of the premises to work in areas indicated. Confine operations to areas within contract limits indicated. Do not disturb portions of the site beyond the areas in which the Work is indicated.
 - 1. Driveways and Entrances: Keep driveways and entrances serving the premises clear and available to the Owner and Owner's employees and emergency vehicles at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
 - 2. Do not unreasonably encumber the site with materials or equipment. Confine stockpiling of materials and location of storage sheds to the areas indicated. If additional storage is necessary obtain and pay for such storage off-site.
 - 3. Lock automotive type vehicles such as passenger cars and trucks and other types of mechanized and motorized construction equipment, when parked and unattended, so as to prevent unauthorized use. Do not leave such vehicles or equipment unattended with the motor running or the ignition key in place.

1.7 OWNER'S OCCUPANCY REQUIREMENTS

- A. Owner Access to Completed Areas of Construction: Owner reserves the right to place and install equipment in completed areas of building, before Substantial Completion, provided such placement does not interfere with completion of the Work. Such placement of equipment shall not constitute acceptance of the total Work.
 - 1. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of building.

1.8 WORK RESTRICTIONS

- A. On-Site Work Hours:
 - 1. Verify acceptable work hours with the authorities having jurisdiction.
- B. Existing Utility Interruptions: Not applicable

1.9 INCIDENTAL WORK

- A. Any work, materials or equipment that may reasonably be inferred from the Contract Documents as being required to produce the intended result shall be supplied by the Contractor at no additional cost to the owner whether or not specifically called for in the Contract Documents.

1.10 WORK BY OWNER

- A. Owner Furnished – Owner Installed (OFOI) products
- B. Refer to section 11 70 00 for additional owner furnished equipment.
- C. Roughing-in for Owner Furnished, Owner Installed Product is provided by applicable Sections governing the type of work. Obtain rough-in requirements from Owner.

1.11 OWNER FURNISHED PRODUCTS (NOT PURCHASED BY CONTRACTOR)

- A. Owner Furnished – Contractor Installed (OFCI) products
- B. Provide labor, transportation, materials, tools, appliances and utilities necessary for the following:
 - 1. Relocated Products:
 - a. Removing installed product from the Owner's existing facility, as required.
 - b. Transportation of product from Owner's facility to the job site.
 - 2. Receiving and storage of Owner furnished, Contractor installed product, as required.
 - 3. Providing materials and components for the product as necessary to install in an operating condition, but not including repairing of existing damages to the product.
 - 4. Modification of product only as specified under the particular item.



5. Installation of product in this project, complete and in operating condition, including the adjusting and calibration of the product as necessary for proper operation.
6. Testing of product.
7. Paying of fees, licenses, and taxes in conjunction with the installation of the product.
8. Roughing-in and final utility connections for the Owner furnished, Contractor installed product remains the work of Sections governing the specific utility.

1.12 PROJECT ENVIRONMENTAL GOALS

1.13 INTERMOUNTAIN INSURANCE REVIEW OF SUBMITTALS

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01 14 16
COORDINATION WITH OCCUPANTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Contractor use of site and premises.
- B. Working days and hours
- C. Directed premium time
- D. Future work.
- E. Work sequence.
- F. Owner occupancy.
- G. Disruption of existing services.

1.2 CONTRACTOR USE OF SITE AND PREMISES

- A. Limit operations and use of site to "Limits of Construction," and as required to perform Work.
- B. Secure written approval of Owner to disturb portions of site beyond area of required Work.
 - 1. Obtain written approval from Owner at least seven (7) calendar days in advance when scheduling Work outside limits of construction.
 - 2. Provide Owner an estimate of time needed to perform Work outside limits of construction.
 - 3. Cutting, capping, and reconnecting utility systems outside limits of construction shall be performed by Contractor, unless otherwise noted.
 - 4. Conform to laws, ordinances, permits and regulations affecting Work on site.
 - 5. Maintain existing roads, streets, drives, parking lots, entrances and required fire exit ways clear and available at all times for their intended use.
 - a. Do not use these areas for parking, staging or storage without Owner's written approval.
 - b. Coordinate with Owner, and provide alternate routes for public and Owner access if normal routes are affected.
 - 6. Do not encumber site with equipment, materials or vehicles.
 - 7. Return improvements on, or about, site and adjacent property which are not shown to be altered, removed or otherwise changed; to conditions which existed previous to starting performance under Contract.
- C. Use of Facilities:
 - 1. Limit use and operation within existing facilities to areas indicated for construction Work and as required to perform Work.
 - 2. Areas within facility shall not be disturbed or disrupted.
 - 3. Do not to interfere or inconvenience public, staff and Owner's operation.
 - 4. Maintain and keep clear required fire exit ways throughout facility within and in vicinity of construction areas.
 - 5. Coordinate alternate temporary egress routes with Owner and Local Fire Authority.
 - 6. Do not load structure with weights that will endanger structure.
 - 7. Smoking is prohibited within facilities and on Owner's property.
 - 8. Audio devices and radios are prohibited, except two-way radios needed for Contractor's operations.
 - 9. Limit use of two-way radios within occupied facilities, so not to disrupt occupants.



10. Use of toilet facilities, washrooms, and telephones within existing facility or occupied areas is not allowed without Owner's written approval.
11. Elevators in existing facility or within occupied areas of addition may not be used by construction personnel without Owner's written approval and such use shall meet following conditions:
 - a. Protect and maintain system and finishes during use.
 - b. Repair or replace damaged components of system and finishes.
 - c. Clean finishes.
12. Cafeteria and dining areas may not be used by construction personnel without Owner's consent.
13. Clothing with derogatory depictions, language, or slogans which are racial or sexual in nature, shall not be worn on premises.
14. Clothing with depictions, language, or slogans regarding alcohol or drugs shall not be worn on premises.
15. Derogatory language or graphic display of artifacts which are racial, sexual or religious in nature, shall not be used on premises.
16. Coordinate construction operations to assure that operations are carried out with consideration given to conservation of energy, water, and materials.
17. Maintain existing building in weather tight condition throughout construction period.
18. Repair damage and leaks caused by construction operations.
19. Protect building and its occupants during construction period.
20. Keep noise to a minimum in construction operation and employ reasonable noise control measures during operations.
21. Jack hammers and other impact and loud noise-generating equipment will not be permitted within existing building without Owner's consent.

D. Limit Use of Site and Premises to Allow:

1. Owner occupancy.
2. Work by Others.
3. Use of site and premises by public.

1.3 WORKING DAYS AND HOURS

- A. Days: Monday-Friday
- B. Normal Working Hours per Owner Requirements
- C. Work producing noise and vibration to be done after hours as approved by Owner.
- D. Work performed during Holidays or other than normal working days or hours shall be scheduled in advance with, and approved by Owner.

1.4 DIRECTED PREMIUM TIME

- A. Actual premium wages paid for original contract Work directed by Owner to be performed other than normal working hours, including; social security taxes, unemployment insurance, and union fringe benefits if required by union agreements; to be without overhead and profit mark-ups.
 1. Owner approved scheduled utility line tie-in or shutdown affecting building operation that is not allowed to be completed during normal working hours shall be completed on premium time basis.

1.5 WORK SEQUENCE

- A. Coordinate operations and construct Work in per phasing drawings accommodate Owner's occupancy requirements.



1.6 OWNER OCCUPANCY

- A. Perform Work within existing building. Each Contractor will have access to areas in which work occurs, subject to rights of Owner.
- B. Owner will occupy existing building during life of this contract.
- C. Schedule work at such time and in such a manner to minimize interference and inconvenience to public, staff and Owner's operations.
- D. Obtain approval of Owner prior to commencement of work within existing area of building.
- E. Area immediately surrounding areas of Work shall be protected from danger of materials being dropped or dislodged.
- F. Carry out Work in a manner that does not impose hardship, danger, or inconvenience to public or staff.
- G. Prior to commencement of Work, Contractor and Owner shall jointly survey construction site and surrounding areas, making permanent record of such existing damage as cracks, malfunctioning utility equipment and fixtures, or other similar damage.
 - 1. This record shall serve as a basis for determination of subsequent damage to these structures and adjacent areas due to Contractor's operations.
- H. Report damage to structures and adjacent areas not noted in original survey to Owner.
- I. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.
- J. Schedule work to accommodate this requirement.

1.7 DISRUPTION OF EXISTING SERVICES

- A. Plan Work to minimize shutdown time of service.
 - 1. Request approval of a utility or equipment shutdown in writing to Owner not less than seven working days before time shutdown is desired.
 - 2. Provide Owner an estimate of duration of shutdown and how facility is going to be affected.
 - 3. Coordinate with Owner's building engineering staff in advance of shut down.
 - 4. Begin work only after engineering staff is fully informed and has agreed to schedule of shut offs.
 - 5. Do not cut into existing services without first verifying with Owner that service has been correctly identified and shut off.
 - 6. Operation of existing valves, switches, etc., to affect service shutdown will be completed by Owner, unless arranged otherwise.
- B. Limit duration of disruptions of service to maximum of 4 HRS or as approved by Owner.
- C. Fabricate and install interconnecting portions of these systems prior to shut down for final connections.
- D. Maintain utilities or other service, indicated to be abandoned, in service or provide alternate means of service until new facilities are provided, tested, and put in operation.
- E. Maintain fire protection and fire alarm systems operational within existing facilities.
- F. Review existing conditions, drawings and other documents for proper coordination between new and existing construction.
- G. Active utilities whose locations are unknown to Owner but suspected to exist.
 - 1. Exercise caution of their existence. If encountered report to Owner for direction.
- H. Repair or replace to original conditions damage to existing structures, utilities and other items caused by Contractor's operations at Contractor's expense.



END OF SECTION

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SECTION 01 23 00 ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section identifies each Alternate by number and describes basic changes to be incorporated into Work, only when that Alternate is made a part of Work by specific provisions in Construction Contract.
- B. Section includes only nontechnical descriptions of Alternates.
- C. Refer to specific Sections of Specifications and Drawings for technical description of Alternates.
- D. Coordinate related Work, and modify surrounding Work as required to properly integrate Work under each Alternate and to provide complete construction required by Contract Documents.

1.2 DESCRIPTION

- A. Work includes:
 - 1. Indicate Alternate prices on Bid Form.
 - 2. Alternates will be selected after bids are evaluated.
 - 3. Selected Alternates will be made a part of Contract and final Contract Amount will be adjusted accordingly.

1.3 ALTERNATES:

- A. Alternates are listed on the Bid Form. Refer to section 00 40 00.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

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SECTION 01 25 13
SUBSTITUTION PROCEDURES AFTER EXECUTION OF CONTRACT

PART 1 - GENERAL

- A. Acceptable Manufacturers and Products: See Section 01 61 00.
- B. Any product proposed by Contractor that does not meet requirements of the Contract Documents, whether in product characteristics, performance, quality, or manufacturer or brand names, is considered a substitution.
- C. This Section includes administrative and procedural requirements for handling substitutions requests made after execution of Contract.
- D. Substitutions will be considered for cost, schedule, or constructability impact:
 - 1. In case of non-availability of materials, contact Architect for review and action.
 - 2. Accepted substitutions may require re-bidding by prior approved bidders.

1.2 SUBSTITUTION AFTER EXECUTION OF CONTRACT

- A. Whether or not product specified is "Optional" or followed by the words "or equal," or if Contractor desires to use any product other than that specified as "Base," Contractor shall request substitution within 35 days after date of execution of Contract.
- B. If substitution request occurs after 35-day period, substitution may be reviewed at discretion of Owner and Architect; and cost of such review and initiation of a change document shall be borne by Contractor, and deducted from Contract Sum.
- C. All costs including Architect cost will be responsibility of Contractor for substitutions or revisions made necessary by acts or omissions of Contractor, requested due to product submittal or product not being ordered in a timely manor, requested due to ease of construction progress or Work, or requests which are in interest of or for convenience of supplier, subcontractor or Contractor.

1.3 PRODUCT SELECTION - GENERAL

- A. Listing of a manufacturer implies acceptance of them only as supplier of a product that complies with specified item.
 - 1. See Section 01 61 00 for definition of "Base" and "Optional" manufacturers.

1.4 SUBSTITUTION REQUESTS

- A. Only written requests with complete data for evaluation will be considered.
 - 1. Submit evaluation data with attached form to Architect.
 - 2. Submit in timely manner to allow Architect adequate time for evaluating, making recommendation, and for Owner approval.
- B. Supplier, Subcontractor and Contractor in making substitution request, or in using an approved substitution, represent:
 - 1. has personally investigated proposed product, system or method, and has determined that it is equal or superior in all respects to that specified, and that it will perform intended function;
 - 2. is in full compliance with applicable code;
 - 3. will provide same warranty for substitute item as for product, system or method specified;
 - 4. if a finish product, complies color wise and pattern wise with base specified items;



5. will coordinate installation of accepted substitution into Work, to include building modifications if necessary, and be responsible for such modifications as may be required for Work to be complete and functional in all respects;
 6. certifies cost data presented is complete and includes all related costs, excluding Architect's review and redesign cost;
 7. waive all claims for additional costs or time extensions related to substitution which subsequently become apparent or are caused by substitution;
 8. will pay additional costs to other trades, subcontractors or contracts caused by substitution;
 9. will pay all Architect's review and redesign cost, special inspections, and other costs caused by substitutions or revisions made necessary by the acts or omissions of Contractor, due to product submittal or product not being ordered in a timely manner, due to ease of construction progress or Work, or which are in interest of or are for convenience of supplier, subcontractor or Contractor;
 10. responsibility of Contractor for substitutions or revisions made necessary by the acts or omissions of Contractor, requested due to product submittal or product not being ordered in a timely manor, requested to ease construction progress or Work, or which are in interest of or requests for convenience of supplier, subcontractor or Contractor;
 11. acknowledge acceptance of these provisions.
- C. Contractor sign Substitution Request in space provided on form acknowledging acceptance of terms.

1.5 SUBSTITUTION DATA

- A. Submit complete data substantiating compliance of proposed substitution with Contract Documents.
- B. For products and systems:
1. Product identification, including manufacturer's name.
 2. Manufacturer's literature, marked to indicate specific model, type, size, and options to be considered:
 - a. Product description.
 - b. Performance and test data.
 - c. Reference standards.
 - d. Difference in power demand, air quantities, etc.
 - e. Dimensional differences from specified unit.
 3. Samples:
 - a. Architect reserves right to retain sample until physical units are installed on project for comparison purposes.
 - b. Requester pay all costs of furnishing and return of samples.
 4. Name and address of at least five similar projects that proposed product has been in use for at least four years, and name and phone number of owner's and architect's or engineer's representative, which Owner or Architect can contact to discuss; product, installation, and field performance data.
- C. For construction methods:
1. Detailed description of proposed system or method.
 2. Illustrate with drawings.
- D. Itemized comparison of proposed substitute to specified item; indicate variations.
- E. Warranty comparison with specified product or system.
- F. Effect and changes required on other trades, subcontractors or contracts.
- G. Data relating to change in construction time.



- H. Complete breakdown of costs, of proposed substitution that shall include additional costs or saving generated by proposed substitution and shall indicate amount, if any, to be deducted from Contract Sum if proposed substitution is accepted.
- I. Include life cycle cost savings by product, system or assembly proposed, if applicable.
- J. Availability of maintenance and repair services, and sources of repair or replacement items.

1.6 APPROVAL OF SUBSTITUTION REQUEST

- A. For substitutions which have no cost or time impacts, no verbal or written approvals other than by Owner's signed approval on attached Substitution Request form.
- B. For substitutions which have cost or time impacts, no verbal or written approvals other than by Owner's signed approval of a Change Order.

1.7 REJECTION OF SUBSTITUTION REQUEST

- A. Substitution may not be considered if:
 - 1. Submitted after stipulated time period.
 - 2. Not submitted in accord with this section.
 - 3. Acceptance will require substantial revision of Contract Documents, building or systems.
 - 4. Substitution request does not indicate specific item for which request is submitted.
 - 5. Substitution Request form is not properly executed and signed.
 - 6. Substitution request for manufacturer acceptance only.
 - 7. Subcontractor or supplier requested directly.
 - 8. Insufficient information submitted.
 - 9. Substitution color wise or pattern wise does not comply with base specified item.
 - 10. Substitution does not appear to comply with requirements of specifications for base product.
 - 11. Owner or Architect does not want to consider.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION



SUBSTITUTION REQUEST

PROJECT: Logan Regional Hospital Reconfiguration Project

PROJECT NUMBER: 10173823

REQUEST NO.:

TO: Office of the Architect:

HDR Architecture, P.C.
201 California Street, Suite 1500
San Francisco, CA 94111
Attention: Ben Hickman

SPECIFIED PRODUCT:

Substitution request for:

Specification Section
number:

Article(s)/paragraph(s):

REASON FOR SUBSTITUTION: Non-availability due to:

- | | |
|--|---|
| <input type="checkbox"/> Strike | |
| <input type="checkbox"/> Lockout | |
| <input type="checkbox"/> Bankruptcy | |
| <input type="checkbox"/> Discontinuation of Production | |
| <input type="checkbox"/> Proven Shortage | |
| (Explain) | |
| <input type="checkbox"/> Similar Occurrence | |
| (Explain) | |
| <input type="checkbox"/> Fails to comply with building code requirements | <input type="checkbox"/> Not available |
| <input type="checkbox"/> Unavailable to meet Project schedule | <input type="checkbox"/> Reduce Project construction time |
| <input type="checkbox"/> No qualified installer for specified item | <input type="checkbox"/> Project cost savings |
| <input type="checkbox"/> Supplier refuses to warrant item or installation | <input type="checkbox"/> Unsuitable for application |
| <input type="checkbox"/> Supplier, Subcontractor or Contractor convenience | <input type="checkbox"/> Constructability issue |
| <input type="checkbox"/> Other: | |

Explanation in
Detail:

☐ See
attached:



HDR Project No. 10394230

Intermountain Healthcare
Logan Regional Hospital Reconfiguration
LRH PET/CT

June 28, 2024
100% Construction Documents

SUBSTITUTION PROCEDURES AFTER EXECUTION OF CONTRACT
01 25 13 - 4

☐ See attached:

Attach product description, specifications, drawings, photographs, performance data, test data, environmental criteria, and any additional data or information for evaluation of the proposed substitution in accord with requirements of Section 01 25 13.

Ye ☐ No ☐

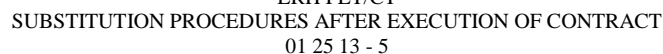
Ye ☐ No ☐

Ye ☐ No ☐
s

If yes, location: _____

Spare Parts Source: _____

Provide a one-to-one comparison of proposed substitution with ALL specified attributes and qualities of specified item(s)

[illegible]

REFERENCES:

LIST MINIMUM OF FIVE PREVIOUS INSTALLATIONS, WHICH PROPOSED PRODUCT HAS BEEN INSTALLED FOR AT LEAST FOUR YEARS:

Project: _____
Address: _____
Architect (name & phone): _____
Owner (name & phone): _____
Contractor: _____
Date Installed: _____
Dollar Value this Work: \$ _____

Project: _____
Address: _____
Architect (name & phone): _____
Owner (name & phone): _____
Contractor: _____
Date Installed: _____
Dollar Value this Work: \$ _____

Project: _____
Address: _____
Architect (name & phone): _____
Owner (name & phone): _____
Contractor: _____
Date Installed: _____
Dollar Value this Work: \$ _____

Project: _____
Address: _____
Architect (name & phone): _____
Owner (name & phone): _____
Contractor: _____
Date Installed: _____
Dollar Value this Work: \$ _____

Project: _____
Address: _____
Architect (name & phone): _____
Owner (name & phone): _____
Contractor: _____
Date Installed: _____
Dollar Value this Work: \$ _____

Project: _____
Address: _____
Architect (name & phone): _____
Owner (name & phone): _____
Contractor: _____
Date Installed: _____
Dollar Value this Work: \$ _____



EFFECT OF SUBSTITUTION:

Substitution affects other parts of Work: No ☐ Yes ☐ (If yes, explain below)

Substitution requires dimensional revision or redesign of structure or mechanical and electrical Work: No ☐ Yes ☐ (If yes, explain below)

Same warrantee provided as specified base product: No ☐ Yes ☐ (If no, explain below)

Explanation: _____

Cost difference: \$ _____ (add / deduct).
Total cost implications of substitution on Project: \$ _____ (add / deduct).
Total time implications: \$ _____ (add / deduct) calendar days.

STATEMENT OF CONFORMANCE OF REQUEST TO CONTRACT REQUIREMENTS:

Supplier, Subcontractor and Contractor in making substitution request or in using an approved substitution represent:

- ☐ Has personally investigated the proposed substitution and determined it is equal or superior in all respects to specified product or system and will perform intended function, except as stated above.
- ☐ Is in full compliance with applicable code requirements.
- ☐ Will provide same warranty for substitute item as for product, system or method specified.
- ☐ Will coordinate installation of accepted substitution into Work, to include building modifications if necessary, making such changes as may be required for Work to be complete in all respects.
- ☐ Waive all claims for additional costs or time extensions related to substitution that subsequently become apparent or are caused by substitution.
- ☐ If a finish product, color wise and pattern wise complies with base specified items.
- ☐ Certifies cost data presented is complete and includes all related costs under this Contract, excluding Architect's review and redesign cost.
- ☐ Will pay Architect's review and redesign cost, special inspections, and other costs caused by substitution.
- ☐ Will pay additional costs to other contractors caused by substitution.
- ☐ Will modify other parts of Work as may be needed, to make all parts of Work complete and functioning.
- ☐ Acknowledge acceptance of these provisions.

List of Attachments: _____

ACKNOWLEDGEMENTS:

FOLLOWING FIRM HEREBY REQUESTS CONSIDERATION OF FOLLOWING PRODUCT OR SYSTEMS AS A SUBSTITUTION IN ACCORD WITH PROVISIONS OF CONTRACT DOCUMENTS:

Requested by (firm): _____

Acknowledged by (print & sign): _____ Date: _____

Position: _____ Phone: _____

Subcontractor: _____

Acknowledged by (print & sign): _____ Date: _____

Position: _____ Phone: _____

Contractor: _____

Acknowledged by (print & sign): _____ Date: _____



Position: _____ Phone _____

Distribution: ☐ Architect ☐ file

ARCHITECT'S ACTION / RECOMMENDATION:

- ☐ Recommend Owner's approval.
- ☐ Submitted to Owner for authorization for Architect's as Change in service to further evaluate and make recommendation.
- ☐ Do not recommend (see comments below).
- ☐ Rejected:
- ☐ Submitted after stipulated time period.
 - ☐ Not submitted in accordance with Section 01 25 13.
 - ☐ Acceptance will require substantial revision of Contract Documents, building or systems.
 - ☐ Request does not indicate specific item which is being requested.
 - ☐ Requested for manufacturer acceptance only.
 - ☐ Request form is not properly executed and signed.
 - ☐ Subcontractor or supplier requested directly.
 - ☐ Insufficient information submitted.
 - ☐ Does not comply color wise or pattern wise with base specified items.
 - ☐ Insufficient information submitted to evaluate.
 - ☐ Does not appear to comply with requirements of specifications for base product.
 - ☐ Other:
- ☐ Additional information needed - Returned to CM/Contractor for providing following:

Comments: _____

Architect: _____
By (print & sign): _____ Date: _____
Position: _____
Distribution: ☐ Owner ☐ CM/Contractor ☐ file

OWNER ACTION:

- ☐ Reject - Do not want to consider.
- ☐ Approved - Contractor may proceed with request as submitted.
- ☐ Approved – Architect directed as Change in Services to issue change document to incorporate substitution into contract Documents, adjust Contract Sum and/or Project time.
- ☐ Architect authorized as Change in Services to further evaluate and make recommendation.
- ☐ Additional information needed - Returned for providing following:

Comments: _____

Owner: _____
By: (print & sign) _____ Date: _____
Position: _____
Distribution: ☐ Architect ☐ CM/Contractor

ARCHITECT FURTHER ACTION / RECOMMENDATION (if needed):

- ☐ Incorporating into change document _____ as directed by Owner.



- ☐ Recommend Owner's approval.
☐ Do not recommend.

Comments: _____

Architect: _____
By: (print & sign) _____ Date: _____
Position: _____
Distribution: ☐ Owner ☐ CM/Contractor ☐ file

OWNER FURTHER ACTION (if needed):

- ☐ Reject - Do not want to consider.
☐ Approved - Contractor may proceed with request as submitted.
☐ Approved – Architect directed as Change in Services to issue change document to incorporate substitution into contract Documents, adjust Contract Sum and/or Project time.
☐ Additional information needed - Returned for providing following:

Comments: _____

Owner: _____
By: (print & sign) _____ Date: _____
Position: _____
Distribution: ☐ Architect ☐ CM/Contractor ☐ file



SECTION 01 26 00

CONTRACT MODIFICATION 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 specifies administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Sections include the following:
 - 1. Section 01 60 00 "Product Requirements" for administrative procedures for handling requests for substitutions made after Contract award.

1.3 MINOR CHANGES IN THE WORK

- A. Architect will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on forms issued by the Architect or the Owner.

1.4 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Proposal Requests issued by Architect are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
 - 2. Within time specified in Proposal Request after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
- B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change to the Architect.
 - 1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
 - 2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - 3. Indicate, delivery charges, equipment rental, and amounts of trade discounts.



4. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
5. Comply with requirements in Division 1 Section "Product Requirements" if the proposed change requires substitution of one product or system for product or system specified.

C. Proposal Request Form: Use forms issued by the Architect or the Owner.

1.5 CHANGE ORDER PROCEDURES

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

1.6 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PART 2 – PRODUCTS - NOT USED

PART 3 - PART 3 – EXECUTION - NOT USED

END OF SECTION



SECTION 01 26 13

REQUESTS FOR INFORMATION (RFI)

PART 1 - GENERAL

1.1 SUMMARY

- A. Section specifies administrative and procedural requirements for handling and processing Requests for Information (RFI).
- B. RFI is intended for requesting clarifications and interpretations of Contract Documents due to apparent inconsistencies, errors or omissions in Contract Documents, and due to unanticipated existing conditions.
- C. RFI is not intended for general communication, requesting substitutions, Contractor's proposed changes, resolution of nonconforming work, coordination between contractors or for general questions not related to Contract Documents.
- D. RFI process is intended to be a cooperative effort between Architect and Contractor to expedite responses to RFIs and maintain progress of Work without utilizing other lengthy procedures.
- E. Any other proposed method of processing RFI's other than indicated within this Section shall be evaluated by Architect for potential impact on Architect's services.
 - 1. If Architect agrees to utilize another proposed method, Architect will be reimbursed for any special training, usage fees, extra time required to implement, maintain, utilize and administer such a system.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 REQUESTS FOR INFORMATION

- A. Review of Contract Documents and Field Conditions:
 - 1. Since contract Documents are complementary; before starting each portion of Work, Contractor shall carefully study and compare various Drawings, Specifications and other Contract Documents, coordination drawings, shop drawings, prior correspondence or documentation relative to that portion of Work, as well as information furnished by Owner.
 - 2. Contractor and Subcontractors shall evaluate and take field measurements of conditions related to that portion of Work and shall observe any conditions at site affecting it.
 - 3. These obligations are for purpose of facilitating coordination and construction by Contractor and are not for purpose of discovering errors, omissions, or inconsistencies in Contract Documents.
 - 4. Contractor and subcontractors acknowledge that all documents pertaining to Work has been examined, have examined character of site and any existing conditions, and are satisfied with nature of Work, and all other matters which can in any way affect Work.
 - 5. In event of inconsistency between portions of Contract Documents or within Contract Documents; provide better quality or greater quantity of Work, and comply with more stringent requirement, either or both in accordance with Architect's interpretation.
 - 6. Any errors, inconsistencies or omissions discovered in Contract Documents shall be reported promptly to Architect as a properly prepared and timely RFI.



7. Contractor and Subcontractors are not required to ascertain Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, and rules and regulations, unless they bear upon construction means, methods, techniques or safety and health precautions, but the Contractor shall promptly report to Architect any nonconformity discovered by or made known to Contractor as a RFI.
 8. If Contractor or Subcontractor fail to give such notice, and knowingly proceeds with Work affected by errors or omissions in Contract Documents, Contractor shall correct any such errors, inconsistencies, or omissions at no additional cost.
 9. Prior to the bid, Contractor shall review all existing facilities that are related to this contract and shall be familiar with all utility requirements and construction.
 - a. Existing facility documents may be available through the Owner for review.
 - b. Perform preliminary investigations as required to ascertain extent of Work.
 - c. Conditions which would be apparent by such investigation will not be allowed as cause for claims for extra costs.
- B. Contractor's and Subcontractor's Responsibilities:
1. When interpretation, clarification or explanation of portion of Construction Documents is needed by Contractor, Subcontractor, Vendor or Supplier, the request shall be processed through Contractor.
 - a. Review request for completeness, quality, proper referencing to drawing or specification section and reason submitted.
 - b. If request is not acceptable it shall be returned to submitter with comments regarding reason for being returned.
 - c. Make every attempt to validate, resolve or respond to RFI by thoroughly researching and reviewing Contract Documents and field conditions.
 - d. Respond to RFI accordingly if review of RFI discloses a response or is related to coordination of construction or other issue not related to Contract Documents.
 - e. If unable to respond to request, it shall be restated in clear, concise, correct, complete and easily understood manner, and rewritten if necessary, additional information included if necessary, and only then submitted to Architect for response.
 2. Request for interpretation, clarification or explanation of Contract Documents shall be submitted to Architect through Contractor.
 - a. List specific Contract Documents researched when seeking information being requested.
 - b. Reference all applicable Contract Drawings by sheet number, section, detail, room number, door number, etc., Specifications by section and paragraph number, and reference any other relevant documents.
 - c. The field titled "Regarding" on attached RFI form must be clear for future reference in reports or correspondence.
 - d. Clearly state request and provide Contract Document references and any additional information needed so request can be fully understood, including sketches, photos or other reference material.
 - e. Fully assess issues, suggest any reasonable solutions and include various factors, including potential costs, schedule impacts, if any, and recommendations which will aid in determining a solution or response. If a reasonable solution can not be suggested, a statement to that effect should be so stated.
 - f. Indicate reason request is being submitted.
 - g. Any critical RFI's requiring a rapid response shall clearly indicate such with an explanation as to why RFI is critical.
 - h. Priority for responses shall be indicated when multiple RFI's are submitted within short period of time.
 3. Copies of responses to RFI's shall be distributed to all parties affected.



4. A response to RFI shall not be considered a notice to proceed with a change that may revise the Contract Sum or Contract Time, unless authorized by Owner in writing.
 5. If response to RFI is determined incomplete, it shall be resubmitted with reason response is unacceptable and any necessary additional information within five (5) days of time of receipt of response to RFI.
 6. If Contractor determines or believes that additional cost or time is involved because of clarifications, interpretations or instructions issued by Architect in response to a RFI, resubmit RFI within five (5) days of receipt of response with reason and alternate solution or suggestion for performing work at no additional cost. If no other solution is possible or desirable, submit Claim in accordance with the Contract Documents within twenty-one (21) days of receipt of response to the RFI.
- C. RFI Submittal Process:
1. RFI's shall be processed and submitted to Architect by Contractor utilizing established web based system (Submittal Exchange).
 - a. Electronic file of sketches, photos or other pertinent information may be uploaded with a RFI request in system to help clarify request.
 2. Submitted RFI's will be responded to by Architect.
 - a. Architect may upload electronic files with RFI response in system to help clarify response.
- D. RFI Submittal Format:
1. Request for information shall be submitted to Architect on Intermountain's RFI form.
 2. RFI form shall be electronically completed and submitted to the Architect's designated representative through the established web based system in Microsoft Word format.
 3. RFI's shall be assigned unique numbers in sequential order (1, 2, 3, 4, etc.).
 4. A resubmitted RFI or a previously answered RFI requiring revising or further clarification shall be submitted using original RFI number preceded by ".1" to indicate revision one of RFI (i.e.: RFI No. 34.1 for revision 1 to RFI No. 34).
- E. Architect's Response to Request for Information (RFI):
1. Clarifications, interpretations and decisions of Architect in response to RFI will be consistent with intent of and reasonably inferable from Contract Documents, and will be in writing, and if determined to be necessary by Architect, will be provided in form of drawings and other attachments or both.
 2. When making such interpretations and decisions, Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either and will not be liable for results of interpretations or decisions so rendered in good faith.
 3. Architect's decisions on matters related to aesthetic effects will be final if consistent with intent expressed in Contract Documents.
 4. Architect will not undertake to settle differences between Contractor, Subcontractors, trades suppliers, fabricator or manufacturer, or act as arbiter as to which Subcontractor, trade, supplier or manufacturer is to furnish or install various items indicated or required.
 5. Architect shall provide responses to RFI's with reasonable promptness, but will endeavor to respond within twenty-one (21) days from date of receipt.
 - a. If multiple RFI's are submitted on same day or within a five (5) day period, review time may be extended by mutual agreement of parties.
 - b. Architect will provide a written response to RFI if Architect believes response only involves an interpretation, clarification, supplemental information or orders a minor change in Work not involving an adjustment in Contract Sum or extension of Contract Time, and is not inconsistent with intent of Contract Documents, and shall be binding.
 - c. If Architect believes response may result in a change to Contract Sum or Contract Time, response will indicate that a change document will be issued for the response,



and appropriate change document will be issued indicating changes to Contract Documents.

- d. Architect will provide any additional or supplemental drawings, specifications or other information as Architect may deem necessary to facilitate response.
- 6. Architect may return RFI without response for following reasons:
 - a. Request is unclear or incomplete.
 - b. Detailed information not provided.
 - c. Is related to construction means, methods or techniques.
 - d. Is related to health or safety measures.
 - e. Is due to Contractor's lack of adequate coordination.
 - f. Is for coordination between Subcontractors.
 - g. Is considered a "Substitution Request."
 - h. Is considered a "Contractor Proposed Change".
 - i. Is due to non-conformance.
 - j. Response is required by another party.
- F. If requested information is available from careful study and comparison of Contract Documents, field conditions, other Owner-provided information, coordination drawings, or prior Project correspondence or documentation, Architect may invoice Owner as a change in services for costs involved in Architect's review, analysis, responding and processing of such RFI.
 - 1. Contractor shall reimburse Owner for such costs.
- G. Contractor and Subcontractors may anticipate receiving clarifications, interpretations, orders for Minor Changes in Work or responses to valid requests for interpretations or clarifications of Contract Documents.

END OF SECTION

SECTION 01 29 00

PAYMENT 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 specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Sections include the following:
 - 1. Division 1 Section "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.

1.3 DEFINITIONS

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

1.4 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.
 - 1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:
 - q. Application for Payment forms with Continuation Sheets.
 - b. Submittals Schedule.
 - c. Accepted Alternates.
 - 2. Submit the Schedule of Values to Architect at earliest possible date but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
 - 3. Sub-schedules: Where the Work is separated into phases requiring separately phased payments, provide sub-schedules showing values correlated with each phase of payment.
- B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section.
 - 1. Identification: Include the following Project identification on the Schedule of Values:
 - a. Project name and location.
 - b. Name of Architect.



- c. Architect's project number.
 - d. Contractor's name and address.
 - e. Date of submittal.
2. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or Division.
 - b. Description of the Work.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.
 - f. Change Orders (numbers) that affect value.
 - g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
 1. Labor
 2. Materials
 3. Equipment
3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate.
4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
5. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
 - a. Differentiate between items stored on-site and items stored off-site. Include evidence of insurance or bonded warehousing if required.
6. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
7. Allowances (If Applicable): Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances (if applicable), as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
8. Alternates (If Applicable): Provide a separate line item in the schedule of values for each accepted alternate.
9. Change Orders: Provide a separate line item in the schedule of values for each change order.
10. Purchase Contracts: When applicable, provide a separate line item in the schedule of values for each purchase contract. Show line-item value of purchase contract. Indicate owner payments or deposits, if any, and balance to be paid by Contractor.
11. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
 - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at Contractor's option.
12. Schedule Updating: Update and resubmit the Schedule of Values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.



1.5 APPLICATIONS FOR PAYMENT

- A. General: Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
 - 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.
- C. Payment Application Forms: Use AIA Document G702 and AIA Document G703 Continuation Sheets as form for Applications for Payment.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
 - 1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
 - 2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- E. Stored Materials: If accepted by Owner, include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
 - 1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
 - 2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
 - 3. Provide summary documentation for stored materials indicating the following:
 - a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
 - b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
 - c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.
- F. Transmittal: Submit 3 signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments.
 - 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
 - 1. Submit partial waivers on each item for amount requested, before deduction for retainage, on each item.
 - 2. When an application shows completion of an item, submit final or full waivers.



3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 4. Waiver Delays: Submit each Application for Payment with Contractor's waiver of mechanic's lien for construction period covered by the application.
 - a. Submit final Application for Payment with or preceded by final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
 5. **Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner.**
- H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
 2. Schedule of Values.
 3. Contractor's Construction Schedule (preliminary if not final).
 4. Products list.
 5. Schedule of unit prices.
 6. Submittals Schedule (preliminary if not final).
 7. List of Contractor's staff assignments.
 8. List of Contractor's principal consultants.
 9. Copies of building permits.
 10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 11. Initial progress report.
 12. Report of preconstruction conference.
 13. Certificates of insurance and insurance policies.
 14. Performance and payment bonds.
 15. Data needed to acquire Owner's insurance.
 16. Initial settlement survey and damage report if required.
- H. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete, including commissioning and a statement showing an accounting of changes to the Contract Sum.
 2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- I. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements, including completion of commissioning.
 2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 3. Updated final statement, accounting for final changes to the Contract Sum.
 4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
 5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
 6. AIA Document G707, "Consent of Surety to Final Payment."
 7. Evidence that claims have been settled.
 8. Final meter readings for utilities, a measured record of stored fuel, and similar



- data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
9. Final, liquidated damages settlement statement.

PART 2 – PRODUCTS - NOT USED

PART 3 – EXECUTION - NOT USED

END OF SECTION

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SECTION 01 31 00

PROJECT MANAGEMENT AND COORDINATION

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 provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. General project coordination procedures.
 - 2. Conservation.
 - 3. Coordination Drawings.
 - 4. File Transfer.
 - 5. Administrative and supervisory personnel.
 - 6. Project meetings.
- B. Each contractor shall participate in coordination requirements. Certain areas of responsibility will be assigned to a specific contractor.
- C. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Section 01 73 00 "Execution Requirements" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
 - 2. Section 01 77 00 "Closeout Procedures" for coordinating Contract closeout.

1.3 COORDINATION

- A. Coordination: Coordinate construction operations included in various Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, which depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - 2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Memoranda: If necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
 - 1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.



- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Contractor's Construction Schedule.
 2. Preparation of the Schedule of Values.
 3. Installation and removal of temporary facilities and controls.
 4. Delivery and processing of submittals.
 5. Progress meetings.
 6. Preinstallation conferences.
 7. Project closeout activities.
 8. Startup and adjustment of systems
- D. Administrative Requirements: Contractor shall submit all project related information (i.e. submittals, RFI's, ASI's, addenda, construction documents, project logs, field reports, and meeting minutes) using the Architect's File Transfer Site. Architect will provide access information to the Contractor at the pre-construction meeting or as appropriate to the schedule of the project.
1. Contractor shall employ a PDF review software system such as Blue Beam (www.bluebeam.com) or another similar system for producing, formatting, and marking-up project related documents. Contractor shall review all the documents and add their stamp and comments directly to the PDF prior to posting for the Architect to review.
 2. Contractor shall provide to the Architect and Owner an electronic archive of all data at the end of the project via DVD(s) for final project records.
- E. Contractor is to keep a printed record of all Construction Documents including all clarifications, RFI's and approved changes to the Contract on site.
- F. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.
1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work.

1.4 SUBMITTALS

- A. Staff Names: Within 5 business days of starting construction operations, submit a list of principal staff assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.
1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone.
- B. Submittal Log: See section 'Submittals' for electronic delivery and record keeping.



1.5 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

- A. General: In addition to Project superintendent, provide other administrative and supervisory personnel as required for proper performance of the Work.
 - 1. Include special personnel required for coordination of operations with other contractors.
- B. Perform project quality control in accordance with requirements specified in Related Sections, including:
 - 1. Division 1 Section "Quality Control Services".

1.6 CONSTRUCTION PROGRESS DOCUMENTATION

- A. Progress Photographs:
 - 1. Photographically document site conditions prior to start of construction operations.
 - 2. Take weekly photographs throughout the entire project. Photographs shall be provided for unrestricted use by Owner.
 - a. Indicate photographs demonstrating environmental procedures.
 - 3. Submit minimum 20 photographs on CD, formatted to ISO 9660 with each application for payment. Organize photographs by date and description.

1.7 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.
 - 1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
 - 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 - 3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within 3 days of the meeting.
- B. Preconstruction Conference: Schedule a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.
 - 1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; manufacturers; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 2. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Tentative construction schedule.
 - b. Phasing.
 - c. Critical work sequencing.
 - d. Designation of responsible personnel.



- e. Procedures for processing field decisions and Change Orders.
 - f. Procedures for processing Applications for Payment.
 - g. Distribution of the Contract Documents.
 - h. Submittal procedures.
 - i. Preparation of Record Documents.
 - j. Use of the premises.
 - k. Responsibility for temporary facilities and controls.
 - l. Parking availability.
 - m. Office, work, and storage areas.
 - n. Equipment deliveries and priorities.
 - o. First aid.
 - p. Security.
 - q. Progress cleaning.
 - r. Working hours.
- C. Progress Meetings: Conduct progress meetings at weekly intervals. Coordinate dates of meetings with preparation of payment requests.
- 1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.
 - 4) Deliveries.
 - 5) Off-site fabrication.
 - 6) Access.
 - 7) Site utilization.
 - 8) Temporary facilities and controls.
 - 9) Work hours.
 - 10) Hazards and risks.
 - 11) Progress cleaning.
 - 12) Quality and work standards.
 - 13) Change Orders.
 - 14) Documentation of information for payment requests.
 - 3. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.
 - a. Schedule Updating: Revise Contractor's Construction Schedule after



each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

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SECTION 01 31 12
MECHANICAL AND ELECTRICAL COORDINATOR

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section provides for the services of a Mechanical and Electrical Coordinator.
- B. Responsible for the coordination between mechanical and electrical work, and with work of other Sections.
- C. Special coordination of mechanical and electrical construction with respect to finished ceilings, structural components and other building elements.

1.2 MECHANICAL-ELECTRICAL WORK COORDINATOR

- A. Employ and pay for services of person or firm, technically qualified and experienced in field coordination for type of mechanical and electrical work required for this Project, for duration of Work.

1.3 SUBMITTALS

- A. Shop Drawings.
- B. Product Data:
 - 1. Coordination Drawings and Schedules.
 - 2. Submit prior to shop drawings.
- C. Samples:
 - 1. Submit prior to shop drawings.
- D. Contract Closeout Information:
 - 1. Project Record Documents.
 - a. See Section 01 78 39.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.1 COORDINATION REQUIRED

- A. Coordinate Work of mechanical and electrical Divisions with Work of other Divisions.
- B. Coordinate Progress Schedules, including dates for submittals and delivery of products.
- C. Conduct meetings among subcontractors and others concerned with Work to establish and maintain coordination and schedules, and to resolve coordination matters in dispute.
- D. Participate in progress meetings.
- E. Report on progress of Work to be adjusted under coordination requirements, and any required changes in schedules.
- F. Transmit minutes of meetings and reports to concerned parties.



3.2 COORDINATION DOCUMENTS

- A. Prepare coordination drawings in accordance with Section 01 78 39.
- B. Show work of trades indicated with specific emphasis on timing of installation, layout, vertical and horizontal space requirements.
- C. Scale Drawings: 1/4 IN = 1 FT or larger if required.
- D. At points of apparent conflict, draw sections to show relationship of various elements to ceiling plane and building structure.
- E. Each trade shall coordinate with other trades in order to provide complete and coordinated layout.
- F. Prior to Architect and Owner review, each installer shall review and sign final drawings indicating approval.
- G. Work to be shown:
 - 1. Structural Framing System.
 - 2. Lighting Fixtures.
 - 3. Ductwork.
 - 4. Sprinkler piping heads and piping above ceilings.
 - 5. Conduit runs 1 IN and greater in size.
 - 6. Walls extending up to structure.
 - 7. Finished ceilings.
 - 8. Others as required whose work falls within these affected physical limitations.
- H. Coordination drawings shall not supplant requirements specified elsewhere for shop drawings, unless trades involved indicate coordination drawings sufficient for fabrication purposes, and so state in writing.
- I. Prepare master schedule to record responsibilities under each Section of Divisions 01 through 49 of Project Manual for actions which directly relate to mechanical and electrical work, including submittals and temporary utilities.
 - 1. Identify electrical power characteristics and control wiring for each item of equipment.
- J. Maintain documents for duration of Work, recording changes due to site instructions, modifications and adjustments.
- K. After review of original and revised documents, reproduce and distribute copies to concerned parties.

3.3 COORDINATION OF SUBMITTALS

- A. Review Shop Drawings, Product Data, and samples for compliance with Contract Documents and for coordination among work of all Sections of the Project Manual. Transmit submittals to C/M for review with copy of transmittal to Architect and Owner.
- B. Check field dimensions, clearances and relationship to available space and anchors.
- C. Check compatibility with equipment and work of other Sections, electrical characteristics, and operational control requirements.
- D. Check motor voltages and control characteristics.
- E. Coordinate controls, interlocks, wiring of pneumatic switches, and relays.
- F. Coordinate wiring and control diagrams.
- G. Review effect of any changes on work of other sections.



H. Verify and coordinate maintenance of Record Documents.

3.4 COORDINATION OF SUBSTITUTIONS AND MODIFICATIONS

- A. Review proposals and requests from Subcontractors.
- B. Verify compliance with Contract Documents and compatibility with work of other Sections.
- C. Submit written report to Owner and Architect with recommendation for action.

3.5 OBSERVATION OF WORK

- A. Observe work for compliance with Contract Documents.
- B. Maintain list of observed deficiencies and defects; promptly submit to Contractor, Owner and Architect

3.6 DOCUMENTATION

- A. Observe and maintain a record of tests. Record:
 - 1. Specification Section number, product or equipment, and name of installer.
 - 2. Name of testing agency and name of inspector.
 - 3. Name of manufacturer's representative present.
 - 4. Date, time and duration of tests.
 - 5. Type of test and results.
 - 6. Retesting required.
- B. Assemble background documentation for dispute and claim settlements.
- C. Submit copies of documentation Owner.

3.7 EQUIPMENT START UP

- A. Verify utilities, connections and controls are complete and equipment is in operable condition as required by Section 01 77 00.
- B. Observe startup and adjustments. Record time and date of start-up, and results.
- C. Observe equipment demonstrations to Owner per Section 01 79 00.
 - 1. Record times and additional information required in Operation and Maintenance Manuals.

3.8 INSPECTION AND ACCEPTANCE OF EQUIPMENT

- A. Prior to inspection, verify that equipment is tested and operational, clean, and in specified condition.

END OF SECTION



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SECTION 01 31 19

PROJECT MEETINGS

PART 1 - GENERAL

1.1 PREBID CONFERENCE

- A. See Section 00 21 13 - Instructions to Bidders.

1.2 PRECONSTRUCTION CONFERENCE

- A. The Architect will schedule and hold preconstruction conference prior to construction.
- B. Attendance Required:
1. Owner:
 - a. Project Representative.
 - b. Director of Operations or Engineering.
 2. Architect.
 3. Construction Manager:
 - a. Home office representative.
 - b. Field Project Manager.
- C. Contractor must be prepared to discuss the following items:
1. List of subcontractors.
 2. Tentative construction schedule.
 - a. Start and completion dates.
 - b. Critical work sequence.
 3. Status of Contract, bonds, and insurance.
 - a. Accepted alternates.
 4. Procedures.
 5. Designation of responsible personnel.
 6. Processing of field decisions and change orders.
 7. Submittal process.
 8. Procedures for maintaining record documents.
 9. Use of premises:
 - a. Office and storage areas.
 - b. Owner's requirements.
 10. Submission and processing of monthly Application for Payment and associated requirements.
 11. For projects requiring demolition of existing structures address removal and disposal of hazardous materials and toxic substances as applicable.
- D. Contractor to conduct a meeting with subcontractors after preconstruction conference to discuss procedures.

1.3 CONTRACTOR MEETINGS

- A. Conduct weekly progress, coordination and scheduling meetings with subcontractors.

1.4 PROGRESS MEETINGS

- A. Attend scheduled meetings; time, day and place to be determined.
1. Generally, meetings will be held monthly or as required by progress of the Work and scheduled to coincide with Architect's regular scheduled site visits.
 2. Meetings to be held at job site or as arranged.
 3. Construction Manager administer meetings and record minutes.



- B. Attendance Required:
 - 1. Owner's Representative.
 - 2. Architect's Representative.
 - 3. Construction Manager:
 - a. Home office representative.
 - b. Field Project Manager.
 - c. Superintendent.
- C. Agenda:
 - 1. Review, approve minutes of previous meeting.
 - 2. Review work progress since last meeting.
 - 3. Planned progress during next work period.
 - 4. Review construction schedule.
 - 5. Identify concerns which impede planned progress.
 - 6. Note field observations, questions, and decisions.
 - 7. Review submittal schedules.
 - 8. Review Owner/Contractor coordination items.
 - 9. Review status of changes.

1.5 PREINSTALLATION CONFERENCE

- A. Construction Manager administer meetings and record minutes.
 - 1. Convene affected parties for coordination where required by Contract Documents.
 - 2. Conduct meetings prior to installation of the Work.
 - 3. Meetings to be held at job site or as arranged.
- B. Attendance Required:
 - 1. Owner's Representative.
 - 2. Architect's Representative.
 - 3. Contractor:
 - a. Field Project Manager.
 - b. Superintendent.
 - c. Fabricator or Supplier.
 - d. Installer.
 - e. Others whose work may affect or be affected by installation.
- C. Agenda:
 - 1. Review or inspect existing conditions.
 - 2. Review submittals.
 - 3. Review construction schedule and identify concerns.
 - 4. Review Owner/Contractor coordination items.
 - 5. Discuss mobilization and delivery.
 - 6. Note field observations, questions, and decisions.

END OF SECTION



SECTION 01 32 16

CONSTRUCTION SCHEDULES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work Includes:
1. Contractor, promptly after being awarded the Contract, shall prepare and submit for Owner's and Architect's information a Contractor's construction schedule for the Work. Schedule shall not exceed time limits current under Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to entire Project to extent required by Contract Documents, and shall provide for expeditious and practicable execution of Work.
 2. Coordinate Subcontractors' schedules for entire Project:
 - a. Secure time commitments for performing critical elements of Work from parties involved.
 - b. Coordinate each element on the schedule with other construction activities; include minor elements involved in sequence of Work.
 - c. Show each activity in proper sequence.
 - d. Indicate graphically the sequences necessary for completion of related portions of Work.
 - e. Resolve conflicts among schedules of Subcontractors.
 - f. Revise as required by conditions and progress of Work.
 - g. Furnish copy of schedules for entire Project to each Subcontractor.
 - h. Coordinate with Section 01 50 00; Construction Facilities, Temporary Controls and Utilities.
 3. Contractor shall perform Work in general accordance with most recent schedules submitted to Owner and Architect.

1.2 SUBMITTALS

- A. Project information:
1. Preliminary Construction Schedule: Provide to Owner and Architect prior to start of Work, but not later than date set for preconstruction conference.
 2. Project Schedules: Provide to Owner and Architect within 60 days of start of construction.
 3. Updated Project Schedules:
 - a. Provide to Owner and Architect quarterly.
 - b. Provide if completion date is revised or sequence of Work is revised.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 FORM OF SCHEDULES

- A. Horizontal Bar Chart:
1. Provide separate horizontal bar column for each line item of the approved Schedule of Values.



2. Indicate each bar with start and completion date of each item, its total dollar value percent to be completed for each month.
 3. Identify each bar column:
 - a. By specification section number, Work element and major component.
 - b. By distinct graphic delineation.
 4. Horizontal time scale: Identify first week day of each week.
 5. Scale and spacing: To allow space for updating.
 6. As Work progresses, place contrasting mark in each bar to indicate actual progress and completion.
- B. Sheet Size: Maximum 11 x 17 IN.
- C. CPM Schedule: Furnish a CPM schedule covering items of construction with, as a minimum, early/late start and early/late finish and normal float.

3.2 CONTENT OF SCHEDULES

- A. Provide complete sequence of construction by activity.
1. Shop drawings, product data and samples:
 - a. Submittal dates as indicated in approved Submittal Schedule.
 - b. Dates reviewed copies will be required.
 2. Decision dates for:
 - a. Selection of finishes.
 3. Product procurement and delivery dates.
 4. Dates product information and delivery of Owner furnished, installed equipment and materials is needed.
- B. Dates for early and late beginning, and completion of each element of construction.
- C. Identify Work of separate floors, or separate phases, or other logically grouped activities.
- D. Show how requirements for phased completion and partial occupancy by Owner affect sequence of Work.
- E. Indicate important stages of construction for each major portion of Work, including submittal review, testing, and installation.
- F. Identify punch list preparation and completion durations, agencies inspections, and Owner occupancy dates.
- G. Show projected percentage of completion for each item of Work as of last day of every month.
- H. Identify restraints and constraints.
- I. Identify critical path and critical portions of entire schedule. There shall be only one critical path and it shall be clearly identified.

3.3 UPDATING

- A. Show changes occurring since previous submission of updated schedules.
- B. Indicate progress of each activity, actual versus scheduled start and completion dates, and actual versus scheduled percent complete by month.
- C. Include:
 1. Major changes in scope.
 2. Activities modified since previous updating.
 3. Review projections due to changes.
 4. Other identifiable changes.



- D. Provide Narrative report Including:
1. Discussion of problem areas including current and anticipated delay factors and their impact.
 2. Corrective action taken or proposed and its effect.
 3. Effect of change in schedule.
 4. Description of revisions.
 - a. Effect on schedule due to changes to Contract.
 - b. Revisions in duration of activities.
 - c. Other changes that may affect schedule.

3.4 DISTRIBUTION

- A. Distribute copies of revised schedules to:
1. Owner.
 2. Architect.
 3. Contractors/Subcontractors.
 4. Other concerned parties.
- B. Instruct recipients to report inability to comply and provide detailed requirements and schedule, with suggested remedies.

END OF SECTION

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SECTION 01 32 26
PROGRESS REPORTS AND PHOTOS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work Includes:
 - 1. Compilation and submission of monthly progress reports.
 - 2. Taking and submission of monthly progress photographs.

1.2 SUBMITTALS

- A. Project Information:
 - 1. Progress report:
 - a. Submit monthly prior to or with Application for Payment.
 - 1) Written portion of report shall be in Microsoft Word format.
 - 2. Progress Photos:
 - a. Submit digital photographs electronically.
 - 3. Contract Closeout: Provide two (2) indexed sets of compact disks (CD) of digital progress photographs.

1.3 PROGRESS REPORTS

- A. Each Subcontractor shall prepare comprehensive Daily Log and maintain it during entire project period. Submit copy to Contractor for compilation into monthly Progress Reports.
- B. Progress report to include following Summary narrative for entire month.
 - 1. Current total percent complete.
 - 2. Current percent complete of major work activities.
 - 3. Percent of work completed during past month.
 - 4. Main work activities completed during prior month.
 - 5. Main work activities in process and scheduled for next month, including major equipment deliveries, system tie-ins and system start-ups.
 - 6. Overall status of project compared with project schedule.
 - 7. Delays or potential delays, if any.
 - 8. Waste Management Plan implementation.
- C. Daily logs to include following data for each day of prior month.
 - 1. Manpower, by trade.
 - 2. Work performed, with location.
 - 3. Weather.
 - 4. Situations or circumstances which could delay work or give cause for claims for extension of time or added cost.
 - 5. List of visitors names, to include officials, Owner's representatives, and other authorities.

1.4 PROGRESS PHOTOGRAPHS.

- A. General:
 - 1. Include digital progress photographs on compact disk (CD).
 - 2. Digital camera requirement:
 - a. Minimum 10 megapixels resolution.
 - b. GPS geo-tagging capable.



3. Photograph format: JPEG format and file extension with 1600 by 1200 pixels, minimum.
 4. Digitally date photographs.
- B. Identify photographs with project name, date, direction, and view or vantage point.
- C. Photograph/file naming: Include date (YRMODY), Building or Area, Direction photo taken (N.S.E.W.), and Description of Subject.
1. File name example: 07 04 12_Area-A1_NE_AHU-6.jpeg.
- D. Provide index of submitted digital photos.
- E. Building exterior: Minimum 12 digital photos monthly until project exterior is finished, taken from different view points of interest, related to current progress.
- F. Building Interior: Minimum 48 digital photos monthly until project interior is finished, taken from different view points of interest, related to current progress.

END OF SECTION

SECTION 01 33 00

SUBMITTALS

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 specifies administrative and procedural requirements for submittals required for performance of the Work, including:
 - 1. Contractor's construction schedule.
 - 2. Daily construction reports.
 - 3. Shop Drawings.
 - 4. Product Data.
 - 5. Samples.
 - 6. Delegated Design/Deferred Submittals for review by the Building Code Official.
- B. Administrative Submittals: Refer to other Division-1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to:
 - 1. Applications for payment.
 - 2. Performance and payment bonds.
 - 3. Insurance certificates.
 - 4. List of Subcontractors.
- C. Related Sections:
 - 1. Section 01 31 00 "Project Management and Coordination" for electronic web-based construction administration software (using Architect's file transfer site).
 - 2. Section 01 40 00 "Quality Control Services" for inspection and test reports.

1.3 ELECTRONIC SUBMITTAL DELIVERY

- A. To minimize printing reimbursables, shipping reimbursables and the impact on the environment, process and deliver submittals electronically through the Owner's Submittal Exchange program (SE).
 - 1. One complete hard copy of each submittal shall also be furnished for verification of the completeness of electronic submission, if requested by Architect.
- B. Construction Manager or General Contractor must first review and approve submittals sent by Subcontractors prior to sending to Architect. Include Contractor's certification that information complies with Contract Document requirements; record deviations from Contract Document requirements, including minor variations and limitations.
 - 1. Contractor shall coordinate numbering system and nomenclature with Architect prior to first submissions.



2. Email notifications of items delivered to the SE shall be sent to both the project manager and the appropriate administrative assistant in the Architect's office simultaneously with posting to the SE.
- C. Submittals must follow the requirements outlined in this specification and as required in individual specification sections.
- D. Deliver the following to the Architect electronically in pdf format:
 1. Product Data
 2. Shop Drawings
 3. Certifications
 4. Test Data
 5. Schedules
 6. Calculations
 7. Mix Designs
 8. Warranty Information
- E. Samples and Color Selection
 1. Log physical samples via SE but deliver by mail or courier to the Architect for review.
 2. Samples and color selection will not be reviewed electronically.
 3. See separate specification sections for quantities and sample selection process. The Architect shall return review comments via SE.
- F. Submittal Stamps
 1. Contractor or Construction Manager shall affix an electronic stamp to PDF submittals.
- G. Submittal Logs
 1. The submittal log will be in the SE program; however, General Contractor or Construction Manager shall be responsible for maintaining the official submittal log.

1.4 SUBMITTAL PROCEDURES

- A. No submittal will be accepted by the Architect without the General Contractor's action stamp, clearly visible, indicating that the submittal has been fully reviewed by the General Contractor for compliance to the Construction Documents.
- B. Submittals with the General Contractor's stamp but not in compliance with the Construction Documents will be deemed incomplete and returned without review. These will not be shown as received.
- C. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.
 1. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.
 - a. The Architect reserves the right to withhold action on a submittal



requiring coordination with other submittals until related submittals are received.

- 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.
1. Initial Review: Allow 15 business days for initial review of each submittal. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 2. Concurrent Review: Where concurrent review of submittals by Architect's consultants, Owner, or other parties is required, allow 20 business days for initial review of each submittal.
 3. Deferred Submittal Review: Where deferred submittals are required by the Building Code Official allow review time as dictated by the Official.
 4. If intermediate submittal is necessary, process it in same manner as initial submittal.
 5. Allow 15 business days for processing each resubmittal.
 6. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing.
- E. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.
1. Include the following information on the 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. Specification section
- F. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from Contractor to Architect using a transmittal form. Submittals received from sources other than the Contractor will be returned without action.
1. On the form, or separate sheet, record deviations from Contract Document requirements, including minor variations and limitations. Include Contractor's certification that information complies with Contract Document requirements.
- G. Submittal requirements for electronic PDF submittals:
1. Create submittals with native PDF files whenever possible. Do not print a PDF file, and scan in as an image file, as this will delete all file search functions typically embedded within a native PDF file.
 2. **Break down PDF submittals by individual specification section.** Do not collate multiple specification sections together into one non-separated submittal package (i.e. carpet, VCT, rubber base, and entry mats; though frequently provided by one installer, shall not be submitted as one non-separated package unless formatted as described below.)
 3. **All PDF submittals that cover multiple items within one specification section**



shall have an index and be formatted with electronic book marks to distinguish various components from one another, and make each item easily retrievable without navigating through each page of an entire submittal.

1.5 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Bar-Chart Schedule: Prepare a fully developed, horizontal bar-chart type Contractor's construction schedule.
1. Provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week. Use the same breakdown of units of the Work as indicated in the "Schedule of Values".
 2. Within each time bar indicate estimated completion percentage in 10 percent increments. As Work progresses, place a contrasting mark in each bar to indicate Actual Completion.
 3. Prepare the schedule on a sheet of sufficient width to show data for the entire construction period.
 4. Secure time commitments for performing critical elements of the Work from parties involved. Coordinate each element on the schedule with other construction activities; include minor elements involved in the sequence of the Work. Show each activity in proper sequence. Indicate graphically sequences necessary for completion of related portions of the Work.
 5. Coordinate the Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests and other schedules.
 6. Indicate completion in advance of the date established for Substantial Completion. Indicate Substantial Completion on the schedule to allow time for the Architect's procedures necessary for certification of Substantial Completion.
- B. Distribution: Following response to the initial submittal, print and distribute copies to the Architect, Owner, subcontractors, and other parties required to comply with scheduled dates. Post copies in the Project meeting room and temporary field office.
1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.
- C. Schedule Updating: Revise the schedule after each meeting or activity, where revisions have been recognized or made. Issue the updated schedule concurrently with report of each meeting.

1.6 DAILY CONSTRUCTION REPORTS

- A. Daily Construction Report: Prepare a daily construction report, recording the following information concerning events at the site; and submit duplicate copies to the Architect at weekly intervals:
1. List of subcontractors at the site.
 2. Approximate count of personnel at the site.
 3. High and low temperatures, general weather conditions.
 4. Accidents and unusual events.
 5. Meetings and significant decisions.
 6. Stoppages, delays, shortages, losses.



7. Meter readings and similar recordings.
 8. Orders and requests of governing authorities.
 9. Change Orders received, implemented.
 10. Services connected, disconnected.
- B. Material Location Reports: At monthly intervals, prepare a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site.
- C. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare a detailed report. Submit with a request for information on CSI Form 13.2A. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

1.7 SPECIAL REPORTS

- A. General: Submit special reports directly to Owner within one day of an occurrence. Distribute copies of report to parties affected by the occurrence.
- B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

1.8 SHOP DRAWINGS

- A. Submit newly prepared information, drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. **Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings.**
- B. Shop Drawings include fabrication and installation drawings, setting diagrams, schedules, patterns, templates and similar drawings. Include the following information:
1. Dimensions.
 2. Identification of products and materials included.
 3. Compliance with specified standards.
 4. Notation of coordination requirements.
 5. Notation of dimensions established by field measurement.
- C. Sheet Size: Submit Shop Drawings, layout drawings and other Revit or CADD style sheets formatted for 24 x 36 inch or 30 x 42 inch sheets. Details and drawings are to match or exceed construction bid document scales. All drawings are to be submitted to scale. All other product brochures and cut sheets can be provided in an 8-1/2 x 11 format.
- D. Final Electronic Submittal: Submit 2 prints, one for the Architect and one for the Owner at the end of the project or as requested by the parties during construction.
1. If submittal was reviewed by members of the design team other than the Architect, provide an additional copy of the submittal for each design firm.



2. The prints shall be marked-up and maintained as a "Record Document".

1.9 DELEGATED DESIGN/DEFERRED SUBMITTALS

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file and three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.
- C. Refer to the General Information sheet on the Drawings for a list of required delegated design/deferred submittals.
 1. Fire Protection / Sprinklers
 2. Fire Alarm System
- D. Submit deferred submittals on same size sheet as original drawings (30 x 42 or 8 1/2 x 11). Drawings and calculations shall be on the Design professionals titleblock stating the project name and all other items specified under 'Submittal Preparation' above.
- E. Furnish deferred submittals to the Architect who will electronically submit to the Building Code Official for review as required by the IBC.
- F. Contractor shall include these submittal sheets in the Record Documents.

1.10 PRODUCT DATA

- A. Submit in timely manner to complete project, but no later than 90 days after Notice of Award.
- B. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams and performance curves. Where Product Data must be specially prepared because standard printed data is not suitable for use, submit as "Shop Drawings."
 1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products, some of which are not required, mark copies to indicate the applicable information. Include the following information:



- a. Manufacturer's printed recommendations.
 - b. Compliance with recognized trade association standards.
 - c. Compliance with recognized testing agency standards.
 - d. Application of testing agency labels and seals.
 - e. Notation of dimensions verified by field measurement.
- C. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.
- D. Submittals: Submit 4 copies of each required submittal; submit 6 copies where required for maintenance manuals. The Architect will retain one, and will return the other marked with action taken and corrections or modifications required.
- E. Electronic Submittals: Submit a pdf copy of each required submittal; include copies where required for maintenance manuals. See electronic submittal delivery and submittal procedures for further requirements

1.11 SAMPLES

- A. Submit in timely manner to complete project, but no later than 90 days after Notice of Award.
- B. Samples: Submit full-size, fully fabricated samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture and pattern.
- C. Submittals: Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation and similar characteristics, submit 3 sets; one will be returned marked with the action taken.
 - 1. Maintain sets of samples and a file of product submittals, as returned, at the Project site, for quality comparisons and product verification throughout the course of construction.

1.12 CONTRACTOR'S REVIEW

- A. Contractor's Review: Review each submittal and check for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.
- C. Submittals not marked with an approval stamp and those not in compliance with the Construction Documents shall be returned without further review. It is the Contractor's responsibility to review submittals for compliance prior to forwarding the submittal to the Design Team for review.



1.13 ARCHITECT'S ACTION

- A. Architect's Action: Except for submittals for record, information or similar purposes, where action and return is required or requested, the Architect will review each submittal, mark to indicate action taken, and return promptly.
 - 1. Compliance with specified characteristics is the Contractor's responsibility.
- B. Action Stamp: The Architect will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked to indicate the action taken.
 - 1. Corrections or comments made on the shop drawings during this review do not relieve the Contractor from compliance with requirements of the drawings and specifications. This check is only for review of general conformance with the design concept of the project and general compliance with the information given in the contract documents. The Contractor is responsible for; confirming and correlating all quantities and dimensions; selecting fabrication processes and techniques of construction; coordinating his work with that of all other trades; and performing his work in a safe and satisfactory manner.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

SECTION 01 35 32
INTERIM INFECTION CONTROL MEASURES (IICM)

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

- A. Owner is responsible for administering the IICM and ICRA required by this Section.
- B. Nosocomial infections of immuno-suppressed patients, staff and visitors may be caused through inhalation of airborne contaminants.
 - 1. Construction, renovation and repair activities may generate suspended fungal spores from dust, debris and earthwork excavation dust.
 - 2. Fungal spores can be carried by air currents to remote locations within a facility.
 - 3. Control of air borne contaminants in smoke, construction dust, debris and excavation dust as required by this Section, is imperative.
- C. Interim Infection Control Measures (IICM's) are intended to provide an appropriate level of safety when there are conditions that increase the risk of nosocomial infections.
- D. An Infection Control Risk Assessment (ICRA) shall be performed by Owner prior to start of any construction, renovation or repair activity.
 - 1. The ICRA will be used to determine what preventive control measures are required.
- E. Owner may provide baseline particle counts and conduct periodic air sampling of Protection Areas during construction to monitor effectiveness of IICM.
- F. Contractors comply with applicable codes and referenced IICM, and use installation procedures and methods that satisfy applicable code requirements and procedures.
- G. Protect indoor air, absorbent materials, and mechanical systems from contamination.
 - 1. ASHRAE-62, Chapter 7.
- H. Contractor verify the maintenance of negative air pressure in Containment Area relative to Protection Areas on a continuous basis by use of differential pressure monitors,
- I. Contractor's failure to maintain IICM:
 - 1. Owner may issue written warning or Non-conformance Notice.
 - 2. Correct non-conformance immediately.
 - 3. If situation is not corrected within eight (8) hours of receipt of warning or Non-conformance Notice, Owner will have cause to stop Work as provided in Contract Documents.
 - 4. Failure of Contractor to correct deficiencies may result in corrective action taken by Owner and deducting cost associated with from Contract Amount.

1.2 DEFINITIONS

- A. Interim Infection Control Measures (IICM): Measures required of this Section.
- B. Infection Control Risk Assessment (ICRA): An assessment of health risks related to construction, renovation or repair activities to determine which Interim Infection Control Measures need to be implemented.
- C. Airborne contaminant producing activities include, but are not limited to:
 - 1. Demolition and removal of walls, floors, ceilings, and other finish materials.
 - 2. Demolition of plumbing, mechanical and electrical systems and equipment.
 - 3. Finish operations such as sanding, painting, and application of special surface coatings.



4. Construction activity that may generate dust, smoke or fumes.
 5. Site Work operations adjacent to occupied facilities.
- D. Containment Areas: Includes areas of renovation construction within or additions to occupied facilities, adjacent staging and storage areas, and passage areas for contractors, supplies and waste; including ceiling spaces above and adjacent to construction.
- E. Protection Areas: Interior occupied areas within facilities which are adjacent to Containment Area, either occupied or used for passage, as well as areas connected to construction area by mechanical system air intake, exhaust and ductwork.

1.3 SUBMITTALS

- A. Project Information:
1. Drawings indicating Work areas and procedure for containment of airborne contaminants for Owner's review and approval.
 - a. Indicate locations of necessary IICM, including temporary enclosures, barriers, isolation vestibules, negative air machines, exhaust fans, capped ductwork, etc.
 2. Specific means and methods of achieving and maintaining control of airborne contaminants during construction for Owner's review and approval.
 3. Infection Control Construction Permit for each Work area for Owner's assessment and approval.
 4. Submit Daily IICM Inspection Reports to Owner

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Acceptable Manufactures:
1. Negative Air Machines:
 - a. Base:
 - 1) Micro-Trap, Inc.
 - b. Optional:
 - 1) Control Resource System Incorporated.
 - 2) or equal.
 2. Adhesive faced contamination control mats:
 - a. Base:
 - 1) Liberty Industries.
 - 2) or equal.
 3. Temporary Prefabricated Units:
 - a. Base:
 - 1) Fiberlock Technologies, Inc.
 - 2) or equal.
 4. Polyethylene (fire retardant):
 - a. Base:
 - 1) Griffolyn.
 - 2) or equal.
 5. Air Pressure Monitor (switch/gauge):
 - a. Base:
 - 1) Dwyer Model 3000-0.
 - 2) or equal.
 6. Biocide:
 - a. Base:
 - 1) MAG Chemical.



2) or equal.

B. Manufactures desiring approval comply with Section 00 26 00.

2.2 MATERIAL DESCRIPTIONS

A. Negative Air Machines:

1. Units shall include prefilters, final filters, HEPA-filters and filter static pressure gauges.
2. HEPA filters shall be 99.997 percent efficient at 0.3 micron particle size.
3. Base Product: Micro Trap MT-C Negative Air Filtration Units by Micro-Trap, Inc.
4. Optional Product: CRSI 2000 by Control Resource System Incorporated.

B. Adhesive faced contamination control mats:

1. Base Product: Tacky Mat by Liberty Industries.

C. Temporary Prefabricated Units:

1. Provide with inspection window and pressure differential porthole.
2. Include Nilfisk 87 CFM vacuum device and manometer, or equal.
3. Base Product: Kontrol Kube, including Adjustable Aluminum Frame No. 6440; Vinyl Enclosure No. 6442; Wheel Base Platform No. 6443 by Fiberlock Technologies.

D. Polyethylene (fire retardant):

1. Thickness: 6 mil.
2. Fire retardant type listed by Fire Underwriter's Laboratories.
3. Base Product: No. T55R by Griffolyn.
4. Include compatible fire retardant tape.

E. Air Pressure Monitor (switch/gauge):

1. Differential switch/gauge to monitor differential pressure between the construction Containment Area and Protection Area.
2. Range: 0 to 0.5 IN of water gauge, and high-low adjustable set points.
3. Install switch/gauge in a NEMA rated enclosure.
4. Provide all necessary power wiring, transformers, relays, etc. to operate system.
5. Provide audio-visual alarm that will activate upon sensing pressure differences beyond range set points.
6. Provide switch that will enable activation of audio, visual or both alarms.
7. Provide manual reset switch to reset gauge after an alarm condition.
8. Base Product: Model 3000-0 by Dwyer.

F. Biocide: Base: Copper 8 Quinolinolate by MAG Chemical.

PART 3 - EXECUTION

3.1 INTERIM INFECTION CONTROL MEASURES (IICM) PANEL

A. Construction Manager and/or Contractor shall become a member of the Owner's IICM Panel immediately after award of Contract. IICM Panel consist of:

1. Owner's Construction Representative.
2. Owner's Risk Assessment Coordinator.
3. Facility Risk Management.
4. Facility Engineering.
5. Facility Safety Officer.
6. Facility Infection Control.
7. Facility Department Director/Manager (If applicable).
8. Construction Manager (If applicable).
9. Contractor.



10. Additional individuals if deemed appropriate by the size, complexity or area of the Work activity.

B. IICM Panel responsibilities:

1. Administer this specification Section, and IICM Drawings and/or Phasing drawings.
2. Review scope and hazards of proposed Work activity, and determine department affected by Work activity and departments surrounding Work area.
3. Perform an ICRA to determine IICM required.
4. Coordinate and document implementation of IICM, including IRCA, audits required, communication and training.
5. Ensure audits are conducted and documented as established by IICM Panel.
 - a. Size, type and nature of Work activity shall dictate number of scheduled audits.
6. Oversee daily inspections, if deemed necessary by ICMA Panel, made by Construction Manager and/or Contractor during Work activity to determine compliance with IICM.
7. Report non-compliance to Construction Manager (if applicable) or Contractor, and take actions deemed appropriate to maintain integrity of IICM throughout duration of Work activity.

3.2 INFECTION CONTROL RISK ASSESSMENT

- A. Prior to starting Work activity in or near health facility an ICRA will be performed.
1. STEP 1: Construction Manager (if applicable) or Contractor shall initiate and submit to Owner's Risk Assessment Coordinator an Infection Control Construction Permit seven (7) days prior to starting Work in or adjacent to any existing area. Use form at end of this Section. Following shall be indicated:
 - a. Location of Activity.
 - b. Work activity.
 - c. Start date.
 - d. Estimated duration.
 - e. Contact and telephone number.
 - f. Construction Activity Type (A - D) using following table:

CONSTRUCTION ACTIVITY TYPE	
TYPE A	Inspection and Non-Invasive Activities includes, but is not limited to: <ul style="list-style-type: none"> ▪ removal of ceiling tiles for visual inspection limited to 1 tile per 50 square feet ▪ painting (but not sanding) ▪ wall covering, electrical trim work, minor plumbing, and activities which do not generate dust or require cutting of walls or access to ceilings other than for visual inspection.
TYPE B	Small Scale, Short Duration Activities which create minimal dust, includes, but is not limited to: <ul style="list-style-type: none"> ▪ installation of telephone and computer cabling ▪ access to chase spaces ▪ cutting of walls or ceiling where dust migration can be controlled.
TYPE C	Generates a Moderate To High Level of Dust or Requires Demolition or Removal of Fixed Building Components or Assemblies includes, but is not limited to: <ul style="list-style-type: none"> ▪ sanding of walls for painting or wall covering ▪ removal of floor coverings, ceiling tiles and casework ▪ new wall construction ▪ minor duct work or electrical work above ceilings ▪ major cabling activities ▪ any activity which cannot be completed within a single work shift.



TYPE D	Major Demolition And Construction Projects includes, but is not limited to: <ul style="list-style-type: none"> activities which require consecutive work shifts requires heavy demolition or removal of a complete cabling system new construction.
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2. STEP 2: Owner's Risk Assessment coordinator shall meet with applicable members of IICM Panel to review submitted Infection Control Construction Permit, and using following table, identify Patient Risk Groups that will be affected. If more than one risk group will be affected, select higher risk group.

Low	Medium	High	SENSITIVE
<ul style="list-style-type: none"> Office areas General Storage Parking Decks Volunteer Services Library Medical Records Engineering Meeting/Class Room Environmental Services 	<ul style="list-style-type: none"> Cardiology Echocardiography Endoscopy Nuclear Medicine Physical Therapy Radiology/MRI Respiratory Therapy Clinic Long Term Care Units Materials Management Admitting Computer Rooms Morgue 	<ul style="list-style-type: none"> CCU Emergency Room Labor & Delivery Laboratories (Specimen) Newborn Nursery Outpatient Surgery Pediatrics Pharmacy Post Anesthesia Care Unit Surgical Units Patient Care areas Physical Therapy Dialysis Respiratory Care Food Service 	<ul style="list-style-type: none"> Any area caring for immunocompromised patients Burn Unit Cardiac Cath Lab Central Sterile Supply Intensive Care Units Medical Unit Negative pressure Isolation Rooms Oncology Surgery Departments C-Section Rooms Sterile Processing

3. STEP 3: On following Infection Control Matrix match Patient Risk Group (Low, Medium, High, Sensitive) with planned Construction Activity Type (A, B, C, D), to find Class of Precautions (I, II, III or IV) or level of IICM required.

CLASS OF PRECAUTIONS	CONSTRUCTION ACTIVITY TYPE			
PATIENT RISK GROUP	TYPE A	TYPE B	TYPE C	TYPE D
LOW	I	II	II	III / IV
MEDIUM	I	II	III	IV
HIGH	I	II	III / IV	IV
SENSITIVE	II	III / IV	III / IV	IV
Note: Infection Control approval will be required and procedures are necessary when Construction Activity Type and Patient Risk Group indicates Class III or Class IV.				

4. STEP 4: Owner's Risk Assessment Coordinator and Construction Manager (if applicable) or Contractor shall then Determine required Interim Infection Control Measures by Class of Precaution:

INTERIM INFECTION CONTROL MEASURES	
During Construction Activity	Upon Completion Activity



CLASS I	<ol style="list-style-type: none"> 1. Execute work by methods to minimize raising dust from construction operations. 2. Immediately replace ceiling tile displaced for visual inspection. 	<ol style="list-style-type: none"> 1. Wet mop and/or vacuum before leaving area.
CLASS II	<ol style="list-style-type: none"> 1. Provide active means to prevent airborne dust from dispersing into atmosphere. 2. Seal unused doors with tape. 3. Block off and seal air vents. 4. Place dust mat at entrance and exit of work area. 5. Isolate HVAC system in areas where work is being performed. 6. Water mist work surfaces to control dust while cutting. 	<ol style="list-style-type: none"> 1. Contain construction waste in tightly covered containers before transporting. 2. Wet mop and/or vacuum with HEPA filtered vacuum before leaving work area. 3. Wipe surfaces with disinfectant. 4. Remove isolation of HVAC.
CLASS III	<ol style="list-style-type: none"> 1. Isolate HVAC system in area where work is being performed to prevent contamination of duct system. 2. Complete all critical barriers i.e. sheetrock, plywood, plastic, to seal area from non-work area or implement control cube method (pre-fab unit with plastic covering and sealed connection to work site with HEPA vacuum for vacuuming prior to exit) before construction begins. 3. Seal unused doors, holes, pipes, conduits, and punctures appropriately. 4. Maintain negative air pressure within work site utilizing HEPA equipped air filtration units. 5. Contain construction waste transport in tightly covered & sealed containers before transporting. 	<ol style="list-style-type: none"> 1. Do not remove barriers until area is inspected by IICM Panel and thoroughly cleaned by Environmental Services Department. 2. Remove barrier materials carefully to minimize spreading of dirt and debris. Transport in tightly covered & sealed containers. 3. Vacuum work area with HEPA filtered vacuums. 4. Wet mop area with disinfectant. 5. Remove isolation of HVAC system.
CLASS IV	<ol style="list-style-type: none"> 1. Isolate HVAC system in area where work is being done to prevent contamination of duct system. 2. Complete all critical barriers i.e. sheetrock, plywood, plastic, to seal area from non work area or implement control cube method (cart with plastic covering and sealed connection to work site with HEPA vacuum for vacuuming prior to exit) before construction begins. 3. Seal holes, pipes, conduits, and punctures appropriately. 4. Construct ante room & require all personnel to pass through so they can be vacuumed using a HEPA vacuum cleaner before leaving work area or they can wear cloth or paper coveralls that are removed each time they leave the work area. 5. Personnel entering work area are required to wear shoe covers. Shoe covers must be changed each time worker exits work area. 6. Maintain negative air pressure within work site utilizing HEPA equipped air filtration units. 7. Contain construction waste transport in tightly covered & sealed containers before transporting. 	<ol style="list-style-type: none"> 1. Do not remove barriers until area is inspected by IICM Panel and thoroughly cleaned by Environmental Services Department. 2. Remove barrier materials carefully to minimize spreading of dirt and debris. Transport in tightly covered & sealed containers. 3. Vacuum work area with HEPA filtered vacuums. 4. Wet mop area with disinfectant. 5. Remove isolation of HVAC system.



5. STEP 5: Consider potential risk of water damage and what is required to minimize or prevent it.
6. STEP 6: Identify work hours needed to perform work (During non-patient-care hours?).
7. STEP 7: Identify control measures using prior assessment (Types of barrier needed? Will isolation/negative airflow rooms needed? Will HEPA filtration be required?).
8. STEP 8: Identify additional IICM, such as ventilation, plumbing, electrical in terms of occurrences and probable outages.
9. STEP 9: Complete Infection Control Construction Permit to document requirements and authorization.
10. Step 10: Owner's Risk Assessment Coordinator, Construction Manager (if applicable) and/or Contractor review required Interim Infection Control Measures with IICM Panel and construction personal so everyone is aware of the requirements.
11. Step 11: Construction Manager (if applicable) and/or Contractor provide required IICM.

3.3 GENERAL

- A. Notify Owner at least fourteen (14) days prior to preparing a Containment Area or starting Work activity outside of any Containment Area or in any occupied spaces.
- B. Maintain low levels of airborne contaminants within enclosed Containment Areas and Protection Areas.
- C. Airborne Contaminant Control:
 1. Ventilate interior Containment Areas by use of negative air machines exhausted through filters to outside of building directed away from building intake louvers, operable windows and doors.
 2. Negative air machines shall provide airflow into Containment Area at not less than 100 FPM at enclosure entrances with all doors fully open.
 - a. As an alternative, provide adequate exhaust air quantity to provide 2 air changes per hour of exhaust.
 3. Provide as many negative air machines as necessary.
 4. Negative air machines shall be connected to emergency power and run continuously.
 5. Change filters as frequently as necessary for duration of Work in Containment Area to maintain a negative pressure of 0.1 - 0.2 IN of water gauge.
 6. Negative air units are to be DOP tested and certified prior to being placed in service, and when dropped, damaged or moved extensively.
 7. Provide pressure monitor to constantly monitor negative air pressure between Containment Area relative to Protection Area.
 8. Provide additional localized exhaust during welding or vapor producing Work.
 9. When installing wet products (fluid applied coatings, adhesives, etc.) ventilate with outside air.

3.4 GENERAL PROTECTION

- A. General: Provide and maintain all barriers, filters, ventilation, and cleaning.
- B. Sealing of Openings:
 1. Seal barrier wall seams, cracks around window and door frames, ductwork, pipes and conduits.
 2. Penetration of dust-proof enclosure shall be sealed on all sides and 360 degrees around penetrating objects.
 3. Secure windows shut.
- C. Duct Caps: Cap ventilation ducts within construction area withstand airflow and make dust tight.



- D. Dust Control: Prevent airborne contaminants due to Work under this contract.
 - 1. Spray surfaces with water during dust-producing demolition activities.
 - 2. Care must be taken to avoid accumulation of standing water or saturation of any materials.
 - 3. Do not use chemical pollutants without permission of Owner.
 - 4. Hard surface floors in work area, adjacent hallways and passage areas require vacuuming with HEPA filtered vacuum cleaners and frequent wet mopping during demolition and construction.
 - 5. Protect adjacent carpeted areas with plastic and heavy kraft paper, and vacuum with HEPA-filtered vacuum cleaners.
 - 6. Vacuum walk-off mats daily and as needed to eliminate the tracking of dust into other areas.
 - 7. Execute Work by methods to minimize raising dust from construction operations.
 - 8. Provide positive means to prevent airborne dust from dispersing into atmosphere.
 - 9. Thorough cleaning of surfaces that become exposed to dust shall be accomplished by use of either a HEPA filtered vacuum cleaner and/or a wet mop.
- E. Removal of debris through Protection Areas or occupied spaces shall be in tightly covered and sealed containers.
- F. Contractor Personnel: Instruct personnel to refrain from tracking dust into adjacent areas or opening windows or doors that would allow airborne contaminants into adjacent hospital areas.
- G. Exterior Work: Direct exhaust from equipment away from building air intakes, windows or doors; assure that filters on building air intakes are operational and protected from excessive amounts of airborne contaminants.
- H. Provide thorough cleaning of surfaces exposed to dust, prior to occupancy.

3.5 AIRBORNE CONTAMINANT CONTROL ENCLOSURES AND BARRIERS

- A. Provide one-hour fire rated and dustproof enclosures for Work to protect protection areas from dust, fumes and air borne contaminants.
 - 1. Construction must be conducted in enclosures which will cut off any flow of airborne contaminants into Protection Areas.
- B. Determine when an enclosure is required to protect any adjoining area.
- C. Provide enclosure whenever and wherever Owner has identified need to control airborne contaminants.
- D. General Requirements:
 - 1. Traffic between containment areas and protection areas shall be kept to a minimum.
 - 2. Keep door to such areas closed at all times.
 - 3. Transport materials and refuse into a containment area from an external site without violating protection areas by transporting in covered containers.
 - 4. Provide negative pressure in enclosed containment areas.
 - 5. Provide adequate ventilation of interior enclosed areas to cure installed materials, to prevent excessive humidity, and to prevent hazardous accumulations of dust, fumes, vapors, or gases.
- E. Fire Rated Dustproof Enclosures:
 - 1. Full height, noncombustible construction, with minimum 1/2 IN gypsum board both sides with 3-1/2 IN R-II insulation or sound batts to reduce noise.
 - 2. Use 3 IN wide tape to tightly seal top, bottom, to prevent spread of dust and fumes to occupied areas, including above ceilings.
 - 3. Doors shall be minimum 45 minute rated, 4 FT-0 IN width, unless larger are required or indicated, solid core wood with metal frame and hardware, including closer, tightly weather-stripped to prevent flow of dust and fumes.



- a. Swing into construction area. Keep enclosures locked during non-working hours.
 - b. Three keys for emergency access shall be furnished to Owner, or keyed to Owner's selected building key system.
- 4. Install floor mats on both sides of construction entrance prior to start of demolition or construction.
 - a. Keep inside mat damp to help remove dust and minimize tracking into adjacent clean areas, vacuum mats daily.
 - b. As an alternative, provide tacky-mats and remove daily, or as needed.
- 5. Obtain Owner's approval of exact location and details of enclosure construction.
- 6. Materials for enclosure shall be pre-cut in unoccupied areas.
- 7. No explosive or pneumatic driven fasteners allowed.
- 8. Provide fire rated partitions and doors when required to maintain integrity of an existing rated partition, and where indicated or required by governing authorities.
- F. Following procedure shall be implemented when construction personnel are required to pass through a Protection Area to enter a Containment Area:
 - 1. Provide air lock isolation vestibules in dustproof enclosures when needed.
 - 2. Personnel shall wear protective clothing if required by Owner while passing through Protection Area.
 - a. Protective clothing shall be removed in air lock vestibule prior to entering Containment Area.
 - b. When exiting Containment Area, personnel shall re-don protective clothing before reentering Protection Area.
- G. All vacuuming outside of Containment Areas shall be with a HEPA-filtered vacuum.
- H. Provide all dustproof and fire rated enclosures, ventilation and filtering equipment, warning signs and warning lights to protect public, existing building and equipment.
- I. Remove enclosures and barriers carefully to minimize spreading dust and debris. Transport waste and materials in tightly covered and sealed containers or carts.
- J. Vacuum and/or wet mop and clean all surfaces free of dust after removal of enclosures and barriers.

3.6 ENCLOSURE IN A PROTECTION AREA

- A. Whenever Work is necessary outside of a Containment Area:
 - 1. Schedule Work in advance with Owner.
 - 2. Contain Work within a full height portable enclosure.
 - a. Contractor may use prefabricated unit.
 - 3. Seal opening upon entering or leaving enclosure.
 - 4. Do not store construction equipment or material construction enclosure.
 - 5. Immediately clean surfaces where dust is tracked or has migrated outside of construction area.
 - 6. Provide necessary manpower and equipment (HEPA filtered vacuum, dust and wet mops, brooms, buckets and clean wiping rags) to keep adjacent occupied areas clean at all times.

3.7 WORK CONFINED TO INDIVIDUAL ROOMS

- A. Miscellaneous Work activities required within a protection area confined to individual rooms shall be performed as follows:
 - 1. Scheduled in advance and notify Owner at least 7 days prior to commencing Work in room to allow Owner to relocate or protect occupants.
 - 2. Room shall be treated as a containment area.
 - 3. Keep door to such areas closed and sealed while Work is being performed.



4. Cap HVAC ductwork or seal air diffusers and grills.
5. Provide negative pressure in room by use of negative air machine or exhaust fan.
6. Traffic between room and adjacent areas shall be kept to a minimum.
7. Transport materials and waste into and from room through adjacent areas by transporting in tightly covered and sealed containers or carts.
8. At no time shall any construction equipment or material be stored outside room.
9. Any dust tracked outside of room shall be cleaned up immediately.
10. Vacuum and clean all surfaces free of dust after completion of Work.
11. Have necessary manpower and equipment (HEPA filtered vacuum, walk off mats, dust and wet mops, brooms, buckets and clean wiping rags) to keep adjacent areas clean at all times.

3.8 ACCESS AND WORK IN EXISTING CEILING SPACES (NOT APPLICABLE)

3.9 SCHEDULE OF INSTALLATION OF FINISH MATERIALS AND PRODUCTS

- A. Use following sequence:
1. Fluid applied wall, ceiling and floor materials.
 2. Adhesive applied sheet and tile flooring.
 3. Adhesive applied wall covering
 4. Carpet.
 5. Acoustical ceiling tile.



Infection Control Construction Permit				
Project: Logan Regional Hospital Reconfiguration Project				Permit No:
Location of Construction Activity:				
Work Activities:			Start Date:	Estimated Duration:
Contractor's Supervisor:		Permit Requested By:		
Telephone No.:		Signature:		Date:
CONSTRUCTION ACTIVITY TYPE (Identified by Contractor)				
PATIENT RISK GROUP (Identified by Owner (See Section 01 35 32))	TYPE A: Inspection and non-invasive activity	TYPE B: Small scale, short duration activities creating minimal dust.	TYPE C: Activity generates moderate to high levels of dust or requires demolition or removal of building components, or requires greater than 1 work shift for completion	TYPE D: Major demolition or construction activities requiring consecutive work shifts
LOW	I	II	II	III / IV
MEDIUM	I	II	III	IV
HIGH	I	II	III / IV	IV
SENSITIVE	II	III / IV	III / IV	IV
Note: Infection Control approval will be required and procedures are necessary when Construction Activity Type and Patient Risk Group indicates Class III or Class IV.				
INTERIM INFECTION CONTROL MEASURES (Check all that apply)				
	DURING CONSTRUCTION ACTIVITY		UPON COMPLETION OF ACTIVITY	
CLASS I	Execute work by methods to minimize raising dust from construction operations. Immediately replace any ceiling tile displaced for visual inspection.		Wet mop and/or vacuum before leaving work area.	
CLASS II	Provide active means to prevent airborne dust from dispersing into atmosphere. Seal unused doors with tape. Block off and seal air vents. Place dust mat at entrance and exit of work area. Isolate HVAC system in areas where work is being performed. Water mist work surfaces to control dust while cutting.		Contain construction waste in tightly covered containers before transport. Wet mop and/or vacuum with HEPA filtered vacuum before leaving work area. Remove isolation of HVAC system. Wipe surfaces with disinfectant.	
CLASS III	Obtain infection control permit before construction begins. Isolate HVAC system in area where work is being performed to prevent contamination of duct system. Complete all critical barriers or provide control cube method before construction begins.		Vacuum work with HEPA filtered vacuums. Wet mop with disinfectant. Do not remove barriers from work area until area is inspected by IICM Panel & thoroughly cleaned by Env. Services Dept.	
Date	Maintain negative air pressure within work site utilizing HEPA negative air machines. Seal unused doors, holes, pipes, conduits, and punctures appropriately.		Remove barrier materials carefully to minimize spreading of dirt & debris. Transport waste in tightly covered & sealed containers	
Initial	Contain construction waste in tightly covered & sealed containers before transport.		Remove isolation of HVAC system.	
CLASS IV	Obtain infection control permit before construction begins. Isolate HVAC system in area where work is being done to prevent contamination of duct system. Complete all critical barriers or provide control cube method before construction begins. Seal holes, pipes, conduits, and punctures appropriately. Maintain negative air pressure within work site utilizing HEPA negative air machines. Construct anteroom & require all personnel to pass through so they can be vacuumed using a HEPA vacuum cleaner before leaving work area or wear cloth or paper coveralls that are removed each time they leave work area. Personnel entering work area are required to wear shoe covers.		Vacuum work area with HEPA filtered vacuums. Wet mop with disinfectant. Do not remove barriers from work area until area is inspected by IICM Panel & thoroughly cleaned by Env. Services Dept. Remove barrier materials carefully to minimize spreading of dirt & debris. Transport waste in tightly covered & sealed containers	
Date	Personnel entering work area are required to wear shoe covers.		Remove isolation of HVAC system.	
Initial	Contain construction waste in tightly covered & sealed containers before transport.			
Additional Requirements:				
Exceptions/Additions to this permit are noted by attached:		Risk Assessment Coordinator:		



	Permit Authorized - <i>Signature</i> :	Date:
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END OF SECTION

SECTION 01 40 00

QUALITY CONTROL SERVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for quality control services.
- B. Quality control services include inspections and tests and related actions including reports, performed by independent agencies, governing authorities, and the Contractor. They do not include Contract enforcement activities performed by the Architect.
- C. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve the Contractor of responsibility for compliance with Contract Document requirements.
 - 1. Specific quality control requirements for individual construction activities are specified in the Sections that specify those activities.
 - 2. Inspections, tests and related actions specified are not intended to limit the Contractor's quality control procedures that facilitate compliance with Contract Document requirements.
- D. Requirements for the Contractor to provide quality control services required by the Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.3 RESPONSIBILITIES

- A. Contractor Responsibilities:
 - 1. Unless otherwise indicated as the responsibility of another identified entity, Contractor shall provide inspections, tests, and other quality-control services specified elsewhere in the Contract Documents and required by authorities having jurisdiction. Costs for these services shall be included in the Contract Sum.
 - a. Where individual Sections specifically indicate that certain inspections, tests, and other quality-control services are the Contractor's responsibility, the Contractor shall employ and pay a qualified independent testing agency to perform quality-control services. Costs for these services are included in the Contract Sum.
 - b. Where individual Sections specifically indicate that certain inspections, tests, and other quality-control services are the Owner's responsibility, the Owner will employ and pay a qualified independent testing agency to perform those services.
 - 2. Retesting: The Contractor is responsible for retesting where results of required



inspections, tests or similar services prove unsatisfactory and do not indicate compliance with Contract Document requirements, regardless of whether the original test was the Contractor's responsibility.

3. Cost of Retesting: Cost of retesting construction revised or replaced by the Contractor is the Contractor's responsibility, where required tests were performed on original construction.
 4. Associated Services: The Contractor shall cooperate with agencies performing required inspections, tests and similar services and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include but are not limited to:
 - a. Providing access to the Work and furnishing incidental labor and facilities necessary to facilitate inspections and tests.
 - b. Taking adequate quantities of representative samples of materials that require testing or assisting the agency in taking samples.
 - c. Providing facilities for storage and curing of test samples, and delivery of samples to testing laboratories.
 - d. Security and protection of samples and test equipment at the Project site.
- B. Owner Responsibilities: The Owner will provide inspections, tests and similar quality control services specified to be performed by independent agencies and not by the Contractor, except where they are specifically indicated as the Contractor's responsibility or are provided by another identified entity. Costs for these services are not included in the Contract Sum.
1. The Owner will employ and pay for the services of an independent agency, testing laboratory or other qualified firm to perform services which are the Owner's responsibility.
- C. Duties of the Testing Agency: The independent testing agency engaged to perform inspections, sampling and testing of materials and construction specified in individual Specification Sections shall cooperate with the Architect and Contractor in performance of its duties, and shall provide qualified personnel to perform required inspections and tests.
1. The agency shall notify the Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 2. The agency is not authorized to release, revoke, alter or enlarge requirements of the Contract Documents, or approve or accept any portion of the Work.
 3. The agency shall not perform any duties of the Contractor.
- D. Coordination: The Contractor and each agency engaged to perform inspections, tests and similar services shall coordinate the sequence of activities to accommodate required services with a minimum of delay. In addition the Contractor and each agency shall coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.
1. The Contractor is responsible for scheduling times for inspections, tests, taking samples and similar activities.

1.4 SUBMITTALS

- A. The independent testing agency shall submit a certified written report of each inspection, test or similar service, to the Architect, in duplicate



1. Submit additional copies of each written report directly to the governing authority, when the authority so directs.
2. Report Data: Written reports of each inspection, test or similar service shall include, but not be limited to:
 - a. Date of issue.
 - b. Project title and number.
 - c. Name, address and telephone number of testing agency.
 - d. Dates and locations of samples and tests or inspections.
 - e. Names of individuals making the inspection or test.
 - f. Designation of the Work and test method.
 - g. Identification of product and Specification Section.
 - h. Complete inspection or test data.
 - i. Test results and an interpretations of test results.
 - j. Ambient conditions at the time of sample-taking and testing.
 - k. Name and signature of laboratory inspector.
 - l. Recommendations on retesting.

1.5 QUALITY ASSURANCE

- A. Qualification for Service Agencies: Engage inspection and testing service agencies, including independent testing laboratories, which are prequalified as complying with "Recommended Requirements for Independent Laboratory Qualification" by the American Council of Independent Laboratories, and which specialize in the types of inspections and tests to be performed.
 1. Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the State in which the Project is located.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 TESTS REQUIRED

- A. Tests required may include but not be limited to the following (all items listed here may not occur, see drawings and associated section of the specifications):
 2. Special Inspections including fabricators.
 - a. Welding.
 - b. High strength bolts.
 - c. Concrete.
 - d. Structural masonry.
 - e. Soils.
 - f. Sprayed fire-resistant materials.
 - g. Special cases as determined by the building official.

3.2 REPAIR AND PROTECTION



- A. General: Upon completion of inspection, testing, sample-taking and similar services, repair damaged construction and restore substrates and finishes to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes.
 - 1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.
- B. Protect construction exposed by or for quality control service activities, and protect repaired construction.
- C. Repair and protection is the Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing or similar services.

END OF SECTION

SECTION 01 41 00
CODES, REGULATIONS, AND GUIDELINES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Project design based on, but not limited to, following codes, regulations, and guidelines.
 - 1. Including:
 - a. Nationally published amendments.
 - b. Local Amendments.
 - 2. Additional requirements may be indicated in specification sections.
- B. Contractor is not required to ascertain Contract Documents are in accordance with applicable laws, statutes, ordinances, building codes, and rules and regulations, unless they bear upon construction means, methods, techniques or safety and health precautions, however nonconformity discovered by or made known to Contractor shall be reported promptly to Architect.

1.2 INDEX

- A. Building Codes:
 - 1. International Building Code (IBC).
 - a. Edition: 2021 With Utah Amendments.
 - 2. Existing Building Code
 - a. Edition: 2021 with Utah Amendments
- B. Life Safety Code:
 - 1. NFPA Life Safety Code 101.
 - a. Edition: 2012 & 2015.
- C. Fire Code:
 - 1. ICC International Fire Code (IFC).
 - a. Edition: 2021 with Utah Amendments.
- D. Accessibility & Healthcare:
 - 1. ADA Accessibility Guidelines.
 - a. 2010 with Municipal and/or State Amendments.
 - 2. International Code Council.
 - a. ICC A117.1.
 - b. Edition: 2009.
 - 3. Where multiple codes are listed, and requirements differ, comply with the most stringent language.
 - 4. Facilities Guidelines Institute:
 - a. Guidelines for Design and Construction of Health Care Facilities.
 - b. Edition: 2010.
 - 5. NFPA 99 Healthcare Facility Code.
 - a. Edition: 2012.
 - 6. Utah Administrative Codes
 - a. R710
 - b. R432: Health Facility Licensing Construction Rules
- E. Mechanical Code:



1. International Mechanical Code.
 - a. Edition: 2021.
- F. Plumbing Code:
 1. International Plumbing Code.
 - a. Edition: 2021.
- G. Electrical Code:
 1. NFPA 70: National Electrical Code.
 - a. Edition: 2020.
- H. Energy Code:
 1. ASHRAE 90.1.
 - a. Edition: 2016.
 2. International Energy Conservation Code.
 - a. Edition: 2021.
- I. Occupational Safety and Health Standards:
 1. OSHA Regulations (Standard 29 CFR) - Part 1910.
- J. Special Seismic Certification:
 1. Comply with International Building Code (IBC), Section 1708 and ASCE 7, Section 13.2.2.
 2. Document certification of required components in one of three ways:
 - a. Shake Table Testing:
 - 1) Testing shall be based upon nationally recognized standards and procedures, such as ICC-ES AC 156, or as acceptable to Authority Having Jurisdiction.
 - 2) Test reports shall satisfy design requirements of component specified with capacities exceeding site required seismic demand forces provide with following parameters used:
 - a) SDS
 - b) W_p
 - c) I_p
 - d) a_p
 - e) R_p
 - f) z/h ratio
 - b. Experience Data:
 - 1) Base data upon nationally recognized standards and procedures, or as acceptable to Authority Having Jurisdiction.
 - 2) Experience shall satisfy design requirements of component specified with capacities exceeding the site required seismic demand forces.
 - c. Rugged Component Exemption:
 - 1) Components shall have sufficient evidence demonstrating compliance in being rugged and shall be approved by the agency having jurisdiction.
 - 2) Items that may be classified as rugged without evidence:
 - 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) Sterilizers
 - h) Blanket warmers
 - i) Anesthesia power columns, ceiling, or wall mounted
 - j) Refrigerators and freezers
 - k) Microwave ovens for patient services



- l) Film illuminators
 - m) Elevator cabs
 - n) Underground tanks
 - 3) Components weighting not more than 20 LBS supported directly by structures.
- 3. Partial list of common components requiring special seismic certification:
 - a. Architectural:
 - 1) CT systems
 - 2) Nurse call systems
 - 3) Radiography/fluoroscopy systems
 - b. Mechanical:
 - 1) Air-conditioning units
 - 2) Air filters
 - 3) Air-handler units
 - 4) Chillers
 - 5) Condensers
 - 6) Cooling towers
 - 7) Day tanks
 - 8) Exhaust/smoke control fans
 - 9) Fan coils
 - 10) Fuel tanks
 - 11) Humidification systems
 - 12) Radiators
 - c. Electrical:
 - 1) Battery cabinets
 - 2) Busways
 - 3) Control panels
 - 4) Distribution panels
 - 5) Generators
 - 6) Motor control centers
 - 7) Power isolation and correction systems
 - 8) Substations
 - 9) Switchboards & switchgears
 - 10) Transformers
 - 11) UPS cabinets

K. Reference Standards:

- 1. Refer to technical specification sections for listed standards.
- 2. Refer to Section 01 42 19 for the applicable edition of each standard indicated.

1.3 SUBMITTALS

A. Project Information:

- 1. Provide manufacturer documentation justifying compliance with one of three methods referenced above – Shake Table Testing, Experience data or rugged components.

END OF SECTION

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SECTION 01 42 10

ABBREVIATIONS - TERMINOLOGY

A	acid, compressed air	AWC	acrylic wall coating
AB	anchor bolt, air barrier, air blender, auger boring	B	boiler, bottom
A/C	air condition, air conditioner	BB	boiler burner, broad band
AC	air compressor, alternating current, architectural casework, asphaltic concrete	BBD	boiler blowdown, broad band data
ACB	air circuit breaker	B to B	back to back
ACH	air changes per hour	B & B	balled and burlapped
ACIP	architectural cast in place concrete	B & BB	breakers and bus bracing
ACLD	air cooled	BARO	barometer
ACSR	aluminum conduit or steel reinforced	BAS	building automation system
ACU	air conditioning unit	BCCMP	bituminous coated corrugated metal pipe
ACV	air control valve	BDD	backdraft damper
AD	area drain, automatic damper	BDF	building distribution frame
ADJ	adjust, adjustable	BF	boiler feed, bamboo flooring
A/E	Architect/Engineer	BFP	backflow preventer
AF	access flooring, air filter, amps frame	BFS	boiler feed system
AFD	adjustable frequency drive	BHC	booster heating coil
AFF	above finished floor	BKR	breaker
AFG	above finished grade	BKT	bracket
AFH	air filter housing	BL	bed locator, baseline
AFM	air flow meter	BLDG	building
AGGR	aggregate	BM	beam
AHU	air handling unit	BOF	bottom of footing
AIC	ampere interrupting capacity	BP	base plate
ALUM	aluminum	BR	bare root, bottom register, bullet resistive
ALT	alternate	BRG	bearing
AM	amplitude modulation, ammeter, acoustical material	BRZ	bronze
AMB	ambient	BS	barium sink
ANCT	acid neutralization tank	BSMT	basement
AMP	amplifier	BT	bathtub
ANOD	anodized	BUR	built-up roof
ANN	annunciator	BWS	brine water supply
ANS	automatic answer and recall switch	BWR	brine water return
ANT	antenna	C	conduit
APC	architectural precast concrete	C & G	curb and gutter
APD	air pressure drop	CA	cold air, cardiac arrest
ARCH	architectural	CAC	custom acoustical ceiling
ARR	arrester	CAD	cadmium
ASPH	asphalt	CALL	incoming call
AT	autotransformer	CANT	cantilever
ATS	automatic transfer switch	CAP	capacity
ATF	athletic flooring	CATV	community antenna television
ATM	atmosphere	CB	chalkboard, circuit breaker, catch basin
ATU	air terminal unit	CC	cooling coil
AUTO	automatic	CCT	cubical curtain track
AUX	auxiliary	CCTV	closed circuit television
AV	acid vent	CCW	counter clockwise
AW	acid waste	CD	ceiling diffuser, condensate drain, coiling door



CFCI	contractor furnished, contractor installed	CSMU	calcium silicate masonry unit
CFS	concrete floor sealer	CSS	clinical service sink
CFWC	composite fiber wall covering	CSV	cushioned sheet vinyl
CG	container grown, corner guard, coiling grille, center of gravity	CT	ceramic tile, cooling tower, current transformer, computer terminal
CGU	ceramic glazed units	C TO C	center to center
CH	chiller	CTR	center, cooling tower return, controlled time run
CHW	chilled drinking water	CTS	cooling tower supply
CI	cast iron	CU	condensing unit, copper
CIP	cast iron pipe, cast in place	CUH	cabinet unit heater
CIR	circulating	CULV	culvert
CJ	construction joint, control joint	CW	cold water, clockwise
CJP	complete joint penetration	CWS	chilled water supply, curtain wall system
CKS	control key switch	CWR	chilled water return
CKT	circuit		
CL	center line	D	delta, depth
CLG	ceiling, cooling	DB	dry bulb, decibel, direct bury
CLPR	clean low pressure steam return	DBA	deformed bar anchor
CLPS	clean low pressure steam supply	DBL	double
CLR	clear	DBT	dry bulb temperature
CM	Construction Manager	DC	direct current
CMP	corrugated metal pipe	DD	diversion dike
CMPA	corrugated metal pipe arch	DDC	direct digital control
CMPR	compressor, clean medium pressure steam return	DEMO	demolition, demolish
CMPS	clean medium pressure steam supply	DET	detail
CMU	concrete masonry unit	DF	drinking fountain
CO	cleanout, carbon monoxide	DIC	difference in conditions contract
CO2	carbon dioxide	DIFF	difference
COL	column	DIM	dimension
CONC	concrete	DISP	dispenser
COND	condition, condenser, condensing, condensation	DIP	ductile iron pipe
CONN	connection	DIST	distribution, distilled
CONST	construction	DIW	deionized water
CONT	continuous	DIWI	double-inlet, double-width
CONTR	contractor	DL	dead load
CONV	converter	DLF	decorative laminate flooring
CORR	corridor	DLO	daylight opening
CP	concrete pipe (non-reinforced),	DMPR	damper
CPD	condensate pump discharge	DN	down
CPR	change proposal request	DO	ditto
CPT	carpet	DP	data processing, differential pressure, dew point
CPTT	carpet tile	DPA	damper position adjustment
CPU	central processor unit	DPAN	distribution panel
CPVC	chlorinated polyvinyl chloride	DPF	decorative polymer fabrication
CR	control room, ceiling register, crash rail	DPS	door position switch
CRAF	clean room raised access flooring	DR	drain
CRCS	clean room ceiling system	DS	downspout
CRF	condensation resistance factor	DT	dew point temperature, drain tile
CRPS	clean room partition system	DTS	data transmission system
CRIT	critical	DW	display wall
CS	concrete stain, counter shutter	DWC	dry erase wall covering
CSI	current source inverters		



DWG	drawing	F	filter
DWH	domestic water heater	F TO F	face to face
DWL	dowel	FA	fire alarm, face area
DWV	drain, waste and vent	FC	foot control
DX	direct expansion	FCAN	full capacity above nominal
E SCAN	emergency medical status scan switch	FCBN	full capacity below nominal
EA	exhaust air, expansion anchor, each	FCO	floor clean out
EAH	exhaust hood	FCS	fire command station
EAT	entering air temperature	FCU	fan coil unit
EE	electrical engineer	FD	fire damper, floor drain
EEG	electro encephalograph	FDN	foundation
EF	exhaust fan	FDV	fire department valve
EFF	efficiency	FE	fire extinguisher, finished end
EFT	electric finned tube	FEC	fire extinguisher cabinet
EGS	ethylene glycol supply	FF	final filter
EGR	ethylene glycol return	FH	fire hose
EH	electric heater	FHC	fire hose cabinet
EIFS	exterior insulation finish system	FHV	fire hose valve
EJ	expansion joint	FIN	finished
EJC	expansion joint cover	FL	floor
EKG	electro cardiograph	FLA	full load amps
EL	elevation	FLUOR	fluorescent
ELEC	electrical	FM	frequency modulation radio
EM	electro-magnetic	FO	fiber optic
EMB	embedment	FOBB	fiber optic backbone
EMER	emergency	FOCC	fiber optic cross connect
EMI	electro-magnetic interference	FODC	fiber optic distribution cabinet
EMS	energy management system	FOF	fuel oil fill
EMT	electrical metallic tubing	FOR	fuel oil return
ENG	engine	FOS	fuel oil supply
ENGR	Engineer	FOSE	fiber optic service entrance
EO	exit only, electrically operated	FOV	fuel oil vent
EPDM	Ethylene Propylene Diene Monomer	FP	full penetration
EPR	ethylene propylene rubber	FR	fire retardant
EPT	electric power transfer	FRP	fiberglass reinforced plastic
EQ	equal	FS	floor sink
EQF	engineered quartz fabrication	FSD	flexible strip door
EQUIP	equipment	FSK	foil scrim kraft
ER	emergency room, exhaust register	FT	finned tube
ES	emergency shower	FTG	footing
EST	estimate	FURN	furnish
ET	expansion tank	FU	furnace unit
EV	evaporator	FUT	future
EVT	equiviscous temperature	FV	field verify, face velocity
EW	each way	FVC	fire valve cabinet
EWC	electric water cooler	FW	flammable waste
EWI	entering water temperature	FXTR	fixture
EXC	excavate		
EXH	exhaust	G	gas, ground, grille
EXP	expansion, exposed	GA	gauge, gage
EXIST	existing	GALV	galvanize(d)
EXT	exterior	GC	high build glazed coating, general contractor



GCWR	glycol chilled water return	HWC	hot water circulating
GCWS	glycol chilled water supply	HWS	hot water supply
GEN	generator	HWR	hot water return
GF	granular fill, granite flooring	HX	heat exchanger
GFI	ground fault interrupter	HZ	hertz
GFP	ground fault protection		
GFCI	ground fault circuit interrupter	IAQ	indoor air quality
GFRC	glass fiber reinforced cement	IC	intercom
GFRG	glass fiber reinforced gypsum	ICW	industrial cold water
GI	galvanized iron	ID	inside diameter
GL	glass	IG	isolated ground
GR	grade	IH	intake head
GUM	glass unit masonry	IHW	industrial hot water
GWB	gypsum wallboard	IMC	intermediate metal conduit
GWS	glycol water supply	INCAND	incandescent
GWR	glycol water return	INFO	information
GYP	gypsum	INSUL	insulation
GYWC	glass yarn wall covering	INT	interior
		INWC	inches water column
H	humidifier, height	I/O	input/output
HA	hot air	IPS	iron pipe size
H2O	water	IU	induction unit
HB	hose bibb, horizontal blinds	IV	intravenous
HBC	high build glazed coating	IVT	intravenous track
HC	heating coil	IWR	ice water return
HCWS	hot chilled water supply	IWS	ice water supply
HCWR	hot chilled water return		
HD	heavy duty	JC	Janitor's closet
HDG	hot dip galvanized	JT	joint
HDPE	high density polyethylene		
HDWD	hardwood	KO	knockout
HE	helium	KT	keyboard tray
HECMP	horizontal elliptical corrugated metal pipe	KSI	kips per square inch
HG	mercury		
HID	high intensity discharge	L	length, lavatory, lock
HK	hook	LA	lightning arrester
HM	hollow metal	LAT	leaving air temperature
HORIZ	horizontal	LAV	lavatory
HOSP	hospital grade	LC	lead covered
HP	heat pump, horse power, high point	LAHP	laboratory air (high pressure)
HPS	high pressure sodium, high pressure steam supply	LALP	laboratory air (low pressure)
HPR	high pressure steam return	LCD	liquid crystal display
HR	handrail, hour	LCW	laboratory cold water
H-STAT	humidistat	LD	linear diffuser, laboratory drain
HS	headed studs	LDW	less door width
HSB	high strength bolt	LED	light emitting diode
HT	heat	LF	limestone flooring
HTG	heating	LHWC	laboratory hot water circulating
HTR	heater	LIM	line isolation monitor
HV	high voltage	LIN	linear, lineal
HVAC	heating, ventilating and air conditioning	LL	liveload, lead lined
HW	hardware group, hot water	LLH	long leg horizontal



LLV	long leg vertical	MPR	medium pressure steam return
LMC	linear metal ceiling	MRGWB	mold and moisture resistant gypsum wallboard
LN	linoleum, liquid nitrogen	MS	mop sink, motion sensor
LONG	longitudinal	MSV	manufactured stone veneer
LP	low point	MTL	material
LPR	low pressure steam return	MTP	metal toilet partition
LPS	low pressure steam supply	MWP	metal wall panel
LR	linear return		
LRA	locked rotor amps	N2	nitrogen
LS	life safety, life support	NA	not applicable
LSH	long slotted holes	NAT	natural
LSS	lock status switch	NBD	narrow band data
LT	light	NBDC	narrow band data cabinet
LTGWR	low temperature glycol water return	NC	nurse call, normally closed, non-corrosive
LTGWS	low temperature glycol water supply	ND	normal duty
LV	low voltage	NDC	nose down curb
LVT	laboratory vent pipe	NDT	non-destructive testing
LVTR	laboratory vent through roof	NEG	negative
LW	lightweight, laboratory waste	NET	nylon entrance tile
LWIC	lightweight insulating concrete	NFWC	natural fiber wall covering
LWT	leaving water temperature	NWT	normal weight
		NI	nickel
M	meter	NIC	not in contract
MA	mixed air, make-up air	NP	non-plenum
MAS	masonry	NPO	non-plenum office
MATL	material	NPS	nominal pipe size
MATV	master antenna television	NPT	nominal pipe thread
MAU	make-up air unit	NO	number, normally open, nitrous oxide
MAX	maximum	NOM	nominal
MB	main breaker, markerboard	NR	noise reduction
MBH	thousand BTUH	NRC	noise reduction coefficient
MCB	main circuit breaker	NST	natural stone tile
MCC	motor control center	NTS	not to scale
MCP	motor circuit protector		
MD	manual damper, motion detector	O2	oxygen
MECH	mechanical	OA	outside air
MED	medicine, medical	OC	on center, overcurrent
MEK	methyl ethyl ketone	OCB	oil circuit breaker
MERC	mercury	OD	outside diameter, overflow roof drain
MET	metal	OF	overflow
MEZZ	mezzanine	OFCI	owner furnished, contractor installed
MF	marble flooring	OFOI	owner furnished, owner installed
MFR	manufacturer	OH	overhead
MGA	medical gas alarm	OPNG	opening
MH	manhole, metal halide	OPP	opposite
MIN	minimum	OPT	operators terminal
MISC	miscellaneous	OSD	open site drain
ML	metal laminate	OSL	outstanding leg
MLO	main lugs only		
MO	masonry opening, motor operated	P	pump, plenum
MOD	modified	P SCAN	Personal attention medical status scan
MP	medium pressure	PA	public address
MPS	medium pressure steam supply		



PB	push button, pull box, power brick	PWM	pulse width modulated
PBX	private board exchange		
PC	plug connector, portland cement	QT	quarry tile
PCC	portland cement concrete	QTB	quarry tile base
PCG	polycarbonate corner guard		
PCWR	process cooling water return	R	radius, rankine, riser, rubber sheath, register
PCWS	process cooling water supply	RA	return air
PD	pressure drop, pressure drain pipe	RAD	radiology
PE	Polyethylene	RB	resilient base
PERF	perforated	RCCP	reinforced concrete culvert pipe
PERM	permanent	RCF	riser connection field
PF	prefilter, power factor	RCG	recycled glass portland cement countertop
PFCC	power factor correction capacitor	RCP	reinforced concrete pipe, reflected ceiling plan
PFF	provision for future feeder	RCPT	receptacle
PH	phase	RCW	ribbon wall/ curtain wall
pH	measure of acidity/alkalinity	RD	roof drain
PH/O	phase	REC	recess, receiver
PHC	preheat coil	RECIRC	recirculate
PI	passive infrared	RED	reducing
PID	proportional-integral-derivative	REF	reference
PIV	post indicator valve	REFR	refrigerator
PL	property line, plate, pilot light, plastic laminate	REG	regulator, register
PLBG	plumbing	REINF	reinforcement
PLNJ	paper and lead neoprene jacket	REL A	relief air
PLS	pure live seed	REM	reminder light set and scan switch, removable
PNL	Panel		
PNT	paint	RET	retaining, return
PNTE	paint (epoxy)	REV	revise, revision, reversing, revolutions
PNTL	paint (latex)	RF	return fan, radio frequency
PNTLO	paint (low-odor)	RFI	request for information, radio frequency interference
PNSR	paint (stain resistant)	RFT	rubber floor tile
POL	polished	RGSC	rigid galvanized steel conduit
PP	partial penetration, pump plumbing	RH	relative humidity
PPCF	patch panel connection field	RHC	reheat coil
PPM	parts per million	RHD	relief hood
PR	pair	RI	rubber insulated
PRL	parallel	RTI	response time index
PROJ	project, projection	RL	refrigerant liquid, roof drain leader
PROP	property	RO	rough opening, reverse osmosis water
PROT	protective, protection	RP	radiant panel
PRV	pressure reducing valve, pressure relief valve	RR	radiation-resistant
PS	plaster sink, presence sensor, pull switch	RS	refrigerant suction, roller shade, resilient sheet
PT	printer, pneumatic tube, potential transformers, porcelain tile	RST	resilient stair tread
PTAC	packaged terminal air conditioner	RT	resilient tile
PTS	pneumatic tube station	RTP	reinforced thermosetting plastic
PVC	polyvinyl chloride	RTV	room temperature vulcanized
PVF	polyvinylidene fluoride	RTZ	urethane rubber terrazzo
PVMT	pavement	RV	reduced voltage, relief vent
PVS	polyvinyl spiral (pipe)	RVT	resilient vinyl tile
PW	purified water	R/W	right-of-way
PWC	purified water circulating	RW	return wall register
PWD	plywood		
		S	sink, soil (piping), sprinkler (piping),



	sanitary sewer
SA	shock absorber, supply air, sound attenuator
SAF	surge arrester field
SAN	sanitary
SAT	saturation
SDR	sound distribution rack
SB	sitz bath
SC	sill cock, shading coefficient
SCE	stabilized construction entrance
SCF	station connection field
SCH	schedule
SCR	silicone controlled rectifier
SCSV	static conductive sheet vinyl
SCT	station cable tray, static conductive tile
SCW	soft cold water
SCWR	secondary chilled water return
SCWS	secondary chilled water supply
SD	smoke damper, storm drain, sensing device
SDC	station distribution cabinet
SDOT	star-delta open transition
SDCT	star-delta-closed transition
SDRS	static dissipative resilient sheet flooring
SDRT	static dissipative resilient tile flooring
SEC	security
SECT	section
SEF	seamless epoxy flooring
SERV	service
SEOR	structural engineer of record
SF	supply fan, silt fence, square feet
SFD	smoke actuated fire damper
SFWC	synthetic fiber wall covering
SG	supply grille
SGB	signal grounding bus
SGD	sectional glass door
SGL	single
SH	shower, sensible heat
SHW	soft hot water
SHWC	soft hot water circulating
SIM	similar
SIWI	single-inlet, single-width
SL	sliding
SOG	slab on grade
SP	standpipe, sump pump, static pressure, single pole
SPA	setpoint adjustment, spaces
SPD	standpipe drain
SPDT	single pole double throw
SPEC	specification
SPKR	sprinkler, speaker
SPS	security pushbutton switch
SQ	square
SR	sheet rubber, supply register
SRV	safety relief valve

SS	service sink, sanitary sewer, stainless steel, storm sewer
SSCG	stainless steel corner guard
SSD	sectional steel door
SSF	solid surface fabrication
SSH	short slotted holes
SSS	surgeons' scrub sink, solid state starter
SST	stainless steel sink
ST	steam trap
STA	station, stationary
START	starter
STC	sound transmission class
STD	standard
STDWT	standard weight
STIFF	stiffener
STIR	stirrup
STN	stone
STM	steam
STOR	storage
STP	shielded twisted pair
STR	strainer
STRUCT	structural
SUF	seamless urethane flooring
SUSP	suspend(ed)
SV	sheet vinyl, steam vent
SVD	switched voice and data
SW	supply wall grille, switch, soft water, sidewalk
SWBD	switchboard
SWD	sectional wood door
SWC	soft wall covering
SWGR	switchgear
SX	steam exhaust
SYM	symmetrical
SYS	system
T	toilet, tank, temperature
T & B	testing and balancing, top and bottom
T & G	tongue and groove
TA	tempered air, transfer air, toilet accessories
TB	tackboard
TBB	tile backer board
TD	temperature differential
TDC	transverse duct connection
TEFC	totally enclosed fan-cooled
TEL	telephone
TEMP	temperature, temporary
TENV	totally enclosed non-ventilated
TERR	terrazzo
TERM	terminal
TFC	textured finish coating
TH	total heat, total head (pumps)
THD	Total Harmonic Distortion



TOC	top of curb, top of concrete	VOL	volume
TOF	top of footing	VP	vacuum pump, velocity pressure, venetian plaster
TONE	tone transfer	VR	vapor retarder
TOS	top of steel	VRI	variable volume with reheat interior
TOW	top of wall	VS	venturi station, vacuum (canister) slide
TP	total pressure, twisted pair	VSI	voltage source inverters
TPC	textured plastic coating	VT	vinyl tile
TPO	thermoplastic olefin	VTR	vent through roof
TPWC	thermoplastic olefin wallcovering	VV	variable volume
TR	top of register	VVR	variable volume with reheat
T-STAT	thermostat	VWC	vinyl wall covering
TSP	total static pressure		
TSU	thermal storage unit	W	width, waste (piping), water, wire
TU	terminal unit	W/	with
TV	television	WB	wet bulb
TVSS	transient voltage surge suppressor	WBT	wet bulb temperature
TX	transformer	WC	water closet
TYP	typical	WD	wood
		WDW	window
UC	undercounter	WF	wall fin, wood flooring
UD	underdrain	WG	water gauge, wall guard
UG	underground	WH	water heater, wall hydrant
UGE	underground electric	WHA	water hammer arrester
UGS	underground signal	WL	wind load
UGT	underground telephone	WLD	welded
UH	unit heater	WM	wattmeter
UHF	ultra high frequency	W/O	without
UNEX	unexcavated	WP	waterproofing, weatherproof, work point
UNO	unless noted otherwise	WPD	water pressure drop
UPS	uninterruptible power supply	WPF	waterproof flooring
UPWC	ultra pure water circulating	WS	wall switch, waterstop, water softener, waste stack
UPWR	ultra pure water return	WT	weight
UPWS	ultra pure water supply	WWR	welded wire reinforcement
UR	urinal		
US	utility sink, ultrasound	XFMR	transformer
UTIL	utility	XL	extra long
UV	ultraviolet	XLPE	cross linked polyethylene
		XP	explosion proof
V	valve, vent, velocity, vacuum	X-STR	extra strength
VAC	vacuum, volts alternating current		
VAV	variable air volume	YD	yard
VB	vapor barrier, vacuum breaker	YH	yard hydrant
VCG	vinyl corner guard	YR	year
VCP	vitrified clay pipe	Y,W	wye
VCPX	vitrified clay pipe, extra strength		
VD	volume damper	ZA	zone annunciator
VERT	vertical	ZN	zone
VEST	vestibule		
VF	ventilation fan	1P	one pole
VFD	variable frequency drive	2P	double pole
VHF	very high frequency		
VM	voltmeter		
VOC	volatile organic compound		



1S	single speed
2S	two speed
1W	one winding
2W	two winding

END OF SECTION



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SECTION 01 42 19

REFERENCE STANDARDS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Materials specified by reference to number, symbol, or title of a specified standard such as a State standard, commercial standard, federal specifications, ASTM or trade-association standard, or other similar standard shall comply with requirements in the revision thereof and any amendments or supplements thereto in effect on date execution of Contract.
- B. Standard referred to, except as modified herein, shall have full force and effect as though printed in these specification.
 - 1. These standards are not furnished to Contractor, since manufacturers and trades involved are assumed to be familiar with their requirements.
- C. By submitting a Bid, Contractor is deemed to represent self as competent to accomplish Work of this Division in conformance with applicable Codes. In case of conflict between the Contract Documents and Code requirements, the Codes shall take precedence. Should such conflicts appear, cease Work on parts of Contract affected and immediately contact Architect in writing. It shall be Contractor's responsibility to correct, at no cost to Owner, work Contractor executes in violation of Code requirements.

1.2 REFERENCE STANDARDS

- A. Perform Work in conformance with latest edition of applicable standards published at the time of Contract Award, including, but not limited to following:

AAMA	American Architectural Manufacturers Association
ASA	American Standard Association
AFI	Air Filter Institute
AMCA	Air Moving & Conditioning Association
ARI	Air Conditioning & Refrigerating and Air
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	ASTM International
AWI	American Woodwork Institute
AWS	American Welding Society
ANSI	American National Standards Institute
FGI	Facilities Guidelines Institute
FR	Federal Register - Volume 44, No. 106 by Department of Transportation
IEEE	Institute of Electrical and Electronic Engineers
IPCEA	Insulated Power Cable Engineers Association
ISA	Instrument Society of America
--	Joint Commission
NAAMM	National Association of Architectural Metal Manufacturers
NAFM	National Association of Fan Manufacturers
NEMA	National Electrical Manufacturer's Association
NESC	National Electrical Safety Code
NFPA	National Fire Protection Association
OSHA	Occupational Safety and Health Administration
PUC	Public Utilities Commission



SMACNA Sheet Metal and Air Conditioning Contractors National Association
UL UL
State and Municipal Codes in force in the Specific Project Area

- B. Exception: Where locally adopted Codes or authorities having jurisdiction otherwise stipulate a specific edition must be followed.
- C. Conflicts between referenced Standards: Comply with one establishing more stringent requirements.
- D. Conflicts between referenced Standards and Contract Documents: Comply with the one establishing more stringent requirements.

END OF SECTION



SECTION 01 43 43
COORDINATION DRAWINGS (GC)

PART 1 - GENERAL

1.1 DESCRIPTION - INTERIOR

- A. Coordinate construction operations included in various Sections of Specifications to assure efficient and orderly installation of all parts of Work. Coordinate construction operations included under different Sections that depend on each other for proper installation, connection, and operation.
- B. Coordination drawings: Reproducible overlay drawings showing work with horizontal and vertical dimensions to avoid interference with structural framing, ceilings, partitions, equipment, lights, mechanical, electrical, conveying systems, and other services:
 - 1. In and above ceilings.
 - 2. Within walls.
 - 3. Within chases and shafts.
 - 4. Under concrete floors on grade.
 - 5. In mechanical spaces.
 - 6. In electrical spaces.
 - 7. Below grade.
- C. Prepare coordination drawings where careful coordination is needed for installation of products and materials fabricated by separate entities.
- D. Prepare coordination drawings where limited space availability necessitates maximum utilization of space for efficient installation of different components.
- E. Coordinate installation of different components to assure maximum accessibility for required maintenance, service, and repair.
- F. Work out all “tight” conditions involving Work of various Sections in advance of installation.
- G. Sleeve, coredrill and blockout layout drawings:
 - 1. Drawings showing proposed locations and sizes of sleeves, coredrills blockouts, and embedded items in concrete walls, columns, floors and beams.
- H. Prior to start of work in any given area, each Subcontractor approve, in writing, coordination drawings affecting Subcontractor’s work in that area.
- I. Modifications required as result of failure to resolve interferences, provide correct coordination drawings, or call attention to changes required in other work as result of modifications shall be paid for by responsible Subcontractor.
- J. Coordination meetings scheduled by Contractor, with all affected Subcontractors.

1.2 PRODUCTION OF COORDINATION DRAWINGS

- A. Contractor provide minimum 1:50 1/4 IN scale plan, elevation and section drawings, showing:
 - 1. Partitions.
 - a. Fire/smoke rated barriers.
 - 2. Ceiling heights.
 - 3. Structural framing locations and elevations.
 - 4. Column lines.
 - 5. Support systems.
 - 6. Other work.



- B. Subcontractors produce combined coordination layout drawings plan and sections of HVAC ductwork, hydronic, steam, condensate, fuel oil, fire protection piping, plumbing, special water systems, natural gas and medical gas systems electrical cable tray, conduit, conveying systems, equipment, and other work.
- C. Resolve major interferences at initial coordination meeting prior to production of any drawings.
- D. Produce initial coordination drawings within 30 days after initial meeting.
- E. Contractor arrange for production of said drawings not provided by that time.
- F. Meet as required to resolve interferences and correct drawings.

1.3 AFTER APPROVAL

- A. After Subcontractors' written approval of coordination drawings, Contractor determine method used to resolve interferences not previously identified.
- B. Contractor give written approval of changes to coordination drawings prior to start of work in affected area.
- C. Maintain one copy of current approved Coordination Drawings at project site.

1.4 PRECEDENCE OF SERVICES FOR COORDINATION DRAWINGS

- A. In event of conflicts involving location and layout of work; use following priority to resolve disputes:
 - 1. Structure and partitions have highest priority.
 - 2. Equipment location and access.
 - 3. Support systems
 - 4. Ceiling system and recessed light fixtures.
 - 5. Gravity drainage lines.
 - 6. High pressure ductwork and devices.
 - 7. Large pipe mains, valves and devices.
 - 8. Pneumatic tube and material conveying systems.
 - 9. Low pressure ductwork, diffusers, registers, grilles, HVAC equipment.
 - 10. Fire protection piping, devices and heads.
 - 11. Small piping, tubing, electrical conduit, and devices.
 - a. Conduits installed in corridors shall be maintained at least 9 IN above finished ceiling. Conduits shall be grouped within a 12 IN width.
 - b. The space utilized for conduit shall be selected to allow access to all devices which normally require adjustment, repair, resetting, etc.
 - 12. Sleeves through rated partitions.
 - 13. Access panels.

1.5 PRODUCTION OF LAYOUT DRAWINGS

- A. Contractor provide scale plan and elevation drawings.
- B. Subcontractors indicate proposed location and size of their required sleeves, coredrills, blockouts and embedded items.
 - 1. At floor slabs and walls to be core drilled or cut, Find and mark all reinforcing in both faces located by means of x-ray, pach-ometer, or prof-ometer.
 - 2. Submit sketch showing location of rebar and proposed cores for review.

1.6 SUBMITTALS

- A. Project information:
 - 1. Contractor's approved Coordination Drawings.
 - a. Letter indicating one copy of approved Coordination Drawings available at project site.



- b. One copy of approved Coordination Drawings to Architect for information, if requested.
- 2. Contractor's proposed sleeve, coredrill and blockout layout drawings.
 - a. One copy of drawing to Architect for information.

END OF SECTION

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SECTION 01 45 00
QUALITY ASSURANCE AND CONTROL

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Quality assurance and control.
- B. Regulatory requirements.
- C. Tolerances.
- D. Manufacturer's field services.

1.2 QUALITY ASSURANCE AND CONTROL

- A. Monitor quality assurance and control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturer's instructions conflict with Contract Documents, request clarification from Architect before proceeding.
- D. Comply with specified standards as a minimum quality for Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Have Work performed by persons qualified and experienced to produce required or specified quality.
- F. Verify that field measurements are as indicated on approved shop drawings or as instructed by manufacturer of product.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.
- H. Materials shall be compatible with one another and with other materials with which they may come in contact.

1.3 SUPERVISION AND CONSTRUCTION PROCEDURES

- A. Contractor shall supervise and direct Work, using Contractor's best skill and attention.
- B. Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences and procedures and for coordinating all portions of Work under the Contract, unless Contract Documents give other specific instructions concerning these matters.
- C. Whether or not Contract Documents give specific instructions concerning construction means, methods, techniques, sequences or procedures, the Contractor shall review, substantiate, and comply with current industry execution standards and manufacturer's current execution instructions and evaluate jobsite safety thereof and shall be fully and solely responsible for jobsite safety of such means, methods, techniques, sequences or procedures.
 - 1. If Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely written notice to Owner and Architect and



shall not proceed with that portion of Work without further written instructions from Architect.

2. If Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without acceptance of changes proposed by Contractor, the Owner shall be solely responsible for any loss or damage arising solely from those Owner-required means, methods, techniques, sequences or procedures.
- D. Contractor shall be responsible to Owner for acts and omissions of Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of Work for, or on behalf of Contractor or any of its Subcontractors.
- E. Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.
- F. Contractor is solely responsible for coordination of scope of Work for its own forces, and of Subcontractors and suppliers, and to complete all Work, whether performed by the Contractor or a Subcontractor.
- G. Contractor shall employ Licensed Surveyor to locate and stake out Work and establish necessary reference and benchmarks.
 1. Work from established benchmarks and reference points, layout and correctly establish all lines, levels, grades, and locations of all parts of their own Work and be responsible for their accuracy and proper correlation with Work and established data.

1.4 REGULATORY REQUIREMENTS

- A. Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of Work.
- B. If Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction, including, but not limited to, any penalties, fines or other damages realized.
- C. When Contract Documents require Contractor, Subcontractor, Vendor or other supplier to provide selection or design of parts of Work, such selection or design shall meet requirements of Municipal, State or other governmental authorities having jurisdiction.

1.5 TOLERANCES

- A. Monitor fabrication and installation tolerance control of Products to produce approved Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.
- C. Adjust Products to appropriate dimensions; position before securing Products in place.

1.6 MANUFACTURER'S FIELD SERVICES AND REPORTS

- A. When field services are specified, have material or product suppliers, or manufacturers, provide technically competent staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment and supervise installation where specified, as applicable and to initiate instructions when necessary.
- B. Report observations, and site decisions or instructions given to applicators or installers which are supplemental or contrary to manufacturer's written instructions.



- C. Submit report in duplicate within 30 days of observation.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify existing site conditions and substrate surfaces are acceptable for subsequent work. Beginning new work means acceptance of existing conditions.
- B. Verify existing substrate is capable of structural support or attachment of new work being applied or attached.
- C. Examine and verify specific conditions described in individual Specification Sections.
- D. Verify that utility services are available, of correct characteristics, and in correct locations.

3.2 PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

END OF SECTION

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SECTION 01 45 23

TESTS AND INSPECTIONS

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

A. General:

1. Work shall be subject to inspection, testing and approval by testing agency, inspector and building official, or public authorities having jurisdiction.
2. Approval as result of inspection or testing shall not be construed to be an approval of a violation of provisions of Contract Documents, or by governing codes, laws, ordinances, rules or regulations.
3. Testing, inspections and approvals presuming to give authority to violate or cancel provisions of Contract Documents, or by governing codes, laws, ordinances, rules or regulations shall not be valid.
4. It shall be duty of Contractor to cause Work to remain accessible and exposed for testing and inspection purposes.
5. It shall be duty of Contractor to notify testing agency, inspector and building official or public authorities having jurisdiction when Work is in conformance with Contract Documents and is ready for testing and inspection.
6. It shall be duty of Owner and Contractor to provide access to, and means for testing and inspections of such Work required by Contract Documents, or by governing codes, laws, ordinances, rules or regulations.
7. Any portion that does not comply shall be corrected and shall not be covered or concealed until authorized by testing agency, inspector and public authorities having jurisdiction.
8. Tests, inspections and approvals of portions of Work required by Contract Documents or by codes, laws, ordinances, rules, regulations or orders of building official or public authorities having jurisdiction shall be made at an appropriate time.
9. Contractor shall give testing agency, inspector, building official or public authorities having jurisdiction, and Architect, if requested, timely notice of when and where tests and inspections are to be made so that they may be present for such procedures.
10. In event such procedures for testing, inspection and approval reveal portions of Work fail to comply with requirements established by Contract Documents, or by governing codes, laws, ordinances, rules or regulations, all costs made necessary by such failure, including those of repeated procedures and compensation for Architect's services and expenses, shall be at Contractor's expense.
11. Required certificates of testing, inspection and approval shall, unless otherwise required by Contract Documents, be secured by Contractor and promptly delivered to Architect, inspector, building official and public authorities having jurisdiction.
12. If Architect, Owner, building official, public authorities having jurisdiction, testing agency or inspector is to observe tests, inspections and approvals required by Contract Documents, or by governing codes, laws, ordinances, rules or regulations or orders of building official or public authorities having jurisdiction, they will do so promptly, and where practicable, at normal place of testing.
13. Construction or Work for which a building permit is required shall be subject to inspections by building officials and such construction or Work shall remain accessible and exposed for inspection purposes until approved.
 - a. Building officials is authorized to accept reports of approved inspection agencies, provided such agencies satisfy requirements as to qualifications and reliability.



- b. See governing codes, laws, ordinances, rules and regulations for additional requirements.
- B. Test and inspection method standards: See technical sections and governing codes, laws, ordinances, rules and regulations.
- C. Qualifications of independent testing agencies:
 - 1. Testing agency shall comply with governing codes, laws, ordinances, rules and regulations.
 - a. Testing agency shall provide all information necessary for building official to determine that testing agency meets applicable requirements.
 - b. Testing agency shall be objective, competent and independent from Contractor responsibility for Work being inspected.
 - c. Agency shall disclose possible conflicts of interest so that objectivity can be confirmed.
 - d. Agency shall have adequate equipment to perform required tests, and equipment shall be periodically calibrated.
 - e. Agency shall employ experienced personnel educated in conducting, supervising and evaluating tests and/or inspections.
 - f. See governing codes, laws, ordinances, rules and regulations for additional requirements.
 - 2. Meet American Council of Independent Laboratories, Recommended Requirements of Independent Laboratory Qualification, latest edition.
 - 3. Meet requirements of ASTM E329, Standards of Recommended Practice for Inspection and Testing Agencies for Concrete, Steel and Bituminous Materials as used in Construction, latest edition.
 - 4. Meet requirements of AASHTO Materials Reference Library (AMRL) R18 Standard Practice for Establishing and Implementing a Quality Management System for Construction Materials Testing Laboratories.
 - 5. Meet requirements of ISO/IEC 17025 General Requirements for the Competence of Testing and Calibration Laboratories.
 - 6. Satisfy inspection criteria of Materials Reference Laboratory of National Bureau of Standards.
 - 7. See technical sections for additional requirements.
 - 8. Testing agency for fenestrations shall be AAMA accredited testing company to perform AAMA tests for building enclosure components.
- D. Testing equipment calibration: Shall be by accredited calibration agency, at maximum 12 month intervals, by devices of accuracy traceable to either:
 - 1. National Institute of Standards and Technology.
- E. Special Inspections:
 - 1. Owner will employ one or more special inspectors to perform inspections during construction on types of Work required by governing codes.
 - a. These inspections are in addition to inspections by building officials having jurisdiction.
 - b. See governing codes, laws, ordinances, rules and regulations for additional requirements.
- F. Structural Observations:
 - 1. Owner will employ a registered design professional to perform structural observations as defined in the governing codes where required by provisions of governing codes.
 - a. See governing codes, laws, ordinances, rules and regulations for additional requirements.



1.2 DESCRIPTION

- A. Owner will arrange and pay for following testing and inspections performed by testing agency or special inspector:
 - 1. Special Inspections.
 - 2. Concrete testing and evaluation of installed work: Section 03 08 13.
 - 3. Concrete reinforcing testing and inspection: Section 03 20 00.
 - 4. Structural steel welding, bolts and stud testing and inspection, except testing to qualify welders: Section 05 12 00.
 - 5. Owner shall bear costs of tests, inspections or approvals which do not become requirements until after bids are received or negotiations concluded.
- B. Contractor arrange and bear all related costs for following tests, inspections and approvals with an independent testing agency or entity acceptable to Owner:
 - 1. Concrete testing for qualification of proposed materials, establishment of mix design, and for Contractor's convenience: Section 03 08 13.
 - 2. Structural steel welding testing to qualify welders: Section 05 12 00.
 - 3. Rebar locating for drilling, core drilling or cutting of concrete.
 - 4. Testing of manufacturers' products for compliance with specifications.
 - 5. All other testing and inspections specified.
 - 6. Testing and inspections of Contractor provided shoring or forming.
 - 7. Any additional inspection and testing required by public authorities having jurisdiction.
 - 8. Contractor's duties for Owner provided tests, as specified.
- C. Contractor shall arrange for, and bear all related costs for following with Owner provided independent testing agency, or entity acceptable to Owner:
 - 1. Re-testing due to failure of initial test or due to nonconformance with Contract Documents.
 - 2. Re-inspections of Work due to failure of Work to pass initial inspection or due to nonconformance with Contract Documents.

1.3 JOB CONDITIONS

- A. Employment of independent testing agency does not relieve obligation of Contractor to comply with Contract Documents.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 TESTS REQUIRED

- A. Tests required may include but not be limited to the following (all items listed here may not occur, see drawings and associated section of the specifications):
 - 1. Special Inspections including fabricators.
 - a. Welding.
 - b. High strength bolts.
 - c. Concrete.
 - d. Structural masonry.
 - e. Soils.
 - f. Sprayed fire-resistant materials.
 - g. Special cases as determined by the building official.

3.2 PERFORMANCE

- A. Perform indicated inspections, sampling and testing of materials and methods of construction.



- B. Use test and inspection or sampling methods or both conforming with methods indicated.
- C. Report each test and inspection or sampling or both as indicated.
- D. Report results called for by test method, in form specified.
- E. Retest failed products and systems.

3.3 REPORTS

- A. Submit reports and logs promptly to Architect, Structural Engineer, Contractor, inspector, and public authorities having jurisdiction.
- B. Include following for test or inspection reports or both:
 - 1. Project name and number.
 - 2. Project location.
 - 3. Product and specification section applicable.
 - 4. Type of test or inspection or both.
 - 5. Name of testing agency, if used.
 - 6. Name of testing or inspecting personnel, or both.
 - 7. Date of test or inspection or both.
 - 8. Record of field conditions encountered; i.e., temperature, weather.
 - 9. Test location.
 - 10. Observations regarding compliance.
 - 11. Test method used.
 - 12. Results of test.
 - 13. Date of report.
 - 14. Signature of testing or inspecting personnel or both.
- C. Maintain log of tests which have failed:
 - 1. Type of test or inspection or both.
 - 2. Date of test or inspection or both.
 - 3. Test or inspection number or both.
 - 4. Reason failed.
 - 5. Date of retest or inspection or both.
 - 6. Results of retest.
 - 7. Method of retest.

3.4 INDEPENDENT TESTING AGENCY DUTIES AND LIMITATIONS OF AUTHORITY

- A. Cooperate with Architect and Contractor.
- B. Provide qualified personnel promptly on notice.
- C. Promptly notify Architect and Contractor of irregularities, or deficiencies of work which are observed during performance of services.
- D. Testing agency is not authorized to:
 - 1. Release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Approve or accept any portion of Work.
 - 3. Perform any duties of Contractor.

3.5 CONTRACTOR'S DUTIES

- A. Cooperate with testing agency personnel, inspector and public authorities having jurisdiction and provide access to work.
- B. Provide preliminary representative samples of materials to be tested, in required quantities.
- C. Furnish copies of mill test reports.



- D. Furnish labor and facilities:
 - 1. To provide access to work to be tested.
 - 2. To obtain and handle samples at site.
 - 3. To facilitate inspections and tests.
 - 4. Storage and curing facilities for testing agency's exclusive use.
- E. It is duty of Contractor to notify building official and testing agencies when Work is ready for inspections.
- F. Construction or Work for which Special Inspections are required shall remain accessible and exposed for special inspections purposes until completion of required special inspections.
- G. It is duty of Contractor to provided access to and means for inspections by building officials and testing agencies of such Work that are required.
- H. Work shall not be done beyond point indicated in each successive inspection without first obtaining approval of building official.
- I. Any portion of Work that does not comply shall be corrected and such portions shall not be covered or concealed until authorized by building official.
- J. Notify appropriate testing agency, inspector or public authorities having jurisdiction sufficiently in advance of operations.

3.6 REPAIR AND PROTECTION

- A. General: Upon completion of inspection, testing, sample-taking and similar services, repair damaged construction and restore substrates and finishes to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes.
 - 1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.
- B. Protect construction exposed by or for quality control service activities, and protect repaired construction.
- C. Repair and protection is the Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing or similar services.

END OF SECTION

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SECTION 01 50 00

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 including, but not limited to, Owner's construction forces, Architect, occupants of project, testing agencies, and authorities having jurisdiction.
- B. Sewer Service: Pay sewer-service use charges for sewer usage, indicated by utility company meter readings, by all entities for construction operations.
- C. Water Service: Pay water service use charges for water used by all entities for construction operations.
- D. Electric Power Service: Pay electric power service use charges for electricity used by all entities for construction operations.

1.4 INFORMATION SUBMITTALS

- A. Dust- and HVAC-Control Plan at Renovation Work: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:
 - 1. Locations of dust-control partitions at each phase of work.
 - 2. HVAC system isolation schematic drawing.
 - 3. Location of proposed air-filtration system discharge.
 - 4. Waste handling procedures.
 - 5. Other dust-control measures.
- B. Temporary Utility Reports: Make available on request, reports of tests, inspections, meter readings, and similar procedures performed on temporary utilities.



C. Implementation and Termination Schedule: Make available on request a schedule indicating implementation and termination of each temporary utility.

1.5 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. 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.
- J. 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.
- K. 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 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 01 60 00

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

1. Make request to Architect in triplicate on copies of Request for Substitution form included at end of this Section.

2. 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.

3. Include related Section and Drawing number(s), and fully document compliance with requirements for substitutions.

4. 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.



5. Include identification of previous use locally with dates and names of Architect and Owner.
6. Anything less will not be considered.
7. 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.
8. 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.
9. 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.
10. 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.
11. Based on Architect's written recommendation of acceptance or rejection, Owner will determine acceptability of proposed substitutions.
12. 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.



13. 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

(a) 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: 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.

- 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 01 61 00
ACCEPTABLE MANUFACTURERS AND PRODUCTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Performance of product, material, or system is result of manufacturing, fabrication, installation procedures, use, and maintenance:
 - 1. Therefore, Architect endeavors to specify quality levels for products, materials, or systems that are advertised to conceptually meet performance goals and desired attributes for Project.
 - a. For most conceptually equal systems and materials, the Architect may specify multiple manufactures.
 - b. In some cases, based on quality and attribute goals for Project, number of manufacturers may be limited.
- B. Product, material, or system substitutions: See Section 00 26 00.

1.2 SPECIFYING METHODS AND PRODUCT OPTIONS

- A. Method 1: Products are specified by naming two or more manufacturers. Substitutions are not permitted. Any one of manufacturers named may be used that meet specified requirements.
- B. Method 2: Products are specified by naming one or more manufacturers. Substitutions are permitted. Any one of manufacturers named may be used that meet specified requirements. Submit a substitution request for any manufacturer not specifically named.
- C. Method 3: Proprietary: No Substitutions. Products are specified by naming only one manufacturer.
- D. Method 4: "Base" and "Optional": Products are shown or specified by naming one manufacturer as Base, "Basis of Design" or "Design Standard", with model numbers, dimensions or other identifying features. Other manufacturers are named as "Optional", and will be considered under following conditions:
 - 1. Base manufacturer:
 - a. Manufacturer listed as Base in Part 2 of specification section.
 - b. Manufacturer listed as Base is particular manufacturer of a specific product used as basis of design.
 - 2. Optional manufacturer:
 - a. Manufacturer listed as Optional in Part 2 of specification section.
 - b. More than one manufacturer may be listed as Optional.
 - c. Manufacturers listed as Optional are particular manufacturers of products similar to specific product used as basis of design.
 - d. Listing manufacturer as Optional indicates acceptance of that manufacturer as supplier of a product, but only to extent product complies with specified requirements, including salient qualities provided by Base manufacturer's product.
 - 1) Salient qualities include, but are not necessarily limited to following:
 - a) Purpose and function.
 - b) Material and finish.
 - c) Strength, durability and other applicable physical properties.
 - d) Compatibility and performance attributes for indicated application.
 - e) Capacity and operating characteristics, where applicable.



- f) Size and configuration to extent required for fit with adjoining and adjacent conditions and within spatial limitations.
 - g) Appearance, including exposed dimensions, profile, texture, pattern and color, where visible to personnel in finished space, or from exterior.
 - e. Contractor is responsible for costs to provide dimensional, operational, structural, utility or any other related adjustments to fit an Optional manufacturer's product into Work.
 - f. See Section 01 33 00 Submittal Procedures, for Optional Product/System Comparison Form.
 - 3. Base Product:
 - a. Indicates specific product or system used, including specified attributes assigned to that product or system, as basis for design.
 - b. Manufactures listed as Optional manufacturers may submit their equivalent products, but only if product complies with specified requirements, including salient qualities of Base Product.
 - 1) Products proposed by Optional manufactures must also comply with descriptive requirements listed in technical specification.
 - 2) Optional Products that obviously differ in appearance and quality of Base product will be rejected.
 - c. Refer to specification sections for additional requirements.
 - 4. Proposals shall be based on the Base Product.
 - 5. Proposals may be based on any of the manufacturers listed, provided that a Substitution Request is submitted with Bid for the "Optional Product".
 - 6. Submit a substitution request for any manufacturer not specifically named.
- E. Method 5: Generic: Products are specified by reference standard , by performance, by description or by any combination of the three specifying methods. Products meeting or exceeding specification requirements may be used. Contractor assumes responsibility for compatibility of products selected.

1.3 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. "Product(s)" means material, machinery, components, equipment, fixtures and systems forming Work. The term does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work. Products may also include existing materials or components required for reuse.
- C. New Products: Items not previously incorporated into another project or facility, except products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
- D. Materials: Products which must be substantially cut, shaped, worked, mixed, finished, refined, or otherwise fabricated, processed, installed, or applied to form units of Work.
- E. 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.).
- F. System: A unit of Work (i.e., structural system, vacuum system, etc.) shown or specified to include particular products, materials, appliances, equipment, or fixtures.



- G. 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.
- H. Prior-to-Bid Approvals: Products, materials, appliances, equipment, fixtures, or systems that have been proposed as substitutions and accepted by Owner prior to bid.

1.4 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.

1.5 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.

END OF SECTION



SECTION 01 65 00
DELIVERY, HANDLING AND STORAGE: MATERIALS AND EQUIPMENT

PART 1 - GENERAL

1.1 JOB CONDITIONS

- A. Comply with applicable codes.
- B. Accomplish work to avoid damage to property.
- C. Provide fire protection.

PART 2 - EXECUTION

2.1 PRODUCT DELIVERY

- A. By manufacturer's normal means.
- B. In original labeled containers.
- C. Where applicable, with UL labeling on packages.
- D. Contractor responsible for acceptance at site.
- E. Schedule deliveries to avoid delaying Work, and to minimize space and duration of storage on site.
- F. Sequence deliveries to avoid unnecessary additional construction of temporary protection.
- G. Schedule and coordinate deliveries to avoid interference with Owner's operation.
- H. Inspect items for damage upon delivery, reorder as required to avoid delays.

2.2 PRODUCT HANDLING AND STORAGE

- A. Use methods to avoid damage to item or structure.
- B. Protect weather fragile items from weather damage.
- C. Handle and store bulk aggregates to avoid contamination.
- D. Store to allow air circulation.
- E. Store only in authorized areas.
- F. Coordinate on site storage with Owner and other contractors working on site.
- G. Replace or repair damaged items.
- H. Uncrate, assemble if required, and remove debris.
- I. When off-site storage is utilized, move items to site at no added cost.



2.3 CLEANUP

- A. Remove excess materials from site.
- B. Turn over to Owner, excess materials scheduled to remain.
- C. Clean debris from site and storage area.
- D. Restore site storage areas to original condition or as directed by Architect or Owner.

END OF SECTION



SECTION 01 71 21

SPECIALTY ENGINEERING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish engineering design, drawings and calculations for Specialty Engineering Requirements, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 DEFINITIONS

- A. Structural Engineer of Record (SER):
 - 1. Structural engineer legally eligible to seal structural Contract Documents for project.
 - 2. Seal acknowledges SER performed or supervised analysis, design, and document preparation for building structure and has knowledge of requirements for structural system.
 - 3. The SER is responsible for the design of the primary structural system.
- B. Specialty Structural Engineer (SSE):
 - 1. Registered Engineer other than Structural Engineer of Record (SER), licensed to practice structural engineering in state in which project is located.
 - 2. Undertakes engineering calculations, design and drawing preparation of components, systems, or installation methods and equipment for specific temporary portions of Work or special items of permanent Work required to be furnished by Contractor.
 - 3. Provide designs and details for items of permanent Work declared to be minor or non-structural.
 - 4. Employee or officer of Contractor or fabricator, employee or officer of an entity providing components to a fabricator, or an independent consultant.

PART 2 - MATERIALS

2.1 NOT USED

PART 3 - EXECUTION

3.1 SYSTEM DESIGN

- A. Contract Documents show conceptually detailed components describing aesthetic intent and provides a performance-type prescription for the design, fabrication and installation.
- B. Contractor is responsible for the engineering and design of components and materials as well as fabrication and installation.
- C. Develop conditions not shown in Contract Documents to same level of aesthetics in compliance with performance and aesthetic criteria specified and indicated for detailed areas.
- D. Provide engineering design with drawings and calculations sealed by registered Engineer, licensed to practice structural engineering in State of Utah.
- E. Comply with requirements of Contract Documents, codes, regulations, standards and guidelines including:
 - 1. Nationally published amendments.
 - 2. Local Amendments.



3. Structural criteria provided.
 4. Additional requirements indicated in specification sections.
- F. Reference Standards:
1. Refer to technical specification sections for listed standards.
 2. Refer to Section 01 42 19 for edition of each standard indicated.
- G. Minor deviations in dimensions and profiles may be considered provided design concept is unchanged or intended performance is not compromised as judged by the Architect.
- H. Where SSE exercises professional judgment and takes exception to specified criteria or reference standards, disclose exception in writing.

3.2 DOCUMENTATION

- A. Include following items common to project:
1. Project Identification
 - a. Project name
 - b. Project location
 - c. Identifying project numbers
 - d. North arrow
 - e. Scale
 2. Governing Codes
 - a. Building code and edition
 - b. Referenced codes and standards
 - c. Design method used for the design
 3. Service Loads
 4. Strength loads or factors
 5. Design Load
 - a. Dead loads
 - b. Live loads
 - c. Snow loads
 - d. Wind loads
 - e. Seismic loads
 6. Material Properties
 - a. Design properties
 - b. ASTM designations
 7. Computer Submittals
 - a. Documentation of computer programs including the program name and version should be included with any submittal of computer calculations. In the case of custom software or spreadsheet developed in house it may be necessary to provide hand calculation of representative elements to verify the use of the program.
- B. Include maximum design loads at connection points to primary structure.
1. Indicate values consistent with method used for design including service loads or strength loads with factors.
 2. Design system to apply loads to the structure through the centerlines of the supporting element.
 3. Assume building supports are free to rotate. Torsional or flexural fixed supports shall not be used unless approved by the SER.
 4. When fixed or eccentric supports are used, provide additional framing as deemed necessary by the SER at no additional cost.
- C. Include member sizes, required reinforcing, connection details and material specifications.



- D. Include statements where the SSE has exercised professional judgment and takes exception to the specified criteria or referenced standard. Final authority and responsibility for decisions concerning structural design criteria shall belong to the SER. When exceptions are stated as qualifications to the contractor's proposal, the SER shall be notified and respond prior to award.
- E. SSE shall review and approve the shop drawings and special erection drawings prepared by a fabricator or supplier and attest to that review with a signed shop drawing stamp, or other means, prior to submittal of the drawings to the SER. When standardized erection drawings are used, there is no need to provide a shop drawing approval stamp.

END OF SECTION

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SECTION 01 71 23

FIELD ENGINEERING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Field Engineering, as indicated, in accordance with provisions of Contract Documents.
- B. Coordinate with work of other trades.

1.2 SUBMITTALS

- A. Project Information:
 - 1. Submit qualifications of surveyor.
 - 2. Submit contact information of Land Surveyor prior to beginning of survey work.
 - 3. As Built Documentation:
 - a. Submit survey location of following at each level as construction progresses:
 - 1) Centerline location and dimensions of columns and load bearing walls.
 - 2) Slab edge location and alignment with respect to design grid line
 - b. Verify survey location is within specified tolerance.
 - c. Certification shall be submitted within 10 working days following completion of building frame.
 - d. Where survey indicates items are outside specified tolerance, obtain approval of plan for corrective work prior to enclosing or modifying.
- B. Contract Closeout Information:
 - 1. Submit documentation verifying accuracy of survey work.
 - 2. Submit certificate prepared and signed by Land Surveyor, indicating elevations and locations of work in conformance with Contract Documents.

1.3 QUALITY ASSURANCE

- A. Employ Land Surveyor registered in State in which project is located.

PART 2 - PRODUCTS – (NOT USED)

PART 3 - EXECUTION

3.1 PROJECT RECORD DOCUMENTS

- A. Maintain complete and accurate log of control and survey work as it progresses.
- B. Prior to start of construction, prepare certified survey illustrating locations of existing structures and verifying control dimensions and grid layout of new work.
- C. On completion of foundation walls and major site improvements, prepare certified survey illustrating dimensions, locations, angles and elevations of construction and site work.
- D. On completion of structural frame prepare certified survey documenting as built construction as described in Paragraph 1.2B.
- E. Submit Record Documents under provisions of Section 01 78 39.



3.2 SURVEY REFERENCE POINTS

- A. Verify location of survey control and reference points prior to starting work.
- B. Verify location of existing structures and control dimensions to new work.
- C. Promptly report any discrepancies discovered.
- D. Control datum for survey is that established by Owner provided survey indicated on Drawings.
- E. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- F. Promptly report loss or destruction of any reference point or relocation required due to change in grade or other reasons.
- G. Replace dislocated survey control points based on original survey control.
- H. Make no changes without prior written notice to Architect.

3.3 SURVEY REQUIREMENTS

- A. Provide field engineering services. Use recognized engineering survey practices.
- B. Establish a minimum of two permanent bench marks on site, referenced to established control points. Record locations, with horizontal and vertical data, on Project Record Documents.
- C. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
 - 1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations
 - 2. Grid or axis for structures.
 - 3. Building foundation, column locations, ground floor elevations
- D. Periodically verify layouts by same means.

END OF SECTION

SECTION 01 73 00

EXECUTION REQUIREMENTS

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 general procedural requirements governing execution of the Work including, but not limited to, the following:
 - 1. Construction layout.
 - 2. Field engineering and surveying.
 - 3. General installation of products.
 - 4. Progress cleaning.
 - 5. Starting and adjusting.
 - 6. Protection of installed construction.
 - 7. Correction of the Work.
- B. Related Sections include the following:
 - 1. Section 01 31 00 "Project Management and Coordination" for procedures for coordinating field engineering with other construction activities.
 - 2. Section 01 33 00 "Submittals" for administrative submittals and also product and procedural submittals.
 - 3. Section 01 77 00 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

1.3 SUBMITTALS

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.
 - 1. Before construction, verify the location and points of connection of utility services.
- B. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other



construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

C. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
 - a. Description of the Work.
 - b. List of detrimental conditions, including substrates.
 - c. List of unacceptable installation tolerances.
 - d. Recommended corrections.
2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect and Owner not less than two business days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's and Owner's written permission.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.



3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.

3.5 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb and make horizontal work level.
 - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - 3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
 - 4. Maintain minimum headroom clearance as indicated in spaces without a suspended ceiling.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- F. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 - 2. Allow for building movement, including thermal expansion and contraction.
- G. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- H. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.
 - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 - 2. Do not hold materials more than 7 days during normal weather or 3 days if the



- temperature is expected to rise above 80 deg F (27 deg C).
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
1. Remove liquid spills promptly.
 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Cutting and Patching: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.
1. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.
- H. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.
- I. Protection: During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- J. Maintenance: Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure smooth operation without damaging effects.
- K. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.7 DUST CONTROL

- A. The Contractor shall be responsible to provide continuous (7 days per week, 24 hours per day) fugitive dust control measures within the limits of the construction site, related sites and adjacent streets and roads. Dust control shall be provided for, but not be specifically limited to, the stabilization of unpaved roads, haul roads, access roads, spoil sites, borrow



and material sources, excavations, embankments, stockpiles, and all other areas which become potential sources of dust as a result of construction activities.

- B. Contractor's dust control measures shall maintain compliance with the General Utah Air Pollution Regulations, R446 - Utah Air Conservation Regulations, Section 4.5, Fugitive Emissions, applicable County Air Pollution Control Ordinances, and as directed by the Architect. Dust control measures shall include but not be limited to the following:
 - 1. Wetting of surfaces with water as appropriate.
 - 2. Minimizing surface disturbances.
- C. In order to control fugitive dust emissions, Contractor shall apply the following procedures and techniques:
 - 1. Cover loads of materials, debris and waste materials taken from construction sites as needed to suppress dust during transit.
 - 2. Water down or apply other approved dust control measures to the construction site, haul roads and public access roads as needed to suppress dust.
 - 3. All mud and dirt shall be removed from vehicles prior to entering a paved or graveled area or road. Any mud or dirt that is carried out onto paved or graveled surfaces shall be removed from surfaces immediately and no less than daily.

3.8 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 1 Section "Quality Requirements."

3.9 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.10 CORRECTION OF THE WORK

- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 2 Section "Cutting and Patching."
 - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.



- B. Restore permanent facilities used during construction to their specified condition.
- C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION

SECTION 01 73 29

CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

- A. This section covers all cut and patch work either in remodel, add-on or new construction as necessary for the execution of the Work.
- B. Completely coordinate with the work of other trades.

1.2 QUALITY ASSURANCE

- A. Employ skilled personnel to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.
- B. Written Requests:
 - 1. Submit requests in advance of cutting or alteration which affects:
 - a. Structural integrity of any component of Project.
 - b. Integrity of weather-exposed or moisture-resistant component.
 - c. Efficiency, maintenance, or safety of any operational component.
 - d. Visual qualities of sight-exposed components.
 - e. Work of Owner or separate contractor.
 - 2. Include in Request:
 - a. Location and description of affected work.
 - b. Necessity for cutting or alteration.
 - c. Description of proposed work, and products to be used.
 - d. Alternatives to cutting and patching.
 - e. Effect on work of Owner or separate contractor.
 - f. Written permission of affected separate contractor.
 - g. Date and time work will be executed.
- C. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would change their load-carrying capacity or load-deflection ratio.
 - 1. Follow applicable NFPA Standards when torch cutting is required.
- D. To the greatest extent practicable, employ original installer to perform cutting and patching for weather-exposed and moisture-resistant components, and sight-exposed surfaces. On existing work, employ persons experienced with material requiring cutting and patching.
- E. Operational Limitations: do not cut and patch operating elements or related components in a manner that would result in reducing their capacity to perform as intended. Do not cut and patch operating elements or related components in a manner that would result in increased maintenance or decreased operational life or safety.
- F. Visual Requirements: Do not cut and patch construction exposed on exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic or visual qualities. Do not cut and patch construction in a manner that would result in visual evidence of cutting and patching. Remove and replace construction which was cut and patched in a visually unsatisfactory manner.



- G. Warranty or existing warranties: Replace, patch, and repair material and surfaces cut or damaged by methods and with materials in such a manner as not to void any warranties required or existing.

1.3 DESCRIPTION

- A. Install Work in such a manner and sequence as to preclude or minimize cutting and patching of new Work.
- B. Execute cutting (including excavation), fitting or patching of Work, required to:
 - 1. Make several parts fit properly.
 - 2. Uncover Work to provide for installation of ill timed Work.
 - 3. Remove and replace defective Work.
 - 4. Remove and replace non-conforming Work.
 - 5. Remove samples of installed Work for testing.
 - 6. Install specified Work in existing construction.
 - 7. Provide rerouting penetrations of non-structural surfaces for installation of piping and electrical conduit.
 - 8. Patch and repair fireproofing damaged after installation of other Work or demolition activities.
 - 9. Remove and finish construction at connections to other structures.
 - 10. Remove existing roofing where required by new Work, and patch to match existing roofing.
 - a. Where existing work is altered to patch in new products with existing, protect integrity of existing membrane at tie-ins.
 - b. Protect vapor barriers, underlayment, insulation, air barriers and seals to remain.
 - c. Ensure existing systems are completely functional.
- C. Do not endanger any Work or any Work of other Contractors, by cutting, excavating, or otherwise altering any Work except with written consent of Contractor subject to review by Architect.
- D. Do not cut into or cut away any structural concrete or other structural members, any other concrete nor dig under any foundations or into structural walls or other parts, or in any case allow same to be done without full knowledge and written consent of Architect.
- E. Be responsible for damage resulting from violation of these provisions.
- F. Use only firms or individual trades qualified to perform Work required under this Section.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. Sleeve and Opening Drawings: For only those conditions specified submit dimensioned drawings showing position and size of sleeves and openings in relation to equipment, other structural and non-structural assemblies, and with reference to dimensional grid of building.
- B. Product data/samples: Replacement material samples shall be approved by Owner. Prior to any mismatched substitution is installed on/in building.

1.5 JOB CONDITIONS

- A. Before start of Work, obtain and pay for all permits required by all authorities having jurisdiction and notify all interested utilities companies.
- B. Obtain approval of Owner and authorities having jurisdiction for Work which affects existing exitways, exit stairs, means of egress, or access to, or exit from, areas.
 - 1. Review with and obtain approval of authorities for any temporary construction which affects such areas.



- C. Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- D. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- E. Avoid cutting existing utilities, pipe, conduit, or ductwork serving the building but scheduled to be removed or relocated until alternate provisions have been provided.
- F. Items to be salvaged and delivered to Owner shall be carefully removed and properly stored in an area easily accessible for removal by Owner.

1.6 PAYMENT FOR COSTS

- A. Costs caused by non-coordinated or defective Work, or Work not conforming to Contract Documents, paid by Contractor responsible for non-coordinated, rejected, or non-conforming Work.

PART 2 - PRODUCTS

2.1 MATERIALS - GENERAL

- A. Use materials identical to existing materials.
- B. For exposed surfaces, use materials that visually match existing adjacent surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible if identical materials are unavailable or cannot be used.
- C. Use materials whose installed performance will equal or surpass that of existing materials.
- D. Where applicable, comply with specifications for type of Work to be performed.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Prior to the bid, review all existing facilities that are related to this contract and shall be familiar with all utility requirements and construction.
 - 1. Existing facility documents may be available through the Owner for review.
- B. Perform preliminary investigations as required to ascertain extent of Work.
 - 1. Conditions which would be apparent by such investigation will not be allowed as cause for claims for extra costs.
- C. Inspect existing conditions for work, including elements subject to movement or damage during:
 - 1. Cutting and patching.
 - 2. Excavating and backfilling.
- D. If unsafe or unsatisfactory conditions are encountered, take corrective action before proceeding.
- E. Before proceeding, meet at Project Site with parties involved in cutting and patching, including mechanical and electrical trades.
 - 1. Review areas of potential interference and conflict.
 - 2. Coordinate procedures and resolve potential conflicts before proceeding.
- F. After uncovering existing conditions for Work, inspect conditions affecting installation of new products or Work.



3.2 PREPARATION PRIOR TO CUTTING

- A. Provide adequate shoring, bracing and support as required to maintain structural integrity of Project.
- B. Provide protection for other portions of Project which may be affected.
- C. Provide protection from elements when required.
- D. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- E. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.
- F. Maintain excavations free of water.

3.3 CUTTING AND REMOVAL - GENERAL

- A. Execute fitting and adjustment to provide finished installation to comply with specified tolerances and finishes.
- B. Execute cutting by methods which will prevent damage to existing or other Work and will provide proper surfaces to receive installation of new Work.
- C. Perform backfilling as specified in applicable sections.
- D. Neatly cut and remove materials, and prepare all openings to receive new work.
- E. Remove masonry or concrete in small sections.
- F. Provide shoring, bracing, and other supports to prevent movement, settlement, or collapse of remaining or adjacent wall areas, structure, or facilities.
- G. Arrange shoring, bracing, and supports to prevent overloading of structure.
- H. Take all precautions necessary to prevent damage to existing remaining work or to adjacent facilities. Return damaged components to better than found status.
- I. Execute Work using methods which will prevent interference with use of remaining and adjacent facilities by Owner.
- J. Remove existing work indicated to be removed, or as necessary for installation of new Work.
- K. Provide for cutting, fitting, repairing, patching and finishing of Work disturbed by installation of new Work.
- L. Do not remove or damage fireproofing materials.
 - 1. Install hangers, inserts, supports, and anchors prior to installation of fireproofing.
 - 2. Repair or replace damaged fireproofing.

3.4 CUTTING

- A. Cut existing construction to:
 - 1. Provide for installation of other components or performance of other construction activities, and subsequent fitting and patching to restore surfaces to their original condition.
 - 2. Fit products together, to integrate with other work.
 - 3. Uncover work to install ill-timed work.
 - 4. Remove and replace defective and non-conforming work.
 - 5. Provide openings for mechanical and electrical penetrations.



- B. Cut existing construction using methods least likely to damage components to be retained or adjoining construction. Where possible, review proposed procedures with original installer. Comply with original installer's recommendations.
 - 1. In general, where cutting is required, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots neatly to size required, with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. To avoid marring existing finished surfaces, cut or drill from exposed or finished side into concealed surfaces.
 - 3. Cut through concrete and masonry using a carborundum saw or diamond core drill.
 - 4. Comply with requirements of applicable Sections of Division 31, where cutting and patching requires excavating and backfilling.
 - 5. Where portions of utility services are shown or required to be removed, relocated or abandoned, bypass those portions shown to remain before cutting. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after bypassing and cutting.

3.5 CUTTING IN STEEL FRAME AND METAL DECK CONSTRUCTION

- A. Do not cut nor drill holes in webs and flanges of columns, beams, and purlins without prior written approval of Structural Engineer.
 - 1. When approval is obtained, comply with requirements and instructions of Structural Engineer and provide reinforcing at such locations when required.
- B. When openings are cut into metal decks having cast-in-place concrete slab over metal deck:
 - 1. No reinforcing of holes is required for circular openings or sleeves up to 6 IN diameter and for rectangular openings having no side dimension greater than 6 IN.
 - 2. Reinforce openings greater than 6 IN.
 - 3. Obtain prior written approval of Structural Engineer for openings not shown on architectural or structural drawings.
 - a. Comply with additional requirements and instructions of Structural Engineer.
- C. When openings are cut into metal roof decks that have no concrete cast-in-place (except lightweight insulating cementitious roof fill) over deck:
 - 1. No reinforcing of holes is required for circular openings less than 6 IN diameter and for rectangular openings having no side dimension greater than 6 IN.
 - 2. Reinforce openings between 6 IN and 12 IN, with 20 GA flat steel sheet 12 IN greater in dimension than opening; fusion weld to top surface of deck at each corner and on each side midway between corners.
 - 3. Do not cut openings greater than 12 IN without prior written approval of Structural Engineer.
 - a. Comply with requirements and instruction of Structural Engineer.

3.6 MATCHING AND PATCHING

- A. Where items are removed from existing walls, ceilings, floors or partitions to remain, repair wall, ceiling, floor or partition disturbed by removal.
- B. Where walls, ceilings, floors or partitions are removed, repair abutting walls, ceilings or floors disturbed by removal.
- C. Where existing construction is cut, removed or otherwise disturbed to permit installation of new Work, match and patch existing disturbed construction.
- D. Use methods and materials similar in appearance, and equal in quality to areas or surfaces being repaired.



- E. Restore Work which has been cut or removed; install new products to provide completed Work in accord with requirements of Contract Documents.
- F. Patch Work must in every way possible match existing work and adjacent surfaces.
- G. Refinish entire surfaces as necessary to provide an even finish to match adjacent finishes.
 - 1. Refinish continuous surfaces to nearest intersections.
 - 2. Assembly - entire refinishing.
- H. In existing areas remove and replace existing ceilings and finishes for installation of Work, if not shown to be removed on Architectural Drawings and Schedules.
 - 1. If existing ceiling can not be satisfactorily reinstalled, replace with like materials and construction.
 - 2. Replace damaged construction with like materials.

END OF SECTION

SECTION 01 74 19

CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The Owner has established that this Project shall include proactive measures for waste management participation by all parties to the contract.
 - 1. The purpose of this program is to ensure that during the course of the Project all diligent means are employed to pursue practical and economically feasible waste management and recycling options.
 - 2. Upon award, each subcontractor shall be required to furnish documentation from suppliers or manufacturers regarding waste management and recycling options for those products and procedures furnished.
 - 3. Waste disposal to landfills shall be minimized.
- B. Definitions:
 - 1. Waste: Any material that has reached the end of its intended use. Waste includes salvageable, returnable, recyclable and reusable construction materials that would otherwise be discarded or destroyed.
 - 2. Construction waste: Solid wastes including, but not limited to, building materials, packaging materials, debris and trash resulting from construction operations.
 - 3. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or Waste to Energy facility acceptable to authorities having jurisdiction.
 - 4. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
 - 5. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
 - 6. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the work.
 - 7. Hazardous waste: Any material or byproduct of construction that is regulated by the Environmental Protection Agency and that may not be disposed in any landfill or other waste end-source without adherence to applicable laws.
 - 8. Trash: Any product or material unable to be returned, reused, recycled or salvaged.
 - 9. Landfill: Any public or private business involved in the practice of trash disposal.
 - 10. Waste Management Plan: A Project-related plan for the collection, transportation, and disposal of the waste generated at the construction site.

1.2 PERFORMANCE GOALS AND REQUIREMENTS

- A. General: Develop Waste Management Plan that results in end-of-Project rates for salvage/recycling of a minimum of 75 percent by weight of total waste generated by the Work.
- B. Salvage/Recycle Goals: Owner's goal is to salvage and recycle as much nonhazardous demolition and construction waste as possible.
- C. Divert at least 75% of the total construction and demolition material; diverted materials must include at least five material streams, both structural and nonstructural.
 - 1. Commingled waste counts as one material stream, unless the sorting facility can separate the commingled waste off-site into separate material streams.



2. If commingled waste is used on-site, the contracted waste management company must provide an itemized breakdown of the five material streams that are diverted from the landfill.

1.3 SUBMITTALS

- A. Project Information:
 1. Construction Waste Management Plan.
 2. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit copies of report. Include separate report for demolition and construction waste. Include the following information:
 - a. Material category.
 - b. Total quantity of waste in tons.
 3. Quantity of waste salvaged, both estimated and actual in tons.
 - a. Quantity of waste recycled, both estimated and actual in tons.
 - b. Total quantity of waste recovered (salvaged plus recycled) in tons.
 - c. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
 4. Waste Reduction Calculations: Before request for Substantial Completion, submit copies of calculated end of Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
 5. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
 6. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
 7. Recycling and Processing Facility Records: Indicate receipt and acceptance of waste by landfills and Waste to Energy facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
 8. Landfill and Waste to Energy Disposal Records: Indicate receipt and acceptance of waste by landfills and Waste to Energy or facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
 - a. Incineration of waste materials is not acceptable.
 9. Alternative Daily Cover (ADC) Records: Indicate receipt and acceptance of waste by landfills for ADC. ADC does not qualify as material diverted from disposal.
- B. Qualification Data: For refrigerant recovery technician.
- C. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.4 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.
- B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Waste Management Conference: Project Manager shall conduct conference at Project site to review methods and procedures related to waste management including but not limited to, the following:
 1. Review and discuss Waste Management Plan.
 2. Review requirements for documenting quantities of each type of waste and its disposition.



3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
5. Review waste management requirements for each trade.

1.5 CONSTRUCTION WASTE MANAGEMENT PLAN

- A. General: Develop plan consisting of waste identification, waste reduction work plan, and cost/revenue analysis. Include separate sections in plan for demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of demolition, land-clearing and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed in landfill or Waste to Energy facilities. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
 1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
 2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone number.
 3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
 4. Recycled Materials: Assign recycling to recycling subcontractor, or list local receivers and processors, and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
 5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and Waste to Energy facility. List hazardous material waste and disposal separately.
 6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.
- D. Waste Management Plan shall include locations of sorting and waste storage facilities on Site Plan of project.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 CONSTRUCTION WASTE MANAGEMENT PLAN IMPLEMENTATION

- A. Implement waste management plan as approved by Architect and Owner. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract. Comply with the following procedures:
 1. Define specific areas to facilitate separation of materials for recycling, salvage, reuse or return.
 2. Separate construction waste by type at Project site to the maximum extent practical.



3. Recycle and waste bin areas are to be maintained in an orderly manner and clearly marked to avoid contamination of materials. Inspect containers and bins weekly for contamination and remove contaminated materials if found.
 4. Do not mix recyclable materials.
 5. Stockpile processed materials on site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 6. Store materials away from construction area. Do not store within drip line of remaining trees.
 7. Store components off the ground and protect from weather.
 8. Remove construction waste off Owner's property and transport to appropriate receiver or processor.
- B. Hazardous Wastes: Store in secure areas and comply with the following:
1. Hazardous wastes shall be separated, stored and disposed of in accordance with local and EPA regulations and additional criteria listed below:
 - a. Building products manufactured with PVC or containing chlorinated compounds shall not be incinerated.
 - b. Disposal of fluorescent tubes and ballasts to open containers is not permitted.
 - c. Disposal of building elements containing mercury to open containers is not permitted.
- C. Unused fertilizers shall not be co-mingled with construction waste.
- D. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
1. Distribute waste management plan to everyone concerned within seven days of submittal return.
 2. Distribute waste management plan to entities when they first begin work on site. Review plan procedures and locations established for salvage, recycling, and disposal.
- E. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
1. Designate and label specific areas on Project site necessary for separating materials that are to salvaged, recycled, reused, donated, and sold.
 2. Comply with environmental controls specified in Division 01 Section 01 50 00 Temporary Facilities, Construction Controls and Facilities.
- F. Submit "Waste Reduction Progress Reports" each month as part of Application For Payment.
- a. Materials identified in the Report shall be reported by weight.
 - b. Where weight is not applicable, Contractor shall report materials by units applicable to material recipient.
 - c. Procure receipts or other validation of waste management procedures and include them as part of the submittal.

3.2 SALVAGING DEMOLITION WASTE

- A. Salvaged Items for Reuse in the Work:
1. Clean Salvaged items.
 2. Pack or crate items after cleaning. Identify contents of containers.
 3. Store items in a secure area until installation.
 4. Protect items from damage during transport and storage.
 5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.



3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.

3.4 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or Waste to Energy facility acceptable to authorities having jurisdiction.
 - 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials on site.
- C. Disposal: Transport waste materials and dispose of at designated spoil areas on Owner's property.
- D. Disposal: Transport waste materials off Owner's property and legally dispose of them.

END OF SECTION

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SECTION 01 74 23

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.

1.3 FIRE PROTECTION

- A. Store volatile waste in covered metal containers.
- B. Remove from premises daily.

1.4 POLLUTION CONTROL

- A. Conduct cleanup and disposal operations to comply with codes, rules, regulations, ordinances, and anti-pollution laws.
- B. Do not burn or bury rubbish and waste on site.
- C. Do not discharge volatile, harmful, or dangerous materials into drainage systems.

PART 2 - PRODUCTS

2.1 CLEANING MATERIALS

- A. Use materials recommended by manufacturers of surfaces to be cleaned.
- B. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.
- C. Use only those cleaning materials which will not create hazards to health or property and will not damage surfaces.

2.2 CLEANING MATERIALS

- A. Use only those cleaning materials which will not create hazards to health or property, are non-toxic to both humans and aquatic life, and will not damage surfaces, and comply with the following:



PART 3 - EXECUTION

3.1 GENERAL

- A. Clean all items installed under this Contract.
 - 1. Leave free of stains, dirt, dust, damage, or defects.
 - 2. Include washing, sweeping, polishing of wall surfaces, floors, windows, hardware, mirrors, lighting fixtures, equipment, etc.

3.2 DURING CONSTRUCTION

- A. Provide on-site containers for the collection of waste materials, debris, and rubbish.
- B. Supervision: Oversee all cleaning of areas by the trades using them. Ensure that resulting accumulations are deposited in appropriate containers.
- C. Clean up all waste materials, rubbish, and debris from site and access daily.
 - 1. Dispose of off site once a week.
- D. Wet down dusty materials and rubbish to prevent blowing dust during entire construction period.
 - 1. If use of water is prohibited by law, seek an alternate method to prevent blowing dust.
- E. Perform cleaning operations as required during construction to prevent accumulations of dust, soil, and debris.
- F. Clean and protect Work in progress and adjoining materials in place, during handling and installation.
- G. Clean and vacuum interior space prior to start of painting, and continue cleaning until painting is completed.
- H. Schedule cleaning operations so contaminants do not fall on wet painted surfaces.
- I. Clean and provide maintenance on completed Work as frequently as necessary through out construction period.
- J. Clean lunch/break area after each use.
- K. Maintain site and building so no condition provides a fire hazard.
- L. Remove snow and ice from accesses to buildings.

3.3 FINAL CLEANING

- A. At Substantial Completion, perform final cleaning of Work and existing areas wherever any area are left less than clean by construction operations.
 - 1. Complete cleaning operations before requesting review for Substantial Completion.
- B. Provide final clean-up and polishing just prior to final inspection and/or acceptance of the work of the Project.
- C. 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.
- D. 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.
- E. Use experienced workmen or professional cleaners for final cleaning.
 - F. Repair and touch-up marred areas.
 - G. Broom clean and remove stains from paved surfaces; rake clean other surfaces of grounds.
 - H. Replace air conditioning filters in units operated during construction.
 - I. Clean ducts, blowers, and coils in air conditioning units operated during construction.
 - J. Remove grease, dust, dirt, stains, labels, fingerprints, mastic, adhesive, and foreign materials from interior and exterior surfaces, and fixtures, hardware, and equipment.
 - K. Wash and shine glazing, mirrors, stainless steel, etc., including existing windows in area of construction.
 - L. Prior to Owner occupancy, Contractor and Owner shall conduct an inspection of interior and exterior surfaces and Work areas to verify Project is clean to Owner's satisfaction.

END OF SECTION

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SECTION 01 75 13

INSTALLATION VERIFICATION CHECKLISTS

PART 1 - GENERAL

1.1 CHECKLISTS

- A. This section contains representative Installation Verification (IV) Checklists in a form format. The Checklists are formatted by a specific system and will include system components that shall be checked by the Contractor prior to the Functional Performance Testing of the system.
- B. The IV Checklist procedures displayed in a form format here are intended to provide the Contractors with an example of a format and an indication of the rigor of the required IV Checklists and documentation for various equipment types. IV Checklists will be provided in a more project specific format after Contractor submittals are reviewed.
- C. The checklists will contain items for Division 21, 22, 23, 26, 27 and 28 contractors to perform. On each checklist, a column is provided that shall be filled out by the designated (Sub)contractor assigned responsibility for that line item.
- D. Those executing the checklists are only responsible to perform items that apply to the specific application at hand. These checklists do not take the place of the manufacturer's recommended checkout and start-up procedures or report. Some checklist procedures will be redundant with some checkout procedures that shall be documented on typical factory supplied field checkout sheets. Double documenting is required in those cases. Additionally, copies of completed manufacturer checkout and start-up documentation shall be attached to the completed IV Checklists.
- E. When a manufacturer's representative is responsible for the installation and start-up procedures exclusively (e.g. boilers, etc.) only an IV Checklist coversheet shall be provided to the Contractor to which the completed manufacturer's documentation shall be attached.
- F. Refer to Section 01 91 13 for additional requirements regarding installation verification checklists, startup and initial checkout. Items that do not apply should be noted along with the reasons on the form. If this form is not used for documenting, one of similar rigor and clarity shall be used. Contractor's assigned responsibility for sections of the checklist shall be responsible to see that checklist items by their subcontractors are completed and checked off. "Ctr." column or abbreviations in brackets to the right of an item refer to the contractor responsible to verify completion of this item. A/E = Architect/Engineer, All = all Contractors, C = Controls Contractor, E = Electrical Contractor, GC=General Contractor, M = Mechanical Contractor, TAB = Test and Balance Contractor, V = Vendor, SPR=Sprinkler and Fire Suppression Contractor, SA=Security Access Contractor.

PART 2 - INSTALLATION VERIFICATION CHECKLISTS

2.1 PROJECT SPECIFIC CHECKLISTS

- A. Project Specific blank checklists will be provided to the Contractor in electronic file format (Adobe PDF files) after approved equipment submittals are received by the Commissioning Agent.
- B. Specific Mechanical & Electrical Equipment Checklists will be developed by the Commissioning Agent for the following systems and system/equipment components:
 - 1. Heating, Ventilation and Air Conditioning Systems
 - a. All HVAC Systems
 - b. Test, Adjust and Balance Verification



- c. Room Pressurization
- d. Building Pressurization
- e. Building Automation System
- 2. Plumbing Systems
 - a. Plumbing Controls Interface
 - b. Medical Gases
 - c. Domestic Hot Water System
 - d. Automatic Plumbing Fixtures
 - e. Fuel Oil System
- 3. Life Safety Systems
 - a. Fire Suppression
 - b. Stairway Pressurization System
 - c. Atrium Smoke Control
- 4. Electrical Systems
 - a. Electrical Power Monitoring
 - b. Uninterruptible Power Supply (UPS) Systems
 - c. Emergency Generators
 - d. Transfer Switches
- 5. Communication
 - a. Telecommunications Systems
- 6. Electronic Safety and Security
 - a. Access Control System
 - b. CCTV
 - c. Fire Detection and Alarm System
 - d. Nurse Call
 - e. Overhead Paging

PART 3 - REPRESENTATIVE INSTALLATION VERIFICATION CHECKLISTS.

- A. The following samples of the checklists (including numbered IV suffix) are included in this specification section. Note that these checklists are generic in nature and are not equipment specific based on manufacturer. Project specific checklists will be provided once approved submittals are received by the Commissioning Agent.
- B. Sample IV Checklist Coversheet
- C. Air Handling Unit
- D. Building Automation System
- E. Compressed Air System
- F. Normal Power
- G. Fire Alarm System

H. Sample IV Checklist Coversheet

By signing below, contractor certifies the **NAME OF SYSTEM/COMPONENT** are complete and ready for functional testing. All supporting systems and equipment are operating within design parameters. The attached pre-functional checklist is being submitted supporting system completion. Only parties having direct knowledge have completed the items listed.

_____ Plumbing Subcontractor	_____ Date	_____ Manufacturer's Representative
_____ Mechanical Subcontractor	_____ Date	_____ Electrical Subcontractor
_____ Controls Subcontractor	_____ Date	_____ TAB Subcontractor

Approval

Commissioning Agent Approval:

I have reviewed the required documentation and ☐ Approve ☐ Disapprove ☐ Approve as
Noted the above named system ready to undergo functional testing.

Notes

Commissioning Agent _____

Date Reviewed _____

Owner's Representative _____

Date Reviewed _____



I. Installation Verification Checklist

J. AIR HANDLING UNIT

M = Mech. Ctr., E = Elect. Ctr., TAB = TAB Ctr., C = Controls Ctr., GC = General Ctr., V=Vendor, A = All Ctr.'s

Item No.	Description	Ctr	Check		Initials
			Y	N	
General Installation					
1	System components have been delivered and installed per approved submittal documentation.	M			
2	Casing condition good: no dents, leaks, door gaskets installed.	M			
3	Access doors close tightly	M			
4	Vibration isolation devices installed	M			
5	Maintenance access acceptable for unit and components	M			
6	Ductwork complete and clean of construction debris	M			
7	Condensate drain pan properly piped	M			
8	Building automation control devices properly installed and calibrated	C			
9	Supply fan protective shrouds for belts in place and secure	M			
10	Supply fan and motor properly lubricated	M			
Operational Checks					
11	All control dampers modulate without binding and fully open and close	C			
12	Controls operational checkouts complete including device calibration, sequence of operation, remote start / stop, etc.	C			
13	Variable speed drives setup / operational by manufacturers representative complete	M			
14	Ensure that the drive on the Supply fan motor follows run/stop and safety interlock commands from the system	M/E			
15	Ensure that the coil circulation pump is operational, including safety interlock commands from the system	M/C			
Documentation					
16	O&M Manuals submitted and approved	GC			
	O and M Manual Location				
17	Temperature control calibration and checkout sheets submitted	C			
	Calibration and checkout sheet location				
18	Training Plan submitted and approved	GC			
	Training Plan documentation location				
19	Nameplate data information provided	M			
	Nameplate data information location				
20	Ductwork static testing submitted and approved	M			
	Duct static test report location				
21	VFD manufacturers completed start-up checklist attached	M			
	VFD start-up report location				
22	AHU manufacturers completed start-up checklist attached	M			



Item No.	Description	Ctr	Check		Initials
			Y	N	
	AHU start-up report location				
23	Duct static pressure transducer input control is directly connected to the same controller as the supply fan output control.	C			
Additional Observation and Comments					
24	Provide location of duct static pressure control transducer (floor and gridlines).	C			
	Floor and gridline location				
25	Test-Adjust-Balancing work complete, and setpoints have been coordinated with Controls Contractor.	TAB/ C			
	TAB setpoints				
26	TAB contractor has balanced each coil and tunnel separately.	TAB			
	TAB report location				
27	Alarms, Trend Logs and Graphs with data are available for review.	C			

K. Installation Verification Checklist

L. BUILDING AUTOMATION SYSTEM

M = Mech.Ctr., E = Elect.Ctr., TAB = TAB Ctr., C = ControlsCtr., GC = GeneralCtr., V=Vendor, A
= All Ctr.'s

		Equip ID	BAS		Rep.
Item No.	Description	Ctr	Check Y	N	Initials
General Installation					
1	System components delivered and installed per approved submittal documentation.	GC			
2	Panel condition good: No dents, scratches	C			
3	Equipment clean and dry	C			
4	Devices located per manufacturer's recommendations	C			
5	Permanent labels affixed to panels/devices	C			
6	Components accessible for maintenance	C			
7	Calibration settings affixed to devices	C			
8	Control wiring complete/labeled	C			
9	Batteries installed/charged in controllers	C			
10	Air pressure gauges installed	C			
Operational Checks					
11	System power energized	C			
12	Operational testing and control checkout / calibration complete	C			
13	Dial up communications operational	C			
14	Alarm limits, time of day functions, energy management programs, etc. programmed and operational	C			
15	Printer functions checked out and operational	C			
16	LAN communications operating (FIBRE)	C			
17	Point names submitted to Owner for approval	C			
18	Battery backup operational checkouts complete	C			
19	Alarm limits submitted to Owner for approval	C			
Documentation					
20	Manufacturer calibration and checkout sheets complete.	C			
21	Location of checkout verification forms				
22	O and M Manual submitted and approved.				
23	O and M Manual location				

Notes



M. Installation Verification Checklist

N. COMPRESSED AIR SYSTEM

M = Mech.Ctr., E = Elect.Ctr., TAB = TAB Ctr., C = ControlsCtr., GC = GeneralCtr., V=Vendor, A
= All Ctr.'s

Item No.	Description	Ctr.	Check			Rep.
			Y	N	Not Tested	Initials
Installation						
1	System components delivered and installed per approved submittal documentation.	P				
2	Piping and manifolds are complete, properly supported, and labeled.	P				
3	Manifold relief valves are piped to exterior and do not discharge nears windows and doors.	P				
4	Emergency Power (120V) has been provided to manifold.	E				
	Document panel / breaker number					
5	Equipment isolation valves are installed, accessible, operate easily, and close bubble tight, with identification tags.	P				
6	Piping has been cleaned and pressure tested in accordance with the Contract Documents and NFPA 99.	P				
	Cleaning and pressure test documentation location					
7	Piping has been flushed with dry nitrogen, and tested for 100% concentration of CO2.by 3 rd party.	P/V				
8	3 rd party documentation location					
9	Third Party Testing is complete, approved, and report is attached or referenced.	P/V				
	3 rd party documentation location					
10	As part of certification, all alarms are actuated and checked.	P/V				
	Certification location					
11	Cross-over test has been performed by independent testing agent and test report is attached.	P/V				
	Report location					
12	Distribution pressure is set to 80 psig.	P				
	Pressure setting					
13	End points have been provided with a ball valve and cap.	P				
14	Alarm signals to BAS system have been verified, tested, and certified.	C				
	Certification location					
Documentation						



15	All required Submittals, O&M's, Manufacturer's Start-up Checklists, Training Plans have been submitted and approved.	GC				
----	--	----	--	--	--	--

O. Installation Verification Checklist

P. Fire Alarm System

M = Mech. Ctr., E = Elect. Ctr., TAB = TAB Ctr., C = Controls Ctr., GC = General Ctr., V=Vendor, A = All Ctr.'s

Item No.	Description per division 28 and dwgs E400-408 and E603	Ctr.	Check		Rep.
			Y	N	Initials
Contractor Submittals					
1	Provide point schedule of inputs and outputs.	E			
2	Provide complete sequence of operations for all fire alarm system functions, as well as CADD floor plans.	E			
3	Provide field test reports and Certificate of Completion.	E			
General Operation					
4	Verify control panels, transponders and remote power supplies are sized to accommodate 20% future growth beyond the initial scope of project.	E			
5	Verify all secondary power batteries are sized for future system growth. Spare battery required in addition to future system growth capacity.	E			
6	Verify combination horn/strobe system in mechanical areas and garages.	E			
7	Verify alarm signal is sent to mechanical building control system.	E/C			
8	Verify AHU fans automatically shutdown only when activated by the Vesda system located in the supply air duct downstream of the filters.	E/C			
Operation of Fire Alarm System: any initiation device shall immediately cause all of the following:					
9	Verify all fire alarm speakers to sound	E			
10	Verify visual alarm lights flash	E			
11	Verify alarm automatically transmits signal to Fire Department	E			
12	Verify alarm signal is transmitted to mechanical control system, and initiate shutdown of supply fans except for pressurization fans for elevator shafts and stairwells.	E			
13	Verify magnetic door holders de-energize and door-closers close doors.	E			
14	Verify live and pre-recorded voice evacuation announcements are heard.	E			
15	Verify system records data history of events.	E			
Documentation					
16	O&M Manuals submitted and approved	GC			
	Location of O and M Documentation				
17	Training Plan submitted and approved	E			
	Location of Training Plan Documentation				
18	Manufacturer's startup reports submitted and approved	E			
	Location of manufacturer's start-up form.				
19	Provide copies of NFPA 72 "Inspection and Testing Form"	E			



	Location of NFPA 72 Documentation				
Additional Observation and Comments					
20					
21					

Q. Installation Verification Checklist

R. NORMAL POWER

M = Mech.Ctr., E = Elect.Ctr., TAB = TAB Ctr., C = ControlsCtr., GC = GeneralCtr., V=Vendor, A
= All Ctr.'s

Item No.	Description	Ctr	Check		Rep.
			Y	N	Initials
General Installation					
1	System components delivered and installed per approved submittal documentation.	A			
2	Unit is free from physical damage	E			
3	All components/accessories present	E			
4	Power conduit openings are plugged	E			
5	Unit tags affixed.	E			
6	Adequate clearance between the ceiling and top of switchgear (indoor applications ONLY)	E			
Wiring					
7	Proper phasing has occurred in relationship to phase conductors	E			
8	All connections are terminated properly	E			
9	All electrical connections are tight.	E			
Startup					
10	Unit has been cleaned of all debris and dirt on interior of unit	E			
11	Insulators and supports show no signs of damage or cracks	E			
12	All switches and circuit breakers have been manually tested	E			
13	Fuses have been installed in all switches (if applicable)	E			
14	All wiring connections verified for proper torques values and are acceptable	E			
15	Phase-to-phase, phase-to-ground, and neutral-to-ground, and dielectric tests have been accomplished and results are acceptable	E			
16	No hazards or adverse circumstances exist per continuity and high potential tests	E			
17	Unit energized by authorized personnel	E			
18	Key and door interlocks function properly	E			
Documentation					



Item No.	Description	Ctr	Check		Rep.
			Y	N	Initials
19	Test results required by NEC have been submitted and approved.A	A			
20	Location of test documentation.				

END OF SECTION

SECTION 01 77 00
CONTRACT CLOSEOUT (GC)

PART 1 - GENERAL

1.1 PROVISIONS FOLLOWED BY AN ASTERISK (*) INCLUDE SOME OR ALL PROVISION AS OBTAINED FROM AIA DOCUMENT A201 - GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION.

1.2 SUBMITTALS

A. Contract Closeout Information:

1. For substantial completion:
 - a. Comprehensive list of all items to be completed or corrected.
 - b. Contractor's Notice of Substantial Completion.
 - c. Certificates of governing authorities.
 - d. Submittals required by other Sections.
2. For final completion:
 - a. Contractor's Certificate of Completion.
 - b. Evidence of payments and release or waiver of liens in triplicate.
 - 1) Contractor's Affidavit of Payments of Debts and Claims: AIA Document G706.
 - 2) Contractor's Affidavit of Release of Liens: AIA Document G706A.
 - 3) Contractor's release or waiver of liens.
 - 4) Separate releases or waivers of liens for subcontractors, suppliers, and others with lien rights against Owner, together with list of all such parties.
 - 5) If required by Owner, other data establishing payment or satisfaction of obligations arising out of Contract.
 - c. Consent of Surety (if any) to Final Payment: AIA Document G707.
 - d. Certificates evidencing that insurance to remain enforce.
 - e. Final application for payment.
 - f. Initialed list(s) of items to be completed or corrected verifying completion of each items.
 - g. List of Subcontractors and equipment suppliers. Include:
 - 1) Name.
 - 2) Address.
 - 3) Telephone number.
 - 4) Representative.
 - h. Letter of site conformance.
 - i. Closeout submittals required by other Sections.

1.3 SUBSTANTIAL COMPLETION

- A. Substantial Completion is the stage in the progress of Work when the Work or designated portion thereof is sufficiently complete in general accordance with Contract Documents so Owner can occupy or utilize Work for its intended use. *
1. Work will not be considered for Substantial Completion until all systems and equipment are operational; all designated or required governing agency inspections and certifications have been made and posted, instruction of designated Owner's personnel in operation of systems and equipment has been completed, operation and maintenance data has been satisfactorily turned over to Owner, and finishes are in place. In general, the only remaining Work shall be minor in nature, such that Owner may occupy or utilize Work or designated portion thereof, and completion or correction of Work by Contractor would not materially interfere or hamper Owner's intended business use or operation.



2. Contractor shall certify that all remaining Work will be completed within 30 consecutive calendar days following date of Substantial Completion, or as agreed to in writing, and failure to do so shall automatically reinstate provisions for damages due Owner as contained elsewhere in Contract Document or as provided by law for such period of time as may be required by Contractor to fully complete Work whether Owner has occupied Work or not.
- B. Obtain evidence of compliance with requirements of governing authorities:
1. Certificates of inspection of:
 - a. Mechanical.
 - b. Electrical.
 - c. Plumbing.
 - d. Fire protection and life safety systems.
 - e. Etc.
 2. Health Department and other governing authorities as required.
 3. Certificate of Occupancy.
- C. When Contractor considers that Work, or a portion thereof which Owner agrees to accept separately, is substantially complete, Contractor shall thoroughly inspect Work, and prepare and submit to Architect a comprehensive list of items to be corrected or completed, and Contractor's Notice of Substantial Completion (utilize form at end of this Section). *
- D. Contractor certify that:
1. Work performed under this Contract has been thoroughly inspected and considered to be sufficiently complete, in accordance with Contract Documents, so Owner can occupy or utilize Work for its intended use.
- E. Failure of Contractor to include an item on such list(s) does not alter responsibility of Contractor to complete all Work in accordance with Contract Documents. *
- F. Contractor shall proceed promptly to complete and correct the items on list.
- G. After receipt of Contractor's comprehensive list of items to be corrected or completed, and Contractor's Notice of Substantial Completion, Architect and Owner will, within reasonable period after notification, review list of items to be completed or corrected, or inspect Work, or designated portion thereof, to determine whether Work is Substantially Complete. *
- H. If Architect's or Owner's review or inspection discloses any item, whether or not included on Contractor's list, which is not sufficiently complete in general accordance with Contract Documents so Owner can occupy or utilize Work or designated portion thereof for its intended use: *
1. Contractor will be notified stating reasons.
 2. Contractor shall substantially complete or correct Work.
 3. Contractor shall thoroughly re-inspect Work.
 4. Contractor shall submit another Contractor's Notice of Substantial Completion, a revised list of items to be completed or corrected, and a request for another review.
 5. Architect and Owner will again review list of items to be completed or corrected and Work.
- I. If Contractor prematurely submits a Contractor's Notice of Substantial Completion or requests Architect's review of Work, and Architect determines that Project or designated portion thereof is not Substantially Complete, Architect may invoice Owner as a change in services for such cost involved in evaluating and reviewing Work, and associated travel costs. Contractor shall reimburse Owner for such costs.
- J. Architect will not perform more reviews of sub-projects or phases than number indicated in Contract Documents or Owner – Architect Agreement, unless otherwise mutually agreed to by Architect and Owner.



- K. When Work or designated portion thereof is considered Substantially Complete, Architect will prepare a Certificate of Substantial Completion.
1. The Certificate of Substantial Completion shall establish date of Substantial Completion, shall establish responsibilities of Owner and Contractor for security, maintenance, heat, utilities, damage to Work and insurance, and shall fix time within which Contractor shall complete and correct Work.
 2. Warranties and guarantees required by Contract Documents shall commence on date of Substantial Completion of Work or designated portion thereof unless otherwise provided in Certificate of Substantial Completion.
 3. The Certificate of Substantial Completion shall be submitted to Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate. *
- L. Owner may occupy Project, or designated portion thereof, under provisions agreed to in Certificate of Substantial Completion, and if required, a certificate of occupancy has been issued by governing authorities.
1. If Owner is going to occupy Project, or designated portion thereof, Contractor shall perform final cleaning immediately.
 2. If Owner or Architect discovers any Work which is not complete and/or is not in conformance with Contract Documents, during or after occupying or utilizes Work, whether included on a list or not, Owner shall notify Contractor to complete or correct item(s) identified.
- M. Contractor shall proceed expeditiously with adequate forces to complete or correct Work, and to complete all Project closeout requirements within designated time.
- N. Upon completion of Work, employ Licensed Surveyor to make survey of site to assure conformance of elevations, grade and site work to contours shown. Provide letter of site conformance.

1.4 FINAL COMPLETION

- A. After Contractor has completed all Work, and has thoroughly inspected Work to determine that it is sufficiently complete, is in general accordance with Contract Documents, and Contract is fully performed, Contractor shall submit Contractor's Certificate of Completion to Architect, and the list(s) of items to be completed or corrected initialed to indicate Contractor has verified completion of each item. * Utilize form at end of this section. Contractor certifies that:
1. Work has been thoroughly inspected by Contractor for compliance with Contract Documents.
 2. Work has been completed in accordance with Contract Documents.
 3. Equipment and systems have been tested and are operating satisfactorily.
 4. Contract closeout requirements have been completed satisfactorily and submitted.
 5. Contractor knows of no reason that insurance will not be renewable to cover period required by Contract Documents.
 6. Work is ready for final inspection and acceptance.
- B. Contractor submit final closeout submittals required by this and other Sections.
- C. Owner and Architect will make final walk through within a reasonable time after receipt of Contractor's Certificate of Completion and final Application for Payment. *
1. If Contractor prematurely submits a Contractor's Notice of Final Completion or requests Architect's final review of Project, and Architect determines that Project is not satisfactorily complete, Architect may invoice Owner as a change in services for such cost involved in evaluating and reviewing Work, and associated travel costs. Contractor shall reimburse Owner for such costs.



- D. Contractor shall remedy any remaining deficiencies or incomplete Work, at Contractor's expense.
- E. When Owner and Architect finds Work acceptable under Contract Documents and Contract satisfactorily performed, Architect will promptly issue a final Certificate for Payment. *
- F. Neither final payment nor any remaining retained percentage shall become due until Contractor submits to Architect;
1. an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with Work for which Owner or Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied (AIA Documents G706 and G706A),
 2. a certificate evidencing that insurance required by 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 has been given to Owner,
 3. a written statement that Contractor knows of no substantial reason that insurance will not be renewable to cover period required by Contract Documents,
 4. consent of surety, if any, to final payment (AIA Document G707),
 5. Contractor's and Subcontractor's final release or waiver of liens,
 6. if required by Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of Contract, to extent and in such form as may be designated by Owner, for Owner's review, and
 7. if a Subcontractor refuses to furnish a release or waiver required by Owner, Contractor may furnish a bond satisfactory to Owner to indemnify Owner against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to Owner all money that Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees. *
- G. If Substantial Completion or Final Completion is delayed through no fault of Owner or Architect, Architect may invoice Owner as a change in services for such costs, and associated travel costs. Contractor shall reimburse the Owner for such costs.

END OF SECTION



CONTRACTOR'S NOTICE OF SUBSTANTIAL COMPLETION

PROJECT: Logan Regional Hospital Reconfiguration Project

ARCH PROJ. NO.: 10173823 CONTRACT DATE: _____

CONTRACT FOR: _____

WORK OR DESIGNATED PORTION SHALL INCLUDE: _____

Work performed under this Contract has been thoroughly inspected and is considered to be sufficiently complete, in accordance with Contract Documents, so Owner can occupy or utilize Work or designated portion thereof for its intended use.

- ☐ Certificates of inspections indicating compliance with requirements of governing authorities, are attached hereto.
- ☐ Certificate of Occupancy have been obtained from governing authorities, are attached hereto.
- ☐ A comprehensive list of items to be completed or corrected, prepared by Contractor is attached, hereto. Failure to include any items on such list does not alter responsibility of Contractor to complete all Work in accordance with Contract Documents.

Contractor will complete or correct Work by: _____

CONTRACTOR: _____

BY: _____ DATE: _____

OWNER (agrees) (does not agree) to accept portion designated above separately from rest of Project.

Owner intends to utilize, occupy or take use on: _____

OWNER: Intermountain Healthcare

BY: _____ DATE: _____

The Work designated above, has been determined to be:

- ☐ Substantially Complete and a Certificate of Substantial Completion will be issued.
- ☐ Not substantially complete for following reasons: _____

ARCHITECT: HDR Architecture, PC.

BY: _____ DATE: _____

DISTRIBUTION: ☐ OWNER ☐ ARCHITECT ☐ CONTRACTOR

END OF CONTRACTOR'S NOTICE OF SUBSTANTIAL COMPLETION



CONTRACTOR'S CERTIFICATE OF COMPLETION

PROJECT: Logan Regional Hospital Reconfiguration Project
ARCH. PROJECT NUMBER: 10173823
CONTRACT FOR: _____
CONTRACT DATE: _____

This is to certify that I am an authorized official of, and have been properly authorized by said firm or corporation to certify following:

I know of my own personal knowledge, and do hereby certify on behalf of Contractor, that Work has been reviewed and thoroughly inspected for compliance with Contract Documents, that Work has been completed, in accordance with Contract Documents and Contract is fully performed, that all equipment and systems have been tested and are operating satisfactorily, that all Contract closeout requirements have been completed satisfactorily and submitted, know of no substantial reason that insurance will not be renewable to cover period required by Contract Documents, and Work is ready for final inspection and acceptance.

Attached are three (3) copies of following documents, which are required prior to final payment:

- ☐ Final Application for Payment.
- ☐ Contractor's Affidavit of Payments of Debts and Claims: AIA Document G706.
- ☐ Contractor's Affidavit of Release of Liens: AIA Document G706A.
- ☐ Contractor's Final Release or Waiver of Liens.
- ☐ Consent of Surety (if any) to Final Payment: AIA Document G707.
- ☐ 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 thirty (30) days' prior written notice has been given to Owner.
- ☐ The list(s) of if items which were to be completed and corrected, with each item initialed to indicate Contractor has verified completion or correction of each.
- ☐ List of subcontractors and equipment suppliers.
- ☐ Certified list of all sales and service taxes paid.
- ☐ Letter of site conformance by licensed surveyor.
- ☐ If required by Owner, other data establishing payment or satisfaction of obligations arising out of Contract.
- ☐ Bond satisfactory to Owner to indemnify Owner against liens from Subcontractors.
- ☐ Transmittal indicating Owner has received Project Record Documents.

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

CONTRACTOR: Okland Construction BY: _____
TITLE: _____ DATE: _____

Subscribed and sworn to me this _____ day of _____

NOTARY PUBLIC: _____

My commission expires: _____



DISTRIBUTION: ☐ OWNER ☐ ARCHITECT

END OF CONTRACTOR'S CERTIFICATE OF COMPLETION

HDR Project No. 10394230



Intermountain Healthcare
Logan Regional Hospital Reconfiguration
LRH PET/CT
CONTRACT CLOSEOUT (GC)
01 77 00 - 7

June 28, 2024
100% Construction Documents

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SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

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 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.

1.3 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 SUBMITTALS

- A. Final Submittal: Submit one copy 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.



1.5 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 2 - PRODUCTS

2.1 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."

2.2 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.

2.3 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.

2.4 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.

2.5 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.

2.6 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 3 - EXECUTION

3.1 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. Comply with Division 1 Sections for schedule for submitting operation and maintenance documentation.

END OF SECTION



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SECTION 01 78 36

WARRANTIES AND GUARANTEES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Execute and provide notarized Project Warranties on form furnished at end of section.
- B. Provide special written warranties or guarantees or both for products, equipment, systems and installations required by other sections of Contract Documents for duration indicated.
- C. Provide manufacturer's warranties or guarantees or both for products, equipment, systems and installations required by other sections of Contract Documents for duration indicated.
 - 1. Where manufacturer's standard warranties or guarantees or both expire before duration required by other sections of Contract Documents, obtain and pay for extensions as part of Contract Price.
- D. Provide all warranties or guarantees or both prior to final payment.
- E. Warranties or guarantees or both required by Contract Documents shall commence on date of Substantial Completion of Work, or designated portion thereof, unless otherwise indicated in Certificate of Substantial Completion.
- F. 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.
- G. Related Damages and Losses: When correcting guarantied 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.
- H. 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.
- I. 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.
- J. 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.
- K. 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.
- L. 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 page 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.

1.2 SUBMITTALS

- A. Contract Closeout Information:
1. Full executed and notarized Project Warranty on included form.
 2. Transmittal letter indicating Owner's receipt of 3-ring binder containing all product equipment and system warranties or guarantees or both required by other sections of Contract Documents.

1.3 JOB CONDITIONS

- A. If for any reason, Contractor cannot warrant or guarantee or both any portion of Work using products or construction methods indicated or required by other sections of Contract Documents, notify Architect in writing during bid period, and before contracts are awarded, indicating reasons and names of products and data on substitutions that can be warranted or guaranteed or both.
1. Should Contractor fail to notify Architect, Contractor will be considered as having agreed to warrant or guarantee or both for Work indicated.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 PROJECT WARRANTY

- A. Execute and provide notarized Project Warranty on form furnished at end of section.
1. Provide Contractor's name, address, signature and date.
 2. Notarial Act and notarization: Warranty document is required to be signed, dated, and sealed with Notary Public seal or stamp in accordance with state and territorial notary laws.

3.2 PRODUCT, EQUIPMENT & SYSTEM WARRANTIES AND GUARANTEES

- A. Compile approved warranties and guarantees or both required by other sections of Contract Documents.
- B. Bind or assemble in 3-ring binders, completely indexed by specification section, with each warranty or guarantee or both clearly labeled.
- C. Identify each warranty or guarantee or both in manner consistent with names and identification numbers used in Contract Documents.
- D. Neatly type or draft all warranties or guarantees or both not furnished in printed form.
- E. Provide transmittal letter containing:
1. Date
 2. Project title
 3. Contractor's name and address
 4. Title and number of warranties or guarantees or both
 5. Indication of Owner's receipt
- F. Deliver to Owner prior to final payment with copy of transmittal letter indicating Owner's receipt.

END OF SECTION



PROJECT WARRANTY

PROJECT: Logan Regional Hospital Reconfiguration Project PROJECT NO.: 10173823

OWNER: Intermountain Healthcare

DATE OF SUBSTANTIAL COMPLETION:

As indicated on Certificate of Substantial Completion

Contractor, warrants to Owner that Work is free from defects not inherent in the quality required or permitted, and that Work conforms with requirements of Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. Contractor's warranty excludes remedy for damage or defect caused by abuse, modifications not executed by Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear under normal usage.

If, within one-year after the date of Substantial Completion of Work or designated portion thereof, or by terms of an applicable special warranty required by Contract Documents, any of the Work is found to be not in accordance with requirements of Contract Documents, the Contractor shall correct it promptly after receipt of written notice from Owner to do so unless Owner has previously given Contractor a written acceptance of such condition. Owner shall give such notice promptly after discovery of the condition.

The above shall not be construed to establish a period of limitation with respect to other obligations which Contractor might have under Contract Documents. Establishment of one-year period for correction of Work relates only to specific obligation of Contractor to correct Work, and has no relationship to time within which obligation to comply with Contract Documents may be sought to be enforced, nor to time within which proceedings may be commenced to establish Contractor's liability with respect to Contractor's obligations other than specifically to correct Work.

CONTRACTOR:
ADDRESS:

BY: _____ SIGNATURE: _____
TITLE: _____ DATE: _____

Subscribed and sworn to me this ____ day of _____ in the year of _____

NOTARY PUBLIC: _____ SIGNATURE: _____
LOCATION: _____

My Commission Expires:



A. 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 INTERMOUNTAIN MEDICAL CENTER IN MURRAY, UTAH"

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 Healthcare Logan Regional Hospital Reconfiguration 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 _____ Countersigned _____
(Subcontractor) (General Contractor)

Name _____ Name _____
(Print) (Print)

Company _____ Company _____

Address _____ Address _____

License No. _____ License No. _____

Countersigned _____
(Material Manufacturer)

Name _____
(Print)

Company _____

Address _____



SECTION 01 78 39

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 01 78 43
SPARE PARTS, TOOLS AND MAINTENANCE MATERIALS

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Contract Closeout Information:
 - 1. Submit spare parts, tools and materials directly to Owner.
 - 2. Submittal to Architect is not required.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Spare Parts and Tools:
 - 1. Package in clearly identified boxes.
 - 2. Indicate manufacturer's name, part name and stock number.
 - 3. Indicate piece of equipment part or tool is for.
 - 4. Indicate name, address and phone number of closest supplier.
- B. Maintenance Materials:
 - 1. Package in clearly identified boxes.
 - 2. Indicate trade name and stock number.
 - 3. Indicate which item material is to be used with.
 - 4. Indicate name, address and phone number of closest supplier.
- C. Extra Materials:
 - 1. Package in clearly identified containers, or install where indicated.
 - 2. Indicate trade name, stock number, size, color, etc.
 - 3. Indicate where product is to be used.
 - 4. Indicate name, address and phone number of closest supplier.

PART 3 - EXECUTION

3.1 DELIVERY

- A. Deliver to Owner prior to substantial completion unless Owner requests earlier delivery.
- B. Deliver to location directed by Owner.
- C. Complete Maintenance Material Transmittal form at end of this Section.
 - 1. Acquire Owner's acceptance of items listed on transmittal.
 - 2. Transmittal to indicate Owner's acceptance.
 - 3. Forward copy of transmittal forms with Owner's acceptance to Architect.

END OF SECTION



SPARE PARTS, TOOLS AND MAINTENANCE MATERIAL TRANSMITTAL

Project: Logan Regional Hospital PET CT Project

To Owner:

Date:

From C.M./Contractor:

Package extra material, maintenance materials, spare parts, and tools in clearly identified boxes; indicate manufacturer's name, trade name, part name, stock number, size, color, etc. Indicate which item maintenance material is to be used with, piece of equipment part or tool is for, or where extra material is to be used. Indicate name, address, and phone of closest supplier.

Owner's Verification and Acceptance

Accepted by: _____

Date: _____

Forward copy of this transmittal to the Architect.

DISTRIBUTION: ☐ OWNER ☐ CONTRACTOR ☐ C. M. ☐ ARCHITECT

END OF TRANSMITTAL



SECTION 01 79 00
DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide instruction for equipment and systems which require Operation and Maintenance Data specified in technical sections.

1.2 QUALITY ASSURANCE

- A. Instructors:
 - 1. Member of installer's staff, and authorized representative of component, assembly, or system manufacturer.
 - 2. See specification technical sections for additional requirements.

1.3 SUBMITTALS

- A. Contract Closeout Information:
 - 1. Transmittal letter indicating Owner's receipt of required demonstrations, copies of completed reports and video files.

1.4 JOB CONDITIONS

- A. Complete instruction prior to Substantial Completion.
 - 1. Submit separate report for each system or type of equipment to Owner for approval.
 - a. Submit report form attached, with preliminary information to Owner at least two (2) weeks prior to first instruction period.
 - b. Submit completed report to Owner and Architect.
 - 2. Submit video files for each instruction to Owner.
 - a. Name each file with description of equipment or system.
 - b. Provide index of instruction files.
 - c. Provide on DVD.

PART 2 - EXECUTION

2.1 PREPARATION

- A. Assemble instructional aids.
- B. Supply operation and maintenance data for use during instruction.
- C. Provide video equipment available for each instruction.
- D. Schedule instruction with Owner when component, assembly, or system has been tested, is in correct operating condition and is fully functional.

2.2 INSTRUCTION

- A. Provide video and physical instruction.
- B. Explain use of operating and maintenance manuals.
- C. Furnish tools required.
- D. Instruct Owner's personnel in operation and maintenance of equipment and systems.
 - 1. Provide instruction to satisfaction of Owner.



- E. Tour building areas involved and identify:
 - 1. Maintenance points and access.
 - 2. Control locations and equipment.
- F. Operating Sequences:
 - 1. Identify location and show operation of switches, valves used to start, stop and adjust systems.
 - 2. Explain use of flow diagrams and operating sequence diagrams.
 - 3. Demonstrate operation through complete cycle or cycles and full range of operational modes, including testing and operational adjustment.
- G. Control Equipment:
 - 1. Temperature settings.
 - 2. Switch modes.
 - 3. Available adjustments.
 - 4. Reading of gauges.
 - 5. Functions serviced only by authorized factory representatives.
- H. Troubleshooting:
 - 1. Demonstrate common occurring problems.
 - 2. Identify procedures requiring attention of factory personnel.
- I. Maintenance Procedures:
 - 1. Identify items requiring periodic maintenance.
 - 2. Demonstrate preventive maintenance procedures and recommended maintenance intervals.
 - 3. Demonstrate commonly occurring maintenance procedures not part of preventive maintenance program.
 - 4. Identify maintenance tools and materials used.

END OF SECTION

EQUIPMENT AND SYSTEMS OWNER INSTRUCTION REPORT

Project: _____

Project Number: _____

Contractor: _____

System or Equipment: _____

Specification Section: _____

PRELIMINARY INFORMATION

To be completed by Contractor/Construction Manager:

Proposed dates for instruction period: _____ to
_____.

Contractor Representative conducting instruction:
_____.

Number of hours of instruction required by Contract Documents: _____.

To be completed by Owner:

Owner's personnel to be instructed (designate supervisor if required).

Contractor's Representative/Construction Managers Representative to maintain and complete this report during course of instruction.

Instruction Log						
Date	Hours	Material Covered	Instructor Initials	Owner's Personnel Receiving Instruction	Personnel Initials	Comments

Total Hours Completed: _____

Instructor's Signature: _____

Date Instruction Completed: _____

Owner's Signature: _____



Distribution: ☐ Owner ☐ Architect ☐ Construction Manager ☐ Contractor

END INSTRUCTION REPORT

SECTION 01 81 21

INDOOR AIR QUALITY MANAGEMENT PLAN

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements governing protection of indoor air quality (IAQ), absorbent materials, and mechanical system from contamination during construction and building flush-out.

1.2 QUALITY ASSURANCE

- A. SMACNA Guidelines for Occupied Buildings Under Construction, 2nd Edition 2007, ANSI/SMACNA 008-2008 (Chapter 3).

1.3 DESCRIPTION - GENERAL

- A. IAQ Management Plan: Minimize contaminants generated during construction. Methods to include, but not limited to:
 - 1. Practices which minimize the amount of dust generated.
 - 2. Reduction of solvent fumes and volatile organic compound (VOC) emissions.
 - 3. Maintaining good housekeeping practices including sweeping and periodic dust and debris removal.
 - 4. Maintain dry conditions to protect stored on-site and installed absorptive materials from moisture damage.
 - 5. No visible haze in air.
- B. Prevent migration of moisture from exterior to building interior and prevent release of moisture from building materials that could result in formation of mold, delamination of adhesive applied materials or other damages caused by water.

1.4 PRECONSTRUCTION CONFERENCE

- A. After award of Contract and prior to the commencement of the Work, schedule and conduct meeting with Owner and Architect to discuss the proposed IAQ Management Plan and to develop agreement relative to details of IAQ Management Plan procedures.

1.5 SUBMITTALS

- A. Project Information:
 - 1. Construction IAQ Management Plan.
 - 2. Compliance Photographs:
 - a. Provide a monthly minimum of six (6) photographs at three distinct phases of completion demonstrating compliance with standard or examples of remediation efforts to bring into compliance.
 - b. Date and time stamp photographs and identify approach taken for each.
 - c. Detailed photo log of implemented IAQ practices.



PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 CONSTRUCTION IAQ MANAGEMENT

- A. Construction IAQ Management Plan:
 - 1. Meet or exceed SMACNA Guidelines for Occupied Buildings under Construction, 2nd Edition 2007, ANSI/SMACNA 008-2008 (Chapter 3), and include following measures:
 - a. HVAC Protection.
 - b. Source Control.
 - c. Pathway Interruption.
 - d. Housekeeping.
 - e. Scheduling.
 - 2. Provide solid physical barriers to isolate areas of construction.
 - a. Securely attach and seal at floor and structure above.
 - 3. Schedule adequate time for product installation.
 - 4. Maintain negative pressure in construction area.
 - 5. Do not recirculate air prior to occupancy.
 - 6. Seal return air ducts and use direct exhaust to outside.
 - 7. Factory age sheet goods.
 - 8. Comply with manufacturer's instructions for appropriate drying times.
 - 9. Protect installed absorbent materials with recycled or recyclable materials.
- B. HVAC Protection:
 - 1. Protect air handling and distribution equipment, and air supply and return ducting during construction.
 - 2. Adequately cover and protect exposed air inlets and outlets, openings, grilles, ducts, plenums, as required to prevent water, moisture, and other contaminant intrusion.
 - 3. Apply protection immediately after installation of equipment and ducting.
 - 4. Protect duct runs at end of each day's Work.
 - 5. During dust producing activities, such as drywall installation and finishing, turn ventilation system off, and protect HVAC supply and return openings from dust infiltration.
 - a. Provide temporary ventilation.
 - 6. Provide temporary filtration media for permanently installed air handlers if used during construction,
 - a. Provide minimum efficiency reporting value (MERV) of 8 at each return air grille, per ASHRAE Standard 52.2 – 2007, with errata.
 - b. Replace filtration media immediately prior to occupancy.
- C. Source Control:
 - 1. Protect stored on-site or installed absorptive or porous materials such as batt insulation and drywall from exposure to moisture.
 - 2. Do not use wet, damaged porous materials in the building. Materials with evidence of moisture damage, including stains, are not acceptable, including both stored and installed materials. Immediately remove them from the site and properly dispose.
 - 3. Preconditioning:
 - a. Prior to site delivery off-gas odorous products, or products with significant volatile organic compound (VOC) emissions, in dry, well ventilated space for 14 calendar days.
 - b. Condition products, without containers and packaging, to maximize off-gassing of VOCs.



- c. Condition products in a ventilated warehouse or other building. Provide a temperature range of 60 DEGF minimum to 90 DEGF maximum continuously during ventilation period.
 - d. Do not ventilate within limits of Work unless otherwise accepted by Architect.
 - e. Comply with substitution requirements for consideration of other locations.
 - 4. Take special care to prevent accumulation of moisture on installed materials and within packaging during delivery, storage, and handling to prevent development of molds and mildew, including materials with moisture stains.
 - 5. Replace moldy materials with new, undamaged materials.
 - 6. Provide ventilation, air circulation and air changes to dissipate excess humidity when present.
 - 7. Prohibit the use of tobacco products inside the building and within 50 FT of building during construction.
- D. Pathway Interruption:
- 1. Isolate work areas from other spaces by sealed doorways or windows or through the use of temporary barriers.
 - 2. Install exhaust ventilation equipment to maintain negative pressure differential between work area and adjacent areas of building.
 - 3. Exhaust ventilation units to outside of building.
- E. Housekeeping:
- 1. Provide temporary ventilation during construction to minimize accumulation of dust fumes, vapors, or gases in the building.
 - 2. Continuously ventilate during and after installation of materials that emit VOCs until emissions dissipate:
 - a. Period after installation shall be sufficient to dissipate odors and elevated levels of VOCs. Where no specific period is specified, ventilate for minimum of 72 HRS.
 - b. Ventilate areas directly to outside.
 - c. If continuous ventilation is not possible via building's HVAC system, ventilate via openings and temporary fans at no less than 3 air changes per hour.
 - 3. Suppress dust with wetting agents or sweeping compounds.
 - 4. Remove dust using a wet method.
 - 5. Increase cleaning frequency when dust build-up is noted.
 - 6. Remove spills or excess applications of solvent-containing products as soon as possible.
 - 7. Remove accumulated water and keep work areas as dry as possible.
 - 8. Keep and store volatile liquid containers closed when container is inside of building and not in use.
- F. Scheduling:
- 1. Where odorous or high VOC-emitting products are applied on site, apply before installation of porous and fibrous materials. Where not possible, protect porous materials with polyethylene vapor retarders.
 - 2. Insure wet applied interior finish materials, such as paints, adhesives, sealants, coatings, finishes, and spray-applied materials, such as structural fireproofing, are fully cured prior to the storage and/or installation of finish materials.
 - 3. Install carpets and furnishings after interior finish materials have been applied and fully cured.
 - 4. Provide adequate ventilation of packaged dry products prior to installation. Remove from packaging and ventilate in a secure, dry, well-ventilated space free from strong contaminant sources and residues.
 - 5. Complete interior finish material installation no less than 14 days prior to Substantial Completion.
 - 6. Store fuels, solvents, and other sources of VOCs separately from absorbent materials.



3.2 MOISTURE CONTROL

- A. Moisture Protection Plan:
 - 1. Moisture Protection Plan shall include:
 - a. Project phasing and logistical planning that ensures either temporary or permanent protection in place that prevents the infiltration of water/moisture into the building.
 - b. Communications of expectations and restrictions to subcontractors and suppliers involved in the Project.
 - c. Methods used to seal building envelope prior to placement and installation of finish systems or materials prone to water intrusion and mold growth.
 - d. A water damage response protocol that addresses notification, inspection, documentation, actions, repair/replacement and closeout.
 - e. Protocol for pressurization of buildings or sections of building under construction , positive pressure maintained once sealed.
 - f. Schedule of finish material application.
- B. Moisture/Water/Mold Prevention:
 - 1. Protect stored on-site or installed absorptive or porous materials such as batt insulation and drywall from exposure to moisture.
 - 2. Install gypsum wall board minimum 1/2 IN above finish floor, unless otherwise indicated.
 - 3. Eliminate water or moisture intrusion into building or structure.
 - 4. Where mold growth is observed the effected materials shall be removed and disposed of by qualified handlers.
 - 5. Correct water leaks or infiltration within 24 HRS of notification.
- C. Store fuels, solvents, and other sources of VOCs separately from absorbent material.
- D. Dispose materials off site susceptible to microbial growth and replace with new, undamaged materials.



DIVISION 02

EXISTING CONDITIONS



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SECTION 02 41 00

DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Demolition, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Conduct work in accordance with OSHA and EPA requirements.
- B. National Fire Protection Association (NFPA):
 - 1. NFPA 241 Standards for Safeguarding Construction, Alteration, and Demolition Operations.
- C. Design, engineering, and construction of shoring, bracing and supports are responsibility of Contractor.
 - 1. Employ a Registered Engineer, licensed to practice structural engineering in state in which project is located.
 - 2. Design to support dead, live, and lateral, wind or seismic loads required by code or as otherwise indicated, along with construction loads during demolition until permanent construction is in place.

1.3 DESCRIPTION

- A. Work Includes:
 - 1. Demolition of portions of structures indicated.
 - 2. Removal of demolition debris.
 - 3. Recycling of construction debris.
 - 4. Protection of construction to remain, including:
 - a. Utilities.
 - b. Other items indicated.
 - 5. Other work indicated.
 - 6. Salvage of items.
- B. Condition of Existing Structures to be demolished:
 - 1. Owner assumes no responsibility for actual condition of structures to be demolished.
 - 2. Owner will maintain building conditions existing at time of inspection for bidding purposes insofar as practicable.

1.4 JOB CONDITIONS

- A. Perform preliminary investigations to ascertain extent of work.
 - 1. Conditions apparent by investigation shall not be allowed as claim for extra cost.
- B. Before start of work, obtain and pay for permits required by authorities having jurisdiction and notify interested utilities companies prior to commencement of activities.
- C. Obtain approval of authorities having jurisdiction for work affecting existing means of egress.
 - 1. Review with and obtain approval of authorities for temporary construction which affects such areas.
 - 2. Obtain approval of fire authorities.



- D. Separate, store and dispose of hazardous materials and toxic wastes in accordance with local and EPA regulations and criteria listed below:
 - 1. Disposal of fluorescent light tubes in open containers is not permitted.
 - 2. Disposal of ballasts and other building elements containing PCBs in open containers is not permitted.
 - 3. Disposal of building elements containing mercury in open containers is not permitted.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 GENERAL DEMOLITION PROCEDURES

- A. Items Designated for Re-use:
 - 1. Remove, tag, protect from damage, store and deliver to locations designated.
 - 2. Brace motors attached to flexible mountings until reinstallation.
- B. Demolition of Structures:
 - 1. Demolish completely and remove from site.
 - 2. Use such methods as required to complete work within limitations of governing regulations.
 - 3. Coordinate with Owner and utility suppliers for shut-off of utilities serving each building.
 - 4. Disconnect and seal utilities before commencement of demolition.
- C. Structural Demolition:
 - 1. Demolish concrete and masonry in small sections.
 - 2. Perform removal to avoid excessive loads on supporting walls, floors or framing.
- D. Existing Utilities to Remain.
 - 1. Keep in service and protect against damage during demolition.
 - 2. Do not interrupt existing utilities serving occupied or facilities in use, except as authorized by Owner.
 - 3. Provide temporary services during interruptions to existing utilities, as acceptable to Owner.
- E. Conduct operations to ensure minimum interference with roads, walks, entrances, exits, and adjacent facilities.
 - 1. Do not close or obstruct private drives, walks or other facilities unless approved in writing.
 - 2. Do not close or obstruct exits from existing facilities or obstruct public thoroughfares and walks without approval of authorities having jurisdiction.
 - 3. Provide alternate routes around closed or obstructed traffic ways.
- F. Provide covered passageways to ensure safe passage of persons in or near areas of work.
- G. Provide barricades and safety lights as required.

3.2 PROTECTION OF FACILITIES TO REMAIN

- A. Protect Property to Remain:
 - 1. Conduct operations to prevent damage by falling debris or other cause to adjacent buildings, structures, and other facilities as well as persons.
 - 2. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement or collapse of structures.
- B. Protect occupants from injury and discomfort.
- C. Provide temporary dustproof partitions between demolition areas and occupied areas.
 - 1. In public areas use clean, painted 1/2 IN thick plywood.
 - 2. Utilize fire rated construction where required by Authorities Having Jurisdiction,.



- D. Provide temporary weather protection and insulation to prevent damage to existing facilities and discomfort to persons in occupied areas.
 - 1. Insulation value: RSI 3.5 R 19.

3.3 ITEMS SALVAGED FOR OWNER

- A. Remove salvage items at appropriate stage of demolition, but early enough to prevent damage to them by demolition operations:
 - 1. Coordinate with Owner items Owner wishes to save.
- B. Remove salvage items as a unit:
 - 1. Clean, list, and tag for storage.
 - 2. Protect from damage.
 - 3. Salvage each item with auxiliary or associated equipment required for operation.
 - 4. Store in area designated by Owner.

3.4 ITEMS SALVAGED FOR CONTRACTOR

- A. Items of salvage value to Contractor may be removed from structure as work progresses.
- B. Transport salvaged items from site as they are removed.
- C. Storage or sale of removed items not permitted on site.

3.5 CLEAN-UP AND DISPOSAL OF DEMOLITION MATERIALS

- A. Remove debris, rubbish, and materials resulting from demolition operations.
 - 1. Remove and legally dispose of off-site.
 - 2. Do not burn materials on site.
- B. Dispose of items and materials not designated for Owner salvage or reuse.
 - 1. Promptly remove from site.
 - 2. Do not store or sell Contractor salvaged items or materials on site.
- C. Clean adjacent structures and improvements of dust, dirt, and debris caused by demolition operations.
- D. Return adjacent areas to condition existing prior to start of work.

END OF SECTION



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DIVISION 03

CONCRETE



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SECTION 03 08 13
CONCRETE TESTING AND EVALUATION - OWNER

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Concrete Testing and Evaluation - Owner, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. ASTM International (ASTM):
 - 1. ASTM C31 Standard Practice for Making and Curing Concrete Test Specimens in Field
 - 2. ASTM C42 Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
 - 3. ASTM E329 Standard Specification for Agencies Engaged in Construction Inspection and/or Testing
- B. American Concrete Institute (ACI):
 - 1. ACI 318 Building Code Requirements for Structural Concrete and Commentary
- C. Testing Agency:
 - 1. Acceptable to Architect.
 - 2. Recent evidence of inspection by Cement and Concrete Reference Laboratory of National Institute of Standards and Technology, with cited deficiencies corrected.
 - 3. Meet requirements of ASTM E329.
 - 4. Agency and its representatives are not authorized to revoke, alter, relax, enlarge or release requirements, nor approve or accept portion of Contract Documents.

1.3 SUBMITTALS

- A. Product Data:
 - 1. For each type of material and accessory.
- B. Project Information:
 - 1. Testing Agency qualifications.
 - 2. Production sample test reports, when required:
 - a. Include same data as that required for mix designs.
 - 3. Reports of Contractor option tests.
 - 4. Test reports on in-place testing, if such testing is performed.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 DESCRIPTION

- A. Test concrete materials and inspect operations as work progresses.
- B. Failure to detect defective work or material shall not prevent later rejection when such defect is discovered nor shall it obligate Architect for final acceptance.
- C. Payment for Testing:



1. Pay for testing services required in paragraph Article 3.2, following.
2. Routine testing of concrete furnished to job site for compliance with Contract Documents will be performed by Owner's testing agency at Owner's expense.
 - a. Test for compressive strength, slump, air content, temperature and unit weight.
 - b. Perform tests every 75 CU YD or fraction thereof, for each mixture design placed in one day.
 - c. Obtain composite samples in accordance with ASTM C172.
 - 1) Obtain each sample from a different batch of concrete on a random basis.
 - 2) Select test batch at random before commencement of concrete placement.
 - d. Mold and cure sufficient specimens from each sample in accordance with ASTM C31 and report deviations from requirements, if any.
 - e. Coordinate number of specimens with test specification requirements and construction operations.
 - f. Test specimens in accordance with ASTM C39.

3.2 RESPONSIBILITIES AND DUTIES OF CONTRACTOR

- A. Provide testing services performed by Testing Agency for qualification of proposed materials and establishment of mix designs.
- B. Submit concrete materials and concrete mix designs.
 1. Include results of testing performed to qualify materials and establish mix designs
- C. Place no concrete until Contractor has received approval.
- D. Use of testing service shall not relieve Contractor of responsibility to furnish materials and construction in compliance with Contract Documents.
- E. Testing and Inspection:
 1. Furnish labor to assist Owner's Testing Agency in obtaining and handling samples or other materials at site.
 2. Advise Owner's Testing Agency in advance of operations.
 3. Provide and maintain facilities for storage and curing of concrete compressive strength test specimens on site for first 24 HRS or until strength is achieved as required by ASTM C31.
- F. Pay for following additional testing services performed by Owner's testing agency when:
 1. When changes in materials or proportions are requested by Contractor Additional testing and inspection.
 2. When specimens fail to meet specification requirements, by test or inspection.
 3. Testing services needed or required by Contractor.
 - a. Field-cured test specimens as needed for control of stripped, reshored, unshored, post-tensioned concrete work.

3.3 EVALUATION AND ACCEPTANCE OF COMPRESSIVE STRENGTH TEST RESULTS

- A. Evaluate test results for standard molded and cured test cylinders separately for each concrete mix design.
 1. Evaluate each mix design for strength and uniformity by a minimum of five tests.
- B. Strength level of concrete shall be considered acceptable when average of three consecutive strength test sets equal or exceed specified strength (f'c) and no individual strength test result is less than specified strength (f'c) by more than 500 PSI.

3.4 TESTING CONCRETE IN PLACE

- A. Test concrete in place when compressive strength tests indicate potential strength deficiency to evaluate actual strength.



1. Pay for concrete tests and engineering time and analysis required to evaluate in-place concrete strength as result of deficient cylinder strength tests.
- B. Testing by rebound hammer, ultrasonic, or other non-destructive device.
 1. Tests shall be used to determine relative strengths at various locations in structure to determine areas to be cored.
 2. Calibrated and correlated tests with other test data shall be used as basis for acceptance or rejection.
- C. Core Tests:
 1. Obtain and test largest practical diameter cores, 2 IN minimum, in accordance with ASTM C42.
 - a. Test dry if concrete in structure will be dry under service conditions,
 - 1) Air dry cores at 60 DEGF to 80 DEGF, relative humidity less than 60% for 7 days before test.
 - b. Test cores after moisture conditioning if concrete in structure is more than superficially wet under service conditions.
 2. Take three cores from area of concrete or member considered deficient in strength.
 - a. Location as selected by Architect.
 - b. Replace cores damaged prior or during removal from structure prior to testing.
 3. Concrete core test shall be considered acceptable if average strength of cores is equal to at least 85% of, with no single core less than 75% of specified strength (f'c).
 4. Fill core holes with low slump patching compound per Section 03 35 00.

3.5 ACCEPTANCE OR REJECTION OF CAST-IN-PLACE CONCRETE

- A. General:
 1. Completed concrete work which conforms to requirements of Contract Documents will be accepted without qualification.
 2. Concrete work which fails to conform to one or more requirements of Contract Documents shall be rejected and will not be accepted until repaired and proven adequate by concrete testing.
 3. Contractor pays costs incurred in providing remedial work necessary to change rejected work to accepted work.
 4. Remedial work includes, but is not necessarily limited to, applicable repairs, replacement, reinforcement, engineering, and testing.
 5. Repair or replacement of concrete in an approved manner and in conformance with Contract Documents constitutes acceptance.
- B. Dimensional Tolerances:
 1. Formed surfaces resulting in concrete outlines smaller than permitted by tolerances shall be considered potentially deficient in strength and subject to confirmation of safety by structural analysis or load test.
 - a. When deficiencies are confirmed, replace or reinforce structure as directed.
 2. Formed surfaces resulting in concrete outlines larger than permitted by tolerances will be rejected if strength or finish of structure is not acceptable, or function is adversely affected.
 - a. If removal of excess material is permitted, repair of surfaces constitutes acceptance.
 - b. If removal of excess material is not permitted, replacement of surfaces constitute acceptance.
 3. Concrete members cast in wrong location will be rejected if: strength or finish is not acceptable, function is adversely affected, and /or interference is encountered with other construction.
 4. Inaccurately formed concrete surfaces exceeding tolerances and exposed to view will be rejected.



- C. Finish:
1. Architectural concrete with surface exceeding limitations will be rejected.
 2. Concrete exposed to view with defects which adversely affect appearance of specified finish may be repaired only by approved methods.
 3. Slabs:
 - a. Finished slabs exceeding tolerance limits specified in Section 03 35 00 will be rejected if finish is not acceptable and function is adversely affected.
 - 1) If rejected, repair of finished surfaces or replacement of slab in an approved manner and in conformance with Contract Documents will constitute acceptance.
 - b. Repair may involve removing high spots by grinding, filling low spots with patching compound, or remedial measures as permitted.
 4. Formed surfaces:
 - a. Concrete exposed to view with defects which adversely affect appearance of specified finish will be rejected.
 - 1) Repair surface defects in conformance with Section 03 35 00.
 5. Concrete not exposed to view is not subject to rejection for defective finish.
- D. Strength of Structure:
1. Concrete in place which control strength of structure will be rejected if it fails to comply with requirements of Contract Documents, including but not necessarily limited to:
 - a. Deficient concrete strength based on compressive strength tests.
 - b. Reinforcing steel size, quantity, strength, position, or arrangement at variance with requirements on reinforcement.
 - c. Concrete which differs from required dimensions or location.
 - d. Curing less than that specified.
 - e. Inadequate protection of concrete from extremes of temperature during early stages of hardening and strength development.
 - f. Mechanical injury, construction fires, accidents or premature removal of formwork.
 - g. Substandard workmanship.
 2. When strength of structure is considered potentially deficient, it will not be accepted until one of following is completed and submitted to Architect for approval prior to action by Contractor.
 - a. Confirmation of safety of structure by structural analysis.
 - b. Core tests shall be performed only when safety of structure is not confirmed by structural analysis.
 - c. Confirmation of safety of structure by load tests performed and evaluated in accordance with ACI 318.
 - d. Replacement of structure deficient in strength.
 - e. Reinforce structure with supplement supports as directed by Architect and approved by Owner.

END OF SECTION



SECTION 03 10 00

CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes formwork for cast-in-place concrete for the following:
 - 1. Footings.
 - 2. Foundation walls.
 - 3. Slabs-on-grade.
 - 4. Suspended slabs.
- B. Related Sections:
 - 1. Division 03 Section "Cast-in-Place Concrete".
 - 2. Division 03 Section "Concrete Reinforcement".
 - 3. Division 31 Section "Earth Moving".
 - 4. Division 32 Section "Concrete Paving".

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Formwork Shop Drawings: Provide information showing geometry and elevation of formed surfaces.
- C. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Form materials and form-release agents.

1.4 QUALITY ASSURANCE

- A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301, "Specifications for Structural Concrete."
 - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 - 1. Plywood, metal, or other approved panel materials.
 - 2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - a. High-density overlay, Class 1 or better.
 - b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
 - c. Structural 1, B-B or better; mill oiled and edge sealed.
 - d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.



- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.
- D. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- E. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that will leave no corrodible metal closer than 1 inch (25 mm) to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, will leave holes no larger than 1 inch (25 mm) in diameter in concrete surface.
 - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
 - 1. Class A, 1/8 inch (3.2 mm) for smooth-formed finished surfaces.
 - 2. Class C, 1/2 inch (13 mm) for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 1. Install keyways, reglets, recesses, and the like, for easy removal.
 - 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.



- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.3 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.
 - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved its 28-day design compressive strength.
 - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

END OF SECTION



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SECTION 03 20 00

CONCRETE REINFORCEMENT

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 reinforcement for cast-in-place concrete for the following:
 - 1. Footings.
 - 2. Foundation walls.
 - 3. Slabs-on-grade.
 - 4. Suspended slabs.
- B. Related Sections:
 - 1. Division 03 Section "Concrete Forming and Accessories".
 - 2. Division 03 Section "Cast-in-Place Concrete".
 - 3. Division 31 Section "Earth Moving".
 - 4. Division 32 Section "Concrete Paving".

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- C. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Steel reinforcement and accessories.
- D. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301, "Specifications for Structural Concrete."
 - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- B. Preinstallation Conference: Comply with Specification Section 03 30 00 Cast-in-Place Concrete.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.



PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed unless noted otherwise. See drawings where high strength reinforcement is required.
- B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.
- C. Plain-Steel Wire: ASTM A1064/A1064M, as drawn.
- D. Plain-Steel Welded Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.

2.2 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.3 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

PART 3 - EXECUTION

3.1 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.2 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.



3.3 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports. Procedures shall meet the requirements of the building code as referenced in the general structural notes.

END OF SECTION

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SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes, for the following:
 - 1. Footings.
 - 2. Foundation walls.
 - 3. Slabs-on-grade.
 - 4. Suspended slabs.
- B. Related Sections:
 - 1. Division 03 Section "Concrete Forming and Accessories".
 - 2. Division 03 Section "Concrete Reinforcement".
 - 3. Division 31 Section "Earth Moving".
 - 4. Division 32 Section "Concrete Paving".

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: fly ash and other pozzolans, and silica fume; subject to compliance with requirements.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
 - 1. Location of construction joints is subject to approval of the Architect.
- D. Qualification Data: For installer and manufacturer.
- E. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Fiber reinforcement.
 - 4. Curing compounds.
 - 5. Bonding agents.
 - 6. Adhesives.
 - 7. Joint-filler strips.
 - 8. Repair materials.
 - 9. Waterstops.
 - 10. Vapor retarder.



- F. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
 - 1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
- G. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.
- H. Field quality-control reports.
- I. Minutes of preinstallation conference.
- J. Samples: For waterstops and vapor retarder.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
- C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
 - 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5 and Section 7, "Lightweight Concrete."
 - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
- G. Mockups: Cast formed-surface panels to demonstrate typical joints, surface finish, texture, tolerances, floor treatments, and standard of workmanship.
 - 1. Build panel approximately 200 sq. ft. (18.6 sq. m) for slab-on-grade and 100 sq. ft. (9.3 sq. m) for formed surface in the location indicated or, if not indicated, as directed by Architect.
 - 2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- H. Preinstallation Conference: Conduct conference at Project site.
 - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.



- c. Ready-mix concrete manufacturer.
 - d. Concrete subcontractor.
 - e. Special concrete finish subcontractor.
2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.
- I. Concrete - Cold Weather: Submit detailed procedures for the placement, protection & curing of concrete during cold weather. Work shall conform to all requirements of ACI 306.1, Standard Specification for Cold Weather Concreting.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 1. Portland Cement: ASTM C 150, type as indicated in the structural drawings, gray.
 2. Fly Ash: ASTM C 618, Class F or C.
- B. Silica Fume: ASTM C 1240, amorphous silica.
- C. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
 1. Maximum Coarse-Aggregate Size: 1 inch (25 mm) nominal, unless indicated otherwise.
 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. Lightweight Aggregate: ASTM C 330, 3/4-inch (19-mm) nominal maximum aggregate size.
- E. Water: ASTM C 94/C 94M.

2.2 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will 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.



7. Corrosion-Inhibiting Admixture: Commercially formulated, capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete, containing a minimum of 30% calcium nitrite and complying with ASTM C 1582.

2.3 FIBER REINFORCEMENT

- A. Synthetic Macro-Fiber: Polyolefin macro -fibers engineered and designed for use in concrete, complying with ASTM C 1116/C 1116M, Type III, 1 to 2-1/4 inches (25 to 57 mm) long.
 1. Products: Subject to compliance with requirements, provide the following available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. 3M; Scotchcast Polyolefin Fibers
 - b. Euclid Chemical Company (The), an RPM company; Tuf-Strand SF
 - c. FORTA Corporation; FORTA FERRO
 - d. Grace Construction Products, W. R. Grace & Co.; Strux 90/40
 - e. Nycon, Inc.; XL
 - f. Propex Concrete Systems Corp.; Fibermesh 650
 - g. Sika Corporation; Sika Fiber
 2. Fiber reinforced concrete shall provide equivalent reinforcing to WWR indicated in both direct tension and bending capacity for thickness indicated.
 3. Testing per ASTM C1018 and/or ASTM C1399 shall indicate a minimum residual flexural strength of 170 PSI. Submit manufacturers data verifying conformance
 4. Minimum Dosage rate 4 LBS/CY.

2.4 VAPOR RETARDERS

- A. Sheet Vapor Retarder:
 1. Manufactured from prime virgin resins.
 2. Water vapor retarder meets or exceeds ASTM E 1745, Class A.
 3. Permeance rating: ASTM E-96 or ASTM F-1249 less than 0.01 perms (gr/sf/hr/in-Hg)
 4. Maintain permeance of less than 0.01 perms after mandatory conditioning tests per ASTM E 154 sections 8, 11, 12, and 13.
 5. Minimum thickness: 10 mils per ACI 302.1R-04.
 6. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Stego Industries, LLC; Stego Wrap 15 mil Class A.
 - b. VaporGuard by Griffolyn.
 - c. Zero-Perm by Alumiseal.
- B. Accessories:
 1. Seam Tape: ASTM E 96, water vapor transmission rate 0.3 perms or lower, manufactured by the vapor retarder manufacturer.
 2. Vapor proofing mastic: ASTM E 96, water vapor transmission rate 0.3 perms or lower, manufactured by the vapor retarder manufacturer.
 3. Pipe boots: Construct pipe boots from vapor retarder material, pressure sensitive tape and/or mastic per manufacturer's instructions.

2.5 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.
 1. Products: Basis of design:
 - a. Curecrete Distribution Inc.; Ashford Formula.



2.6 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BASF Construction Chemicals - Building Systems; Confilm.
 - b. Dayton Superior Corporation; Sure Film (J-74).
 - c. Sika Corporation; SikaFilm.
- 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, 18 to 25 percent solids, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering. Use at suspended slabs.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BASF Construction Chemicals - Building Systems; Kure-N-Seal W.
 - b. Dayton Superior Corporation; Safe Cure and Seal (J-19).
 - c. Euclid Chemical Company (The), an RPM company; Diamond Clear VOX; Clearseal WB STD.
- F. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A. Use at slabs on grade.
 - 1. Products: Basis of design:
 - a. Euclid Chemical Company (The), an RPM company; Super Diamond Clear VOX; LusterSeal WB 300.

2.7 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.
- B. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- C. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness range of 90 to 95 per ASTM D 2240.
- D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
 - 1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- E. Permanent Compressible Joint Filler:
 - 1. Closed-cell expansion joint filler, ultraviolet stable, minimal moisture absorption, non-impregnated, nonstaining and nonbleeding, inert and compatible with cold-applied sealants.
 - 2. Available Products:
 - a. Ceramar by W. R. Meadows



2.8 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Use fly ash as needed to reduce the total amount of portland cement, which would otherwise be used by not less than 25 percent except for slab on grade concrete.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement in reinforced concrete.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing, high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
 - 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 - 3. Use water-reducing admixture in pumped concrete and concrete with a water-cementitious materials ratio below 0.50.
 - 4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.
- E. Definitions of Mix Properties:
 - 1. Concrete Compressive Strength is the compressive strength at 28 days as tested per ASTM C39.
 - 2. Slump Specified is maximum, not to exceed, tested in accordance with ASTM C143.
 - 3. Air Content is by volume at point of placement.
 - 4. Water/Cementitious Materials Ratio is specified by weight.
 - 5. Drying Shrinkage Limit is percentage change in length after 28 days of drying when tested per ASTM C157 with 4 inch x 4 inch x 11 inch specimen moist cured 7 days prior to drying.

2.9 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Proportion concrete mixtures for building elements per the requirements in the structural drawings.
- B. Interior Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:
 - 1. The successful concrete supplier shall perform drying shrinkage tests demonstrating that the mix design complies with the specified drying shrinkage limit. Specimen testing shall be observed by the owner's quality assurance agency to verify conformance with the project specifications. Historical test data will not be accepted. Tests shall be performed on concrete samples made from the mix design that will be used in the project containing materials and aggregates that will be used in the project.

2.10 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, 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 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.2 VAPOR RETARDERS

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
 - 1. Unroll vapor retarder with the longest dimension parallel with the direction of the pour.
 - 2. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.
 - 3. Lap vapor retarder over footings or seal to foundation walls.
 - 4. Seal all penetrations (including pipes) per manufacturer's instructions.
 - 5. No penetration of the vapor retarder is allowed except for permanent utilities.
 - 6. Repair damaged areas by cutting patches of vapor retarder, overlapping damaged area 6 inches and taping all four sides with manufacturer's tape.
- B. Prepare drainage course with mechanical equipment to elevation tolerances of plus 0 inch (0 mm) or minus 3/4 inch (19 mm). Place vapor retarder directly on drainage course. Place concrete slab on grade directly on vapor retarder.

3.3 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated.
 - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
 - 3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 - 4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 - 5. Space vertical joints in walls at 10 feet on center or as otherwise indicated by Architect. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
 - 6. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
 - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (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 will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.



3.4 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
 - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 - 1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
 - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 - 1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 2. Maintain reinforcement in position on chairs during concrete placement.
 - 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 - 4. Slope surfaces uniformly to drains where required.
 - 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- F. Cold-Weather Placement: Provide all necessary cold weather protection for in-place concrete (cover, insulation, heat, etc.). Work shall conform to all requirements of ACI 306.1, Standard Specification for Cold Weather Concreting. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- G. Hot-Weather Placement: Comply with ACI 301 and as follows:
 - 1. Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water.
 - 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.



3.5 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, to be covered with a coating or covering material applied directly to concrete.
- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.6 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. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch (6 mm) in one direction.
 - 1. Apply scratch finish to surfaces indicated and where to receive concrete floor toppings or mortar setting beds for bonded cementitious floor finishes.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
 - 1. Apply float finish to surfaces indicated and where to receive trowel finish or to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
- D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - 1. Apply a trowel finish to surfaces indicated and where exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
 - 2. Finish surfaces to the following tolerances, according to ASTM E 1155 (ASTM E 1155M), for a randomly trafficked floor surface:
 - a. Specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15.
 - b. Suspended Slabs: Finish and measure surface so gap at any point between concrete surface and an unlevelled, freestanding, 10-ft. long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch.
- E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated and where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.
 - 1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.



- F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
 - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.
- G. Slip-Resistive Finish: Before final floating, apply slip-resistive aggregate finish where indicated and to concrete stair treads, platforms, and ramps. Apply according to manufacturer's written instructions and as follows:
 - 1. Uniformly spread 25 lb/100 sq. ft. (12 kg/10 sq. m) of dampened slip-resistive aggregate over surface in one or two applications. Tamp aggregate flush with surface, but do not force below surface.
 - 2. After broadcasting and tamping, apply float finish.
 - 3. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive aggregate.

3.7 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

3.8 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (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. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- D. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least



12 inches (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.

- a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
- a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

3.9 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.
1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
 2. Do not apply to concrete that is less than 28 days' old.
 3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

3.10 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
1. Defer joint filling until concrete has aged at least six month(s). Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.11 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include spalls, popouts, honeycombs, rock pockets, and cracks in excess of 0.02 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
1. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding



- with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
2. Repair defects on concealed formed surfaces over 3/4 inch deep as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 2. After concrete has cured at least 14 days, correct high areas by grinding.
 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.12 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Inspections:
1. Steel reinforcement placement.
 2. Headed bolts and studs.
 3. Verification of use of required design mixture.
 4. Concrete placement, including conveying and depositing.
 5. Curing procedures and maintenance of curing temperature.
- C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
1. Testing Frequency: Obtain at least one composite sample for each 75 cu. yd. or fraction thereof of each concrete mixture placed each day.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.



2. Slump: ASTM C 143/C 143M; one test at point of placement for each truck. Perform additional tests when concrete consistency appears to change.
 3. Air Content: ASTM C 231, pressure method, for normal-weight concrete, one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
 5. Compression Test Specimens: ASTM C 31/C 31M.
 - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
 - b. Cast and laboratory cure an additional set of standard cylinder specimens where a 56 day strength is indicated.
 6. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days, one set of two specimens at 28 days, and one set of two specimens at 56 days when indicated.
 - a. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
 7. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
 8. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
 9. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
 10. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
 11. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 12. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- D. Measure floor and slab flatness and levelness according to ASTM E 1155 (ASTM E 1155M) within 24 hours of finishing.

END OF SECTION



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SECTION 03 54 16

SELF-LEVELING UNDERLAYMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Self-Leveling Underlayment, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Use mixing equipment, tools and techniques approved by underlayment manufacturer.
- B. ASTM International (ASTM):
 - 1. ASTM C109 Compressive Strength of Hydraulic Cement Mortars (Using 2-in. Cube Specimens)
 - 2. ASTM C150 Standard Specification for Portland Cement.

1.3 SUBMITTALS

- A. Product Data.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Self-Leveling Underlayment:
 - 1. Base:
 - a. Ardex Engineered Cements.
 - 2. Optional:
 - a. ProSpec (Bonsal).
 - b. Dayton-Superior.
 - c. Laticrete.
 - d. MAPEI Corp.
 - e. Summitville Tile.
 - f. Master Builders Solutions.
 - g. US Mix Products Company.
- B. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 MATERIALS

- A. Self-Leveling Underlayment:
 - 1. Portland Cement-based, self-leveling underlayment.
 - 2. Minimum Portland cement content: 80%.
 - 3. Minimum Compressive Strength, modified, air cure only:
 - a. 2630 PSI after 1 day.
 - b. 4100 PSI after 28 days.
 - 4. Base Product: K-15 Self-Leveling Underlayment Concrete by Ardex.
- B. Primers:
 - 1. Use manufacturers recommended primer suitable for substrate condition.
 - a. For use with standard, absorbent concrete:



- b. For use with non-porous subfloors, cutback and non-water soluble adhesive residues, metal, and wooden subfloors:
- C. Additives:
 - 1. Base Product: E-25 Resilient Emulsion by Ardex.
- D. Aggregate, where applicable:
 - 1. Well graded, washed gravel.
 - 2. Minimum Size: 1/8 to 1/4 IN.
- E. Water:
 - 1. Clean, potable, and sufficiently cool not warmer than at 70 DEGF.

2.3 MIX DESIGNS

- A. General:
 - 1. Specific mixture ratios listed in following pertain to Base Product, specific amounts of ingredients may vary for Optional Products.
 - 2. Proportions listed below pertain to Base Product.
 - 3. Follow mixing recommendations provided by supplier of product being used.
- B. Standard Mix:
 - 1. Follow manufacturer's instructions for mixing and proportioning.
 - 2. Utilize 7 QT water for every 55 LBS bag.
 - a. Equivalent Ratio: 1:3.5 parts by volume.
 - 3. Mix thoroughly for approximately 2-3 minutes to obtain a lump-free mixture.
- C. Aggregate Mix:
 - 1. Add to Standard Mix where 1-1/2 IN, or greater, underlayment is installed.
 - 2. Mix cementitious materials with water and add 1/3 to 1 part by volume of aggregate.
 - 3. Do not use sand.
- D. Mixes for Pumping:
 - 1. Follow manufacturer's instructions.
 - 2. Do not overwater.
 - 3. Check consistency of product on floor to ensure a uniform distribution of aggregate at both top and bottom of pour.
 - 4. Conditions during installation, such as variations in water, powder, substrate, and ambient temperature, require water setting be monitored and adjusted to avoid overwatering.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Verify substrates are sound, clean, free of oil, waxes and sealers, grease, curing compounds, paints, adhesive residues rust and foreign matter.
- B. Correct substrates with moisture or other conditions affecting performance of underlayment or finished floor covering.
- C. Concrete Substrates:
 - 1. Mechanically clean using shot blasting or other.
 - 2. Acid etching and the use of sweeping compounds and solvents are not acceptable.
- D. Joint Preparation:
 - 1. Moving Joints:
 - a. Extend expansion and isolation joints through underlayment.
 - 2. Saw Cuts and Control Joints:



- a. Fill non-moving joints with products recommended by manufacturer of underlayment.
 - b. Base Products: SD-F Feather Finish or SD-P InstantPatch by Ardex.
 - c. “Planiprep SC” by MAPEI or “Mapecem Quickpatch” by MAPEI.
- E. Priming:
- 1. Use manufacturers recommended primer suitable for substrate.
 - 2. Underlayment shall not be applied until the primer is dry.

3.2 APPLICATION OF UNDERLAYMENT

- A. Minimum thickness:
- 1. 1/8 IN over highest point in substrate.
 - 2. Do not exceed maximum thickness allowed by product used.
- B. Pour or pump self-leveling underlayment and spread in place.
- C. Smooth to featheredge and match existing elevations.

3.3 PROTECTION

- A. Prior to installation of finish flooring, protect surface of underlayment from abuse by suitable protection course.

END OF SECTION

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DIVISION 05

METALS



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SECTION 05 05 00 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 03 30 00 – Cast-in-Place Concrete.
 - 2. Section 09 22 16 – Non-Structural Metal Framing
 - 3. Division 23 – Mechanical.
 - 4. Division 26 – Electrical.

1.2 SUBMITTALS

- A. Comply with provisions of Section 01 33 00 – Submittal Procedures.
- B. Product Data: Manufacturers' information on materials, fabrication, and installation. Include current ICC or IAPMO 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. All post-installed anchors/dowels:
 - a. Test in accordance with the approved code evaluation report, manufacturer's recommended installation procedure, and with ACI 318-14 Section 17.8.2..
 - 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.
- B. LEED Requirements:
 - 1. Refer to Section 01 81 17, LEED HC v4 Requirements, for additional performance requirements that may apply to products specified in this section.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Post Installed Anchors: products as indicated on structural drawings.
- 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. Post installed anchors and dowels.
 1. Install according to the manufacturer's instructions as to tools, torque, and tightening procedure, as applicable.
 2. Abandon holes if the axis of a drilled hole deviates more than 5 degrees from normal to the concrete surface.
 3. 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 nonshrink grout and install expansion bolt with a minimum of 1/2 inch of sound concrete between the expansion bolt and the abandoned hole.
 - 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.
 - 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. 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.
- C. 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:
- Hydraulic Ram Method: Expansion bolt is acceptable if there is no observable movement nor loosening of washer at application of tension test load.
 - 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



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SECTION 05 40 00

COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Cold-Formed Metal Framing in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. ASTM International (ASTM):
 - 1. ASTM A1003 Standard Specification for Steel Sheet, Carbon, Metallic- and – Nonmetallic-Coated for Cold-Formed Framing Members.
 - 2. ASTM C1007 Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories
- B. American Iron and Steel Institute (AISI):
 - 1. AISI S200 Series North American Standards for Cold-Formed Steel Framing.
- C. Provide Cold-Formed Metal Framing engineered to support dead, live, and lateral (wind or seismic) loads indicated.
 - 1. Comply with Section 01 71 21, Specialty Engineering Requirements, if applicable.
 - 2. Include headers and reinforcing members around openings.
 - 3. Required details defining method of fastening throughout system and attachments to supporting primary structure included in engineering requirement.
- D. LEED Requirements:
 - 1. Refer to Section 01 18 17, LEED HC v4 Requirements, for additional performance requirements that may apply to products specified in this section.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Complete building elevations, wall sections, and details defining framing member sizes, locations, and connection details.
 - a. Show openings, edges and support conditions field verified with respect to location.
 - b. Show openings, edges and support conditions coordinated with respect to physical requirements of items to be installed in or on exterior wall system.
 - c. Show all elements and connections for review. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing, details of cuts, wall sections, connections, fastening details, bridging, bracing, splices, member sizes, and other pertinent data. Indicate welds by standard AWS symbols, and show size, length, and type of each weld. Indicate type, size, length, and quantity of screws, anchors, and powder actuated fasteners at each connection. Indicate all connection clips and their required fasteners.
 - d. Photocopies and reproductions of the architectural and/or structural drawings will not be accepted.
- B. Calculations:
 - 1. Drawings provide design of exterior wall Cold Formed Metal Framing and calculations are not required.



2. Provide structural calculations for Cold Formed Metal Framing only for proposed substitutions or deviations from the design contained in the Drawings and for conditions not specifically detailed in the Drawings. Calculations shall indicate design conform to specified design criteria, sealed by the Specialty Structural Engineer.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Cold-Formed Metal Framing:
 1. Base:
 2. Telling Industries.Optional:
 - a. California Expanded Metal Products Co.
 - b. Custom Stud Inc.
 - c. Marino\WARE
 - d. MRI Steel Framing LLC
 - e. The Steel Network
 - f. ClarkDietrich Building Systems
- B. Galvanizing Repair Coating:
 1. Base:
 - a. Tnemec
 2. Optional:
 - a. ZRC Worldwide
 - b. Sherwin Williams
- C. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 DESIGN CRITERIA

- A. Design Cold-Formed Metal Framing to satisfy requirements of applicable building codes as locally amended, but not less than loads shown in contract documents.
 1. Design Exterior Soffits similarly.
 2. Include anticipated dead and live with lateral, wind or seismic, loads where details indicate cladding, soffits or equipment weights are carried by stud wall system.
- B. Limit lateral deflection of stud wall system due to wind or seismic as follows:

MAXIMUM ALLOWABLE DEFLECTION	
Exterior Finish Material	Deflection Limit
Marble, Granite and other Stone Veneers	L/720
Brick and Concrete Masonry Veneers	L/600
Manufactured Stone Veneer, Adhered Stone Veneer, Thin Brick, Tile and similar Mortar-Set finishes.	L/360
Metal Panels, Curtain Walls, and other flexible wall finishes.	L/240

- C. Select stud gauge and spacing as required for strength and to limit deflection due to applied loads.
 1. Utilize properties of metal stud only. Disregard contribution of facings such as Gypsum Wall Board and Gypsum Sheathing.
 2. Neglect bracing provided by wallboard or sheathing



3. Design connections such that anticipated structural movements will not adversely affect system or cladding supported by system
 - a. Allow for vertical beam deflections of 3/8 inch.
 - b. Allow for lateral interstory drift indicated in the table in the general structural notes.
4. Design framing system to resist gravity loads and wind uplift at soffits.

2.3 MATERIALS

- A. Exterior Studs:
 1. Galvanized 50ksi steel studs, runner channels and track, bracing, and accessories, minimum G60 galvanized.
 2. Stud depth:
 - a. As indicated on Drawings.
 3. Span:
 - a. As indicated on Drawings.
- B. Galvanizing Repair Coating:
 1. Tnemec Series 94-H20 Hydro-Zinc.
 2. ZRC Worldwide, Galviline 221.
 3. Sherwin Williams Zinc Clad III HS 100.
- C. Wood Sheathing: Specified in Section 06 11 10.
- D. Wood Wall Blocking: Specified in Section 06 10 53.
- E. Gypsum Sheathing: Specified in Section 06 16 43.
- F. Exterior Joint Sealants: Specified in Section 07 92 13.
- G. Metal Wall Backing: Specified in Section 09 22 16.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine substrate for suitability to accept work.
- B. Start of work constitutes acceptance of substrate and responsibility for performance.

3.2 ERECTION

- A. Studs and Runners:
 1. Align outside deep leg runner track accurately according to exterior wall layout.
 2. Anchorage:
 - a. Top:
 - 1) Fasten per drawings.
 - 2) At drift track:
 - a) Allow 3/4 IN clearance between top track or stud and drift track.
 - b) Do not fasten place fasteners through drift track.
 - b. Bottom:
 - 1) Fasten per drawings.
 3. Touch-up burned off or abraded galvanizing with galvanizing repair coating.
- B. Openings:
 1. Install header, jamb, and sill framing system per approved engineering documents
- C. Coordinate installation of wall blocking used to support wall-supported items with installation of Cold-Formed Metal Framing.



3.3 PROTECTION

- A. Protect erected wall and openings with temporary covers until finish, roofing, flashing, and windows are installed.

END OF SECTION



DIVISION 06

WOOD, PLASTICS, AND COMPOSITES



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THERE ARE HIDDEN SPECIFIER NOTES (BLUE TEXT) AND OPTIONAL TEXT (STRIKEOUTS) IN THIS DOCUMENT. TO SEE THE HIDDEN SPECIFIER NOTES, CLICK "SHOW/HIDE" BUTTON IN THE PARAGRAPH GROUP OF THE HOME TAB OR TOGGLE HIDDEN TEXT ON AND OFF WITH THE "HIDDEN TEXT" BUTTON IN THE VIEWS GROUP ON THE VISISPECS TAB.

SECTION 06 10 00
ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Rough Carpentry, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Lumber Grading Rules and Species:
 - 1. US Department of Commerce (DOC):
 - a. PS 20 American Softwood Lumber Standard.
 - 2. Western Wood Products Association (WWPA).
 - 3. Southern Forest Products Association (SFPA).
- B. Plywood Grading Rules and Recommendations:
 - 1. US Department of Commerce (DOC):
 - a. Softwood plywood: PS1 Structural Plywood.
 - 2. American Plywood Association (APA).
- C. Preservative and Fire Retardant Treatment Standards:
 - 1. American Wood Protection Association (AWPA):
 - a. AWPA U1 Treated Wood.
 - b. AWPA P5 Standard for Waterborne Preservatives.
 - 2. Underwriters Laboratories (UL)
 - 3. ASTM International requirements:
 - a. ASTM E84 Standard Test Method for Surface Burning Characteristics
 - b. ASTM D2898 Standard Method of Accelerated Weathering of Fire Retardant Treated Wood for Fire Testing
 - c. ASTM D3201 Standard Test Method for Hygroscopic Properties of Fire-Retardant Wood and Wood-Based Products
- D. Factory Marking:
 - 1. Identify type, grade, moisture content, inspection service, producing mill, and other qualities.
 - 2. Mark each piece of fire retardant treated material with Underwriters Laboratory Classification mark and fire-retardant treatment for identification.
 - 3. International Building Code (IBC):
 - a. Requirements for identification and labeling.

1.3 SUBMITTALS

- A. See Section 01 33 00 for requirements.
- B. Product Data:
 - 1. For each type of material and accessory.



- C. Project Information:
 - 1. Certification of fire retardant treated material.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Fire-retardant Treated Dimension Lumber and Plywood:
 - 1. Base:
 - a. Hoover Treated Wood Products, Inc.
 - 2. Optional:
 - a. Lonza Group Limited
 - b. Western Wood Preserving Company
- B. Preservative Treated Lumber:
 - 1. Base:
 - a. Lonza Group Limited
 - 2. Optional:
 - a. Stella-Jones Incorporated
 - b. Western Wood Preserving Company

2.2 MATERIALS

- A. Dimensional Lumber and Plywood:
 - 1. Thoroughly seasoned, non-treated, well-fabricated materials.
 - 2. Longest practical lengths and sizes.
 - 3. Application, except where treated types are indicated:
 - a. Non-structural framing, blocking, backing, nailers, grounds, and similar members.
 - b. Other locations where indicated.
- B. Fire-retardant Treated Lumber and Plywood (FRT):
 - 1. Flame spread index: Less than 25.
 - 2. Smoke developed index: Less than 450.
 - 3. Free of halogens, sulfates, chlorides, arsenic, ammonium phosphate, formaldehyde, and urea formaldehyde.
 - 4. Kiln dried after treatment, (KDAT).
 - 5. FRT material for interior and above grade locations:
 - a. Base: Pyro-Guard by Hoover Treated Wood Products, Incorporated
 - b. Optional:
 - 1) Dricon FRT by Lonza Group Limited
 - 2) FirePro by Western Wood Preserving Company.
 - c. Natural wood products treated to add fire-retardant qualities.
 - d. Type A: not more than 28 PCT moisture when tested according to ASTM D3201.
 - e. Interior and above grade applications include but not limited to:
 - 1) Interior, above grade framing, blocking, and sill plates within non-load bearing interior partitions that are fire rated 2 HRS or less.
 - 2) Above grade framing, blocking, and sill plates within non-load bearing exterior walls that are not fire-rated.
 - 3) Platforms and Stages.
 - 4) Wood in concealed spaces.
 - 5) Framing, blocking, cants and nailers within roof covering and waterproofing systems.
 - 6) Interior sleepers and sill plates in contact with concrete slabs-on-grade.
 - 7) Interior wood items in direct contact with exterior concrete and exterior masonry walls.



- 8) Window frame blocking within non-rated exterior walls.
- 9) Plywood backing panels for electrical, telecommunication equipment.
- 10) Similar locations where wood products are indicated and building code does not permit non-fire-resistive treated products.
- 11) Above grade dimensional lumber and plywood, unless indicated otherwise.
 - a) Exception: Upgrade to exterior grade where scheduled in the following article.
- 6. FRT material for wet locations:
 - a. Base:
 - 1) Exterior Fire-X by Hoover Treated Wood Products, Incorporated
 - b. Optional:
 - 1) Dricon FRX by Lonza Group
 - c. Natural wood products treated to add fire-retardant qualities plus decay and termite resistance.
 - d. Non-leaching treatment under direct exposure to precipitation, sunlight, and effects of weather.
- C. Preservative Treated Lumber and Plywood:
 - 1. Natural wood products treated to add decay and termite resistance.
 - 2. Base:
 - a. FrameGuard by Lonza Group Limited
 - 3. Optional:
 - a. Lumber Products by Stella-Jones Incorporated
 - b. Advance Guard by Western Wood Preserving Company
 - 4. Preservatives:
 - a. Compatible with direct exposure to precipitation, sunlight and effects of weather.
 - b. Authenticate by factory marking each piece with manufacturer's mark and applicable standards.
 - c. Acceptable treatments:
 - 1) Alkaline Copper Quaternary (ACQ).
 - 2) Copper Boron Azole (CBA).
 - 3) Borate based (BORON).
 - 5. Lumber Species:
 - a. Southern Pine.
 - b. Mixed Southern Pine.
 - c. Hem-Fir.
 - d. Spruce.
 - e. Pine.
 - f. Other species meeting requirements.
 - 6. Plywood:
 - a. Grading:
 - 1) PS1, B-C Grade.
 - 2) PS1, A-C Grade where exposed.
 - b. Veneers:
 - 1) Softwood species.
 - 2) Glue with waterproof adhesives.
 - 7. Application:
 - a. Below grade, or in contact with earth.
 - b. Where indicated in Drawings.

2.3 FASTENERS

A. General:



1. Provide fasteners of size and type indicated that comply with requirements specified for material and manufacture.
 2. Where rough carpentry is exposed to weather, in contact with earth, pressure-preservative treated, or in area of high relative humidity:
 - a. Use fasteners with hot dip zinc coating complying with ASTM A153.
 - b. Use fasteners of Type 304 stainless steel.
- B. Nails, Brads, and Staples: ASTM F1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts: ASME B18.2.1.
- F. Bolts: ASTM A307, Grade A steel bolts with ASTM A563 hex nuts and washers.
- G. Expansion Anchors:
1. Tested in accordance with ASTM E488.
 2. Anchor bolt and sleeve assembly:
 - a. Masonry assemblies: Sustain load equal to 6 times load imposed when installed in unit.
 - b. Concrete assemblies: Sustain load equal to 4 times load imposed when installed in unit.
 3. Interior applications:
 - a. Carbon-steel components.
 - b. Zinc plated to comply with ASTM B633, Class Fe/Zn 5.
 4. Exterior and wet applications:
 - a. Stainless Steel components, ASTM F593 and ASTM F594 Alloy Group 1 or 2.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine conditions under which work is to be installed.
- B. Verify measurements, dimensions, and details before proceeding.
- C. Coordinate location of furring, nailers, blocking, grounds and similar supports.
- D. Correct unsatisfactory conditions.

3.2 INSTALLATION OF ROUGH CARPENTRY

- A. Form to shapes indicated.
- B. Cut and fit accurately.
- C. Set work to required levels and lines, plumb and true.
- D. Shim as required.
- E. Provide wood grounds or nailers as required for attachment of other work and surface applied items.
- F. Grounds:
 1. Dressed, key beveled lumber.
 2. Minimum 1-1/2 IN wide x thickness required to bring face of ground even with finish material.
 3. Remove temporary grounds when no longer required.
- G. Wall Blocking:



1. Provide in-wall fire-treated wood blocking reinforcement where following items are required to be wall-mounted to interior walls:
 - a. Architectural casework, millwork, cabinets, shelving, wardrobes, and bookcases.
 - b. Handrails at stairwells.
 - c. Between studs at height of door stop, behind stop.
 2. Metal wall backing:
 - a. See Section 09 22 16.
- H. Anchor work to support applied loading.
1. Provide washers under bolt heads and nuts.
 2. Fasten plywood in accordance with APA recommendations.
 3. Use fasteners of size that will not penetrate members where opposite side will be exposed to view or receive finish materials.
 4. Predrill holes to avoid splitting wood with fasteners.
 5. Do not drive threaded friction type fasteners.

3.3 INSTALLATION OF FIRE RETARDANT TREATED WOOD

- A. Fire retardant treated lumber and plywood used in structural applications shall be applied according to lumber and plywood strength tables provided by manufacturer.
- B. Use only fasteners approved by the manufacturer of fire retardant treated or preservative treated wood.
- C. Field Cuts:
 1. Dimensional Lumber: Do not rip or mill fire retardant treated lumber.
 - a. Cross cuts, joining cuts, and drilling holes are permitted.
 2. Plywood: Fire retardant treated plywood may be cut in any direction.
 3. Field treat cuts and holes in preservative and fire retardant treated material in accordance with AWPA M4.

END OF SECTION

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DIVISION 07

THERMAL AND MOISTURE PROTECTION



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SECTION 07 16 04

CONCRETE FLOOR MOISTURE TESTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Concrete Floor Moisture Testing in accordance with provisions of Contract Documents.
- B. Completely coordinate with Section 07 16 05, Water Vapor Emission Control System, and work of other trades.
- C. Contractor's Responsibilities:
 - 1. Provide pre-installation coordination with concrete and space acclimatization trades upon building enclosure.
 - 2. Facilitate testing and inspection and furnish labor to assist Owner's testing agency at site.
 - 3. Advise Owner's testing agency sufficiently in advance of operations to allow for completion of routine testing and for assignment of personnel.

1.2 QUALITY ASSURANCE

- A. Section includes testing agency administrative and procedural requirements for quality assurance and quality control in performing concrete moisture testing for compliance with floor finishes.
- B. Testing and inspection services are required to verify compliance with requirements specified or indicated and do not relieve Contractor's responsibility for compliance with Contract Document requirements.
- C. Testing Agency Qualifications:
 - 1. Firm experienced in field of concrete floor moisture testing for projects similar in scope, material, design, and extent indicated for this Project.
 - 2. International Concrete Repair Institute (ICRI) Certified in moisture and pH testing, conducting ASTM tests, and interpretation of results.
- D. ASTM International (ASTM):
 - 1. ASTM F710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
 - 2. ASTM F2170 Standard Test Method for Determining Relative Humidity in Concrete Slabs Using in situ Probes

1.3 SUBMITTALS

- A. See Section 01 33 00 for requirements.
- B. Product Data:
 - 1. For each type of material and accessory.
- C. Project Information:
 - 1. Prepare schedule of tests and inspections in tabular form to include following:
 - a. Specification Section number and title.
 - b. Description of test and inspection method.
 - c. Identification of applicable standards.
 - d. Identification of test and inspection methods.
 - e. Number of tests and inspections required.
 - f. Time schedule or time span for tests and inspections.
 - g. Entity responsible for performing tests and inspections.
 - h. Requirements for obtaining samples.



- i. On elevated slabs on metal deck, test at deepest portion of deck flute.
 - j. Each test shall be identified by its own unique number directly on concrete and site map.
 - k. Digital pictures of testing methods in place.
 - 2. Submit reports of test results and include following:
 - a. Date of issue.
 - b. Project title and number.
 - c. Name, address, and telephone number of testing agency.
 - d. Dates and locations of samples and tests or inspections.
 - e. Names of individuals making tests and inspections.
 - f. Description of Work and test and inspection method.
 - g. Record for each test listing interior temperature, interior humidity, concrete internal RH, moisture vapor, and alkalinity results for testing period for both new or existing concrete slabs or both.
 - h. Test and inspection results and an interpretation of test results.
 - i. Provide electronic copy of Architectural Floor Plans identifying each test by number and location where conducted.
 - j. Name and signature of laboratory inspector.
 - k. Recommendations on retesting and re-inspection.
 - 3. Testing equipment and devices used to conduct tests:
 - a. Product data for components.
 - b. Date of most recent calibration as required by manufacturer.
- D. Contract Closeout Information:
- 1. Testing Agency shall include closeout document including testing reports, test location maps, submittal information for installed below grade vapor barrier, concrete mix designs, admixtures, curing methods and moisture control products utilized on project.

1.4 SEQUENCING

- A. Owner Responsibilities:
- 1. Owner shall engage qualified Testing Agency to perform testing specified herein and in accordance with Section 01 45 23.
 - 2. Payment for testing services will be made by Owner directly to testing agency.
- B. Testing Agency Responsibilities:
- 1. Cooperate with Contractor and Architect in performance of duties.
 - 2. Provide qualified personnel to perform required tests and inspections.
 - a. Provide documented confirmation of previous projects completed of similar size and scope of proposed project.
 - b. Technicians conducting or overseeing performance of moisture testing are required to be International Concrete Repair Institute (ICRI) certified to Grade 1, Moisture Testing Technician level.
 - 3. Notify Contractor and Architect promptly of irregularities or deficiencies observed in Work during performance services.
 - 4. Determine locations from which test samples will be taken.
 - 5. Provide test results marked on finish floor plan drawings showing test results with vapor reduction system recommendations.
 - 6. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 - 7. Submit a certified written report for each test, inspection, and similar quality assurance service to Owner, Architect, and Contractor.
- C. Schedule of Tests and Inspections:



1. Allow adequate time for results of tests, inspections and moisture control system to conclude prior to erection of interior walls, fixtures and equipment.
 2. Prepare a schedule of tests, inspections, and similar quality control services required by Contract Documents.
 3. Submit schedule within 30 days of date established for Notice to Proceed.
 4. Distribute schedule to Owner, Architect, Contractor, testing agencies, and each party involved in performance of portions of Work where tests and inspections are required.
 5. Preinstallation Conference:
 - a. Testing Agency, Owner, Architect, and Contractor shall meet 90 days prior to flooring installation to discuss testing requirements, specifications, and locations of test sites.
 - b. See Section 01 31 19.
- D. Acclimate building to working environment as required by manufacturer requirements of specified flooring materials and in accordance with ASTM F2170 requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Base:
1. Wagner Electronics.
- B. Optional:
1. American Moisture Test.
 2. Delmhorst Instrument Co.
 3. Tramex.

2.2 MATERIALS

- A. Testing equipment shall be from single source, meeting specified requirements:
1. Alkalinity (pH): ASTM F710.
 - a. Wide Range 1-14pH.
 2. Relative humidity (RH): ASTM F2170.
 - a. Relative humidity range of 0-100 PCT.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify building weatherproof, exterior doors installed and windows secured.
- B. Begin testing process when concrete installation is minimum 90 days of age.

3.2 PREPARATION

- A. Prepare test sites per ASTM F710 and ASTM F2170.
- B. Conditioning: Minimum 48 HRS prior to testing:
1. Concrete floor slabs: Service temperature.
 2. Occupied air space above the floor slab: Service temperature.
 3. Occupied air space relative humidity above floor slab: Service humidity.
 4. Continue conditioning required until and during floor installation and adhesive cure.
- C. Clearly mark each test location on floor plan and directly on concrete surface with non-removable marker.



3.3 TESTING

- A. Test concrete for each area of each non-permeable flooring type.
- B. Test concrete for each area of each low permeable flooring type in accordance with criteria provided by flooring manufacturer.
- C. Perform tests at rate of 3 tests for areas up to 1000 SQFT , and 1for each 1000 SQFT thereafter.
- D. HVAC system shall be operational during testing period and for a minimum period of 60 days preceding tests.
 - 1. Record temperature and humidity readings at start and end of testing.
 - 2. Continue conditioning after flooring installation as required by applicable manufacturers.
 - 3. If proper conditions cannot be achieved during construction process and testing is performed results shall be used as preliminary information only.
 - a. Re-testing when conditions are achieved or application of Section 07 16 05 scope is required.
- E. Perform in-situ probe tests per probe manufacturer's specifications with regard to temperature and humidity of space being tested.
 - 1. Proof of calibration is required for each sensor or testing apparatus prior to use.
 - 2. Test conditions: Service temperature and humidity.
- F. Perform digital Alkalinity (pH) tests within water vapor emission test dome.
 - 1. Test in accordance with ASTM F710 and manufacturer's recommendations.
 - 2. Apply manufactures recommended liquid to form 1 IN diameter puddle.
 - 3. Allow liquid to absorb for 60 seconds.
 - 4. Expose probe to liquid and allow meter to calculate pH level for 10 seconds.
 - 5. Document results to nearest hundredth.
- G. Perform Relative Humidity (RH) tests.
 - 1. Test in accordance with ASTM F2170 and manufacturer's recommendations.
 - 2. Drill hole to diameter and length required for concrete thickness.
 - 3. Remove concrete debris by compressed air and vacuuming holes.
 - 4. Place RH probe sleeve in opening, secure cap and allow acclimating for minimum 72 HRS.
 - 5. Protect from wet work and trade traffic.
- H. Acceptable readings during HVAC operation shall be in accordance with following:
 - 1. Relative Humidity Level per ASTM F2170: Less than 75 PCT.
 - 2. Alkalinity-pH per ASTM F710: Acceptable Range 7.0 pH to 10.0 pH.
- I. Section 07 16 05 Water Vapor Emission Control System is required where test results are found unacceptable per flooring manufacturer installation recommendations and requirements.

3.4 POST-INSTALLATION TESTING

- A. Coordinate and conduct tests for moisture vapor emissions and alkalinity reductions to comply with specifications prior to placement of self-leveling cementitious surfacing.
- B. Repair and re-test locations where system is found to be deficient prior to commencement of topping installation and scheduled floor covering products.

END OF SECTION



SECTION 07 81 16
CEMENTITIOUS FIRE PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Fireproofing, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. ASTM International (ASTM):
 - 1. ASTM E605/E605M Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members
 - 2. ASTM E736/E736M Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members
 - 3. ASTM E759/E759M Standard Test Method for Effect of Deflection on Sprayed Fire-Resistive Material Applied to Structural Members
 - 4. ASTM E859/E859M Standard Test Method for Air Erosion of Spray Fire-Resistive Materials (SFRMs) Applied to Structural Members
 - 5. ASTM E1513/E1513M Standard Practice for Application of Sprayed Fire-Resistive Materials (SFRMs)
- B. UL:
 - 1. Fire resistance ratings for assemblies: UL Fire Resistance Directory.
 - 2. Fire resistance ratings for materials: UL Building Materials Directory.
- C. Building Construction Parameters:
 - 1. Comply with building code as locally adopted and amended.
 - a. See Section 01 41 00 Codes, Regulations, and Guidelines.
 - 2. See Drawings for minimum fire resistance of building structural elements required by Building Use and Occupancy Classification and by Construction Type.
 - 3. Structural Steel Design: AISC Allowable Strength or Load and Resistance Factor Design, thus non-load restricted UL designs are required.
 - 4. Minimum hourly fire resistance of building structural elements as defined by Building Code:
 - a. Primary structural frame: 3 HR.
 - b. Primary structural frame supporting roof only: 2 HR.
 - c. Floor deck and secondary structural members: 2 HR.
 - d. Roof deck and secondary structural members: 1-1/2 HR.
- D. Provide services of manufacturer's field service representative prior to, and during application for purposes of:
 - 1. Checking surfaces which fireproofing is to be applied for proper preparation.
 - 2. Provide instructions and technical assistance.
- E. Preinstallation Conference:
 - 1. See Section 01 31 19.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer standard literature indicating physical properties of proposed products.



- B. Project Information:
 - 1. Field test reports.
 - 2. Detailed plans of sprayed fireproofing, or schedule of sprayed fireproofing, identifying project specific structural elements, floors and roofs.
 - a. Select UL designs and prepare under direction of fireproofing manufacturer, indicating physical properties of proposed products including:
 - 1) Complete UL design data for each system selected.
 - a) Verification that design is not load restricted.
 - 2) Thickness of sprayed fireproofing for specific structural elements.
 - 3) Densities of sprayed fireproofing and where used.
- C. Contract Closeout Information:
 - 1. Letter of Certification.
 - 2. Minutes from Preinstallation Conference.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Fireproofing:
 - 1. Base:
 - a. GCP Applied Technologies
 - 2. Optional:
 - a. Carboline Company
 - b. Isolatek International
- B. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 DESIGN CRITERIA

- A. Select UL approved fireproofing assemblies which meet or exceed the hourly fire resistive requirements of applicable building code.
 - 1. Use materials that comply with Minimum Physical Properties by Durability Classification table below.
 - 2. Use formulations as indicated in Minimum Durability Required for Location/Exposure Condition table in Part 3.
- B. Restrained or unrestrained classification of structural members as defined by ASTM E119 Standard Test Methods for Fire Tests of Building Construction and Materials. Structure is classified as restrained unless noted otherwise.
- C. Select designs that are not load restricted as determined by Allowable Strength Method or Resistance Factor Method.
- D. Use fireproofing systems which have been tested for use in proposed manner.

2.3 MATERIALS

- A. Provide cementitious products containing no detectable asbestos as determined in accordance with method specified in US Environmental Protection Agency Code of Federal Regulations (CFR) Chapter 40, Part 763, Subpart E, Appendix E, Section 1, and Polarized Light Microscopy.
 - 1. Free from forms of asbestos, including actinolite, amosite, anthophyllite, chrysotile, crocidolite and tremolite.
- B. Standard Durability:
 - 1. For use in buildings not defined as high-rise.
 - 2. Monokote MK-6 by GCP Applied Technologies.



C. Medium Durability:

1. For use in areas exposed to pedestrian traffic or indirect moisture (mechanical room columns, parking garage beams, etc.)
2. Monokote Z-106/HY by GCP Applied Technologies.

D. High Durability:

1. For use in areas exposed to impact or direct moisture (unenclosed parking garages, loading dock columns, and exterior construction exposed to rain or flooding, etc.)
2. Monokote Z-146 by GCP Applied Technologies.

E. Comply with following minimum properties:

Minimum Physical Properties by Durability Classification						
Property	Test Method	Standard Durability	High Rise Durability	Super High Rise Durability	Medium Durability	High Durability
Binder Type	--		Gypsum	Gypsum	Portland Cement	Portland Cement
Dry Density	ASTM E605	15 PCF	15 PCF	18 PCF	22 PCF	40 PCF
Bond Strength	ASTM E736	200 PSF	600 PSF	1,000 PSF	2,000 PSF	10,000 PSF
Compression (at 10 PCT Deformation)	ASTM E761	1200 PSF	4500 PSF	7344 PSF	100 PSI	500 PSI
Maximum Air Erosion	ASTM E859	0.000 G/FT2 Category A	0.000 G/FT2 Category A	0.000 G/FT2 Category A	0.005 G/FT2	0.005 G/FT2
Corrosion	ASTM E937	Does not contribute	Does not contribute	Does not contribute	Does not contribute	Does not contribute
Bond Impact	ASTM E760	No cracking, spalling or delamination	No cracking, spalling or delamination	No cracking, spalling or delamination	No cracking, spalling or delamination	No cracking, spalling or delamination
Deflection	ASTM E759					
Resistance to Mold Growth	ASTM G21	No growth after 28 days	No growth	No growth	No growth	No growth
Combustibility	ASTM E1354	Less than 5 MJ/M2	Less than 5 MJ/M2	Less than 5 MJ/M2	Less than 20 MJ/M2	Less than 20 MJ/M2
Flame Spread	ASTM E84	0	0	0	0	0
Smoke Developed	ASTM E84	0	0	0	0	0

Footnotes

1. Gypsum-based products may be substituted where prolonged exposure to water is unlikely.

F. Metal Lath:

1. Expanded metal lath fabricated from material, weight, configuration and finish required to comply with approved UL design designations and fireproofing manufacturer's written recommendations.
2. Include clips, lathing accessories, corner beads and other anchoring devices required to attach lath to substrates and to receive spray applied fireproofing.

G. Water:

1. Potable.

H. Cellular Metal Decking:



1. Include manufacturer's standard spatter coat or primer where required by UL Design or where recommended by manufacturer for optimal bond to substrate types.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify suitability of substrates to accept application.
- B. Do not install fireproofing until structure is sufficiently enclosed and roofing is installed to prevent damage to material.
- C. Apply only when ambient temperatures are above 40 DEGF and will remain so during curing period.
 1. Where temporary protection and heat is provided:
 - a. Maintain ambient temperatures at or above level indicated before, and for 24 HRS after application.
- D. Ventilate spaces during and after application of spray applied fireproofing by natural means or forced-air circulation until fireproofing material dries thoroughly.

3.2 PREPARATION

- A. Substrates shall be free of oil, grease, rolling compounds, incompatible primers, loose mill scale, soil and other foreign substances capable of impairing bond of fireproofing under conditions of normal use or fire exposure.
- B. Coordination:
 1. Sequence and coordinate application of spray applied fireproofing with other construction operations to comply with following requirements:
 - a. Provide temporary enclosures to confine spraying operations and to protect environment, and to prevent deterioration of fireproofing material due to exposure to weather or unfavorable ambient conditions of humidity, temperature or ventilation.
 2. Avoid exposure of fireproofing material to abrasion and other damage caused by construction operations after application.
 3. Do not apply concealed fireproofing until clips, hangers, supports, sleeves and other items penetrating fire protection are in place.
 4. Mark location of hangers, inserts, straps, anchors, supports, and similar items by other trades that may be concealed by fireproofing to permit locating after fireproofing is applied.
 5. Do not install ducts, piping and other items that would interfere with application of spray applied fireproofing until application is complete and approved by field testing.
 6. Do not install enclosing or concealing construction until spray applied fireproofing has been installed, inspected and tested, and corrections have been made to defective applications.
 7. Do not begin application of spray-applied fireproofing to underside of roof deck until roofing is complete, roof top units are installed, and construction roof traffic has ceased.
- C. Conduct tests in accordance with fireproofing manufacturer's written recommendations to verify substrates are free of substances capable of interfering with bond.
 1. Correct unsatisfactory conditions.
 2. Start of application constitutes acceptance of conditions and responsibility for performance.
- D. Cover other work subject to damage from fallout or overspray of fireproofing during application.
- E. For exposed fireproofing applications, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of spray-applied fireproofing.
 1. Remove minor projections.
 2. Fill voids that would telegraph through fireproofing after application.



3.3 INSTALLATION

- A. Install fireproofing of durability types listed in this section for exposure locations and that provide fire resistance ratings indicated for components and assemblies.
 - 1. Thickness: Minimum average thickness indicated for UL design designation, but not less than 3/8 IN.
 - 2. Apply in accordance with manufacturer and UL requirements.
 - 3. Provide preparation, primers, adhesives, materials, taping and sealers necessary to provide required fire resistance ratings.
- B. Extend fire resistive material in full thickness over entire area of each substrate to be protected.
 - 1. Install body of fire resistive covering in single course, unless otherwise recommended in writing by SFRM manufacturer,
- C. Connections of Dissimilar Structural Elements:
 - 1. Definition: Where structural elements are joined to other, often different type, of structural elements having a lesser SFRM protection requirement.
 - 2. Overlap the lesser priority structural element with superior SFRM thickness required by the higher priority element.
 - 3. Minimum Width of Overlap: As required in design system published by UL or similar testing agency, but not less than 6 IN.
- D. Install metal lath if required to comply with fire resistance ratings or fireproofing manufacturer's written recommendations for conditions of exposure and intended use.
 - 1. Securely attach lath to substrate in position required for support and reinforcement of fireproofing material.
 - 2. Use anchorage devices of type recommended in writing by fireproofing manufacturer.
 - 3. Attach lathing accessories where required for secure attachment to substrate.
- E. Spray apply fireproofing to maximum extent possible.
 - 1. Apply fireproofing in thicknesses and densities not less than required for fire resistance ratings for each condition; however, apply in greater thicknesses and densities if indicated.
 - 2. Following the spraying operations in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.
- F. Exposed Fireproofing:
 - 1. Apply fireproofing in thicknesses and densities not less than required for fire resistance ratings for each condition, or apply in greater thicknesses and densities indicated.
 - 2. Finish:
 - a. Following the spraying operations in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.
 - b. In addition, provide uniform even spray textured finish up to 8 FT above finished floor.
 - c. Roll flat surfaces with damp paint roller to remove drippings and excessive roughness of applied exposed fireproofing.
 - 1) Provide rolled flat fireproofing surfaces in mechanical rooms, elevator machine rooms, emergency generator rooms, electrical switchgear rooms, and rooms containing similar equipment items.
 - d. Exposed fireproofing higher than 8 FT above finished floor is not required to have rolled flat surface finish using paint roller.
- G. Cure exposed fireproofing in accordance with manufacturer's written recommendations to prevent premature drying.
- H. Fireproof accessory items including but not limited to X-bracing, struts, outriggers, hangers and attachments, and similar items.



- I. At elevated slab depressions, including regions sloped to drain:
 1. Apply additional fireproofing as required to compensate for reduced overall floor slab thickness.
 2. Extend to nearest adjacent beams to depressed region.

3.4 SCHEDULE OF DURABILITIES REQUIRED BY EXPOSURE CONDITIONS

- A. Determine appropriate durability required for project conditions based on following:
 1. Some conditions may not apply to subject project.

Minimum Durability Required for Location/Exposure Condition					
Location/Exposure Condition of Structural Members			Minimum Durability Required		
			Standard Durability	Medium Durability	High Durability
Interior	Concealed	Members that are fully concealed behind permanent Wall or Soffit Construction. Refer to Exposed if any portion of a member is not concealed.	S		
	Exposed	Members that are entirely above ordinary (non-walkable) Suspended Ceilings.	S ^{1,2}		
		Members where any exposed portion occurs within interstitial spaces above walkable Ceiling Systems (i.e. Laboratories or Clean Rooms).		M ¹	
		Members where any exposed portion occurs within Elevator Shafts, Air Shafts or Air Plenum Space.		M ¹	
		Members where any exposed portion occurs within 8 FT (2.44 m) of Floors, Stair Landings, Treads or similar walking surface.		M ¹	
		Members in Parking Garages, Mechanical Rooms and Storage Rooms where any portion is exposed.		M ¹	
		Members where any portion is protected with Deluge Fire Suppression System.			H
Exterior	Concealed	Members that are fully concealed by weathertight construction.	S		
		Members that are fully concealed by exterior soffit construction.	S		
		Members that are concealed by construction that is not completely weathertight.			H
	Exposed	Members that are permanently exposed to weather including Parking Structures.			H

Notes

Use above Table to select appropriate minimum durability, based on the Location/Exposure criteria which best describes the condition. It is acceptable to provide material of a higher durability.

Where a member or various portions of a member fits multiple Location/Exposure categories, select highest durability product from among potential choices and apply to entire member.

Footnotes

1. Ensure the use of Portland Cement-based formulas where prolonged exposure to water or humidity greater than 70 PCT RH is likely.
2. Upgrade to Medium where above-ceiling space is designed as an Air Plenum.

3.5 FIELD QUALITY CONTROL

- A. Testing Requirements:
 1. Test and inspect as required by Chapter 17 of the IBC or applicable building code in local jurisdiction.



2. Test for thickness, durability, and bond adhesion and cohesion.
- B. Testing Procedure:
1. Contractor provide fireproofing systems schedule, prepared by spray fireproofing manufacturer, to independent testing laboratory.
 2. Contractor arrange with independent testing laboratory to take samples and perform required tests.
 3. Test in field, per local requirements.
 - a. Do not inform applicator in advance, of location of tests.
 - b. Should test fail, take additional tests until extent of defective area has been determined.
 - c. Repair or remove and replace defective material and retest until requirements are met.
 - d. Cost of initial tests paid by Owner.
 - e. Retesting due to test failure paid by Contractor.
- C. Upon completion of project, manufacturer's representative to certify fireproofing system is properly installed in accordance with design requirements and manufacturer's instructions.

3.6 CLEANING, PROTECTION AND REPAIR

- A. Cleaning:
1. Immediately after completing fireproofing in each containable area, remove material overspray and fallout from surfaces of other construction.
 2. Clean exposed surfaces to remove soiling.
- B. Protection:
1. Protect fireproofing from damage or deterioration resulting from construction operations.
 2. Coordinate application of fireproofing with other construction to minimize need to cut or remove fireproofing.
- C. Repair:
1. Patch, repair and restore fireproofing to complete UL required where areas of fireproofing is damaged.

END OF SECTION



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SECTION 07 84 00 FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Firestopping, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Certified, licensed or approved by firestopping manufacturer, trained to install firestop products per specified requirements.
 - 2. Licensed by State or local authority, where applicable.
 - 3. Shown to have successfully completed not less than five (5) comparable scale projects.
- B. Provide firestop systems in compliance with following requirements:
 - 1. Obtain firestop system for each type of penetration and construction condition from a single firestop systems manufacturer.
 - 2. Firestop products and systems shall bear classification marking of qualified testing and inspection agency.
 - 3. Firestopping tests, performed by qualified, testing and inspection agency.
 - a. UL or other agency, performing testing and follow-up inspection services for firestop systems, acceptable to local authorities having jurisdiction.
 - 4. Existing applications for which no tested and listed classified system is available through a manufacturer:
 - a. Provide Engineering Judgment or Equivalent Fire Resistance Rated Assembly (EFRRA) for submittal derived from similar UL system designs or other tests approved by local authorities having jurisdiction, prior to installation.
 - b. Engineering judgment drawings must follow requirements set forth by International Firestop Council.
 - 5. Inspect applied firestopping systems in accordance with International Building Code (IBC) Chapter 17.
 - a. Inspections shall be performed by an FMG 4991 Approved Specialty Contractor/UL Qualified Firestop Contractor and/or ASTM E2174 and ASTM E2393.
 - b. See Section 01 45 23.
 - 6. FM Approved in accordance with FM Standard 4991 – Approval of Firestop Contractors.
 - 7. UL Qualified Firestop Contractor.
- C. Underwriters Laboratories, Inc. (UL):
 - 1. UL 263, Fire Tests of Building Construction and Materials
 - 2. UL 723, Surface Burning Characteristics of Building Materials
 - 3. UL 1479, Fire Tests of Through Penetration Firestops
 - 4. UL 2079, Tests for Fire Resistance of Building Joint Systems
- D. ASTM International (ASTM):
 - 1. ASTM E84 Surface Burning Characteristics of Building Materials
 - 2. ASTM E119 Fire Tests of Building Construction and Materials
 - 3. ASTM E136 Test Method for Behavior of Materials in a Vertical Tube Furnace at 750F



4. ASTM E814 Fire Tests of Through Penetration Fire Stops
 5. ASTM E1399 Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems
 6. ASTM E1966 Test Method for Fire Resistive Joint Systems
 7. ASTM E2174 Standard Practice for On-site Inspection of Installed Fire Stops
 8. ASTM E2307 Standard Test Method for Determining the Fire Endurance of Perimeter Fire Barrier Systems Using the Intermediate-Scale, Multi Story Test Apparatus (ISMA)
 9. ASTM E2393 Standard Practice for On-site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers
 10. ASTM G21 Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi
- E. Building Code as locally adopted and amended.
- F. Underwriters Laboratories (UL) Fire Resistance Directory:
1. Through Penetration Firestop Systems (XHEZ).
 2. Joint Systems (XHBN).
 3. Fill, Void or Cavity Materials (XHHW).
 4. Firestop Devices (XHJI).
 5. Forming Materials (XHKU).
 6. Wall Opening Protective Materials (CLIV).
- G. National Fire Protection Association (NFPA):
1. NFPA 70: National Electrical Code
 2. NFPA 101: Life Safety Code
 3. NFPA 22: Standard for High Challenge Fire Walls, Fire Walls, and Fire Barrier Walls
 4. NFPA 251: Fire Tests of Building Construction and Materials
- H. Firestop Contractors International Association (FCIA): MOP – FCIA Firestop Manual of Practice
- I. International Firestop Council (IFC):
1. Recommended IFC Guidelines for Evaluating Firestop Engineering Judgments, latest revision.
 2. Inspectors Field Pocket Guide, latest edition.
- J. Identification Labels for Firestop Assemblies:
1. Follow guidelines set in Chapter 7 of International Building Code.
 2. Coordinate with Section 09 29 00.
 3. Label penetration on both sides of wall or slab.
 4. Label each penetration or group of similar penetrations with a permanent label marked with the following information:
 - a. UL system number.
 - b. Rating.
 - c. Products used.
 - d. Installation date.
 - e. Installer name.
 - f. Penetration reference number unique to each location.
- K. Pipe insulation shall not be removed, cut away or otherwise interrupted through wall or floor openings.
1. Provide products appropriately tested for the thickness and type of insulation utilized.
- L. Cabling where frequent cable moves, add-ons, and changes are likely to occur in future:
1. Where cable trays are used:



- a. Utilize re-enterable products (e.g. removable intumescent pillows) specifically designed for retrofit.
- 2. Where cable trays are not used:
 - a. Utilize fire-rated cable pathway devices.
 - b. Where not practical, re-enterable products designed for retrofit may be used.
- M. Protect penetrations passing through fire-resistance rated floor-ceiling assemblies contained within chase wall assemblies with products tested by being fully exposed to fire outside of chase wall.
 - 1. Identify systems within UL Fire Resistance Directory with the words: Chase Wall Optional.
- N. Fire Resistive Joint Sealant:
 - 1. Provide flexible fire-resistive joint sealants to accommodate normal and thermal building movement without seal damage.
 - 2. Provide fire-resistive joint sealants designed to accommodate a specific range of movement.
 - a. Test in accordance with cyclic movement test criteria as outlined in: ASTM E1399, ASTM E1966 or UL 2079.
 - 3. Provide fire-resistive joint systems subjected to an air leakage test.
 - a. Conduct in accordance with UL 2079, with published L-Ratings for ambient and elevated temperatures, as evidence of ability of fire-resistive joint system to restrict movement of smoke.
 - 4. Coordinate firestopping with acoustical sealant requirements in Section 07 92 16.
- O. Subject smoke wall containment systems to air leakage test.
 - 1. Conduct in accordance with UL 1479, with published L-Ratings for ambient and elevated temperatures, as evidence of ability of fire-resistive joint system to restrict movement of smoke.
- P. System Description:
 - 1. Through Penetration Firestop Systems for protection of penetrations through following fire-resistance rated assemblies, including both blank openings and openings containing penetrating items:
 - a. Roof assemblies.
 - b. Floor assemblies.
 - c. Wall and partition assemblies.
 - d. Fire-rated smoke barrier assemblies.
 - e. Existing, fire and smoke-rated assemblies.
 - f. Construction enclosing compartmentalized areas.
 - 2. Fire Resistive Joint Assemblies for linear voids where fire-rated floor, roof, or wall assemblies abut one another, including following types of joints:
 - a. Top and bottom of wall interface with overhead roof or floor structure:
 - 1) Coordinate with acoustical sealant specified in Section 09 29 00.
 - 2) Select products to maintain acoustical, smoke and fire ratings indicated.
 - b. Non-Fire Rated Expansion Joints
 - c. Fire Rated Expansion Joints.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's standard information indicating certification of products proposed for use on project.
- B. Manufacturer's Installer Certification is required for all personnel using and installing the products. The General Contractor shall maintain an active list of qualified installers on the job site. Any firestops that have been installed by uncertified installers is subject to removal and replacement at the discretion of the Architect, Owner, AHJ, manufacturer and Owner's inspection agency.



- C. Project Information: UL reports with illustration of systems, system numbers, temperature ratings, and products proposed for use on project.
- D. Contract Closeout Information:
 - 1. Warranty.
 - 2. Electronic file of project firestopping documentation.

1.4 WARRANTY

- A. Written five (5) year warranty guaranteeing quality of installation and meeting requirements of manufacturer's written instructions and tested systems.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Firestopping:
 - 1. Base:
 - a. Hilti Inc.
 - 2. Optional
 - a. STI EZ-Path
 - b. SpecSeal
 - c. 3M
- B. Forming Materials:
 - 1. Base:
 - a. Hilti, Inc.
 - 2. Optional
 - a. STI EZ-Path
 - b. SpecSeal
 - c. 3M
- C. Other manufacturers desiring approval, comply with Section 00 26 00.
 - 1. See systems Volume 2 of UL Building Materials Directory.

2.2 MATERIALS

- A. Through Penetration Firestop Systems:
 - 1. VOC content not to exceed 250 g/L
 - 2. Base Products:
 - a. FS-ONE Intumescent Firestop Sealant.
 - b. CP 604 Self-leveling Firestop Sealant.
 - c. CP 620 Fire Foam.
 - d. CP 606 Flexible Firestop Sealant.
 - e. CP 601S Elastomeric Firestop Sealant.
- B. Fire-resistive Joints:
 - 1. VOC content not to exceed 250 g/L
 - 2. Base Products:
 - a. CFS-SP WB Firestop Joint Spray.
 - b. CP 601S Elastomeric Firestop Sealant.
 - c. CP 606 Flexible Firestop Sealant.
 - d. CP 604 Self-leveling Firestop Sealant.



- C. Firestop Devices:
 - 1. Factory-assembled collars lined with intumescent material sized to fit specific outside diameter of penetrating item.
 - 2. Base Products:
 - a. CP 680-P Cast-in-Place Firestop Device.
 - b. CP 680-M Cast-in-Place Firestop Device.
 - c. CP 681 Tub Box Kit.
 - d. CFS-DID Firestop Device.
- D. Intumescent Pads, Wall Opening Protective Materials:
 - 1. Intumescent, non-curing pads or inserts for protection of electrical panels, switch and receptacle boxes, medical gas outlets and valve boxes and other items recessed in face of fire rated walls.
 - 2. Base Product:
 - a. CFS-P PA Firestop Putty Pad.
 - b. CP 617 Firestop Putty Pad.
 - c. Hilti Biox Insert.
- E. Fire-rated Cable Pathways:
 - 1. Usage:
 - a. Cables passing through fire-rated floors or walls shall pass through fire-rated cable pathway devices made from an intumescent material that adjusts automatically to cable additions or subtractions.
 - 2. Product description and requirements:
 - a. Pathway device modules comprised of steel raceway and intumescent pads with adjustable smoke seal sleeve.
 - b. F-Rating equal to the rating of barrier the device penetrates.
 - c. Pathway devices shall be capable of allowing a 0 to 100 percent fill of cables.
 - d. Size to accommodate quantity and size of electrical wires and data cables indicated plus 100 percent expansion.
 - e. Provide wire devices with steel wall plates allowing for single or multiple devices ganged together without requiring additional wall structure framing.
 - 3. Base product:
 - a. CP 653 Speed Sleeve.
 - 1) Use in conjunction with CFS-SL GP when more than one device is required.
 - b. CFS-CC Firestop Cable Collar.
- F. Firestop Putty:
 - 1. Intumescent, non-hardening, water resistant putties containing no solvents, inorganic fibers or silicone compounds.
 - 2. Firestop putty shall be provided and installed at, but not limited to, the gap between wire, cabling, or both, exiting an open end of conduit, where conduit penetrates one or both sides of a smoke or fire rated wall assembly.
 - 3. Base products:
 - a. CP 618 Firestop Putty Stick.
 - b. CFS-PL Firestop Plug.
- G. Wrap Strips:
 - 1. Single component intumescent elastomeric strips faced on both sides with a plastic film:
 - 2. Base Products:
 - a. CP 643N Firestop Collar.
 - b. CP 644 Firestop Collar.
 - c. CP 648E/648S Wrap Strips.
- H. Firestop Blocks:



1. Re-enterable, non-curing, intumescent flexible block.
 2. Base products:
 - a. CFS-BL Fire Block.
 - b. CFS-PL Firestop Plug.
- I. Mortar:
1. Portland cement based dry-mix product formulated for mixing with water at Project site to form a non-shrinking, water-resistant, homogenous mortar.
 2. Base product:
 - a. CP 637 Firestop Mortar.
- J. Silicone Sealants:
1. Moisture curing, single component, silicone elastomeric sealant for horizontal surfaces pourable or nonsag or vertical surface nonsag.
 2. Base product:
 - a. CP 601S Elastomeric Firestop Sealant.
 - b. CP 604 Self Leveling Silicone Firestop Sealant.
 - c. CFS-SIL SL Self Leveling Silicone Firestop Sealant.
- K. Pre-formed mineral wool:
1. CP 767 Speed Strips
 2. CP 777 Speed Plugs
- L. Fire Sealant:
1. Single component latex or acrylic formulations that upon cure do not re-emulsify during exposure to moisture.
 - a. CP 601S Elastic Firestop Sealant.
 - b. CP 606 Fire Resistant Joint Filler.
 - c. CP 672 Firestop Joint Spray.
 - d. CFS-SP WB Firestop Joint Spray.
 2. VOC content of sealants shall be no greater than 250 g/L.
 3. VOC content of sealants shall be no greater than 250 g/L.
 4. Adhesives and sealants shall contain no carcinogen or reproductive toxicant components present at more than 1 percent of total mass of the product as defined in the California Office of Environmental Health Hazard Assessment's (OEHHA) list entitled, Chemicals Known to the State to Cause Cancer, or the Reproductive Toxicity, Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65).
- M. Composite Sheet:
1. Non-curing, re-penetrable material.
 2. Base Products:
 - a. CP 675T Firestop Board.
 - b. CFS-BL FireBlock.
- N. Forming Materials:
1. Materials listed as components in laboratory-approved designs.
 2. Mineral Wool:
 - a. Base Product: CP 767 Speed Strip
 - b. Similar product specifically named as components in laboratory-approved designs.
- O. Perimeter Fire Containment.
- P. Acoustical Sealant: Specified in Section 07 92 16.

2.3 THROUGH PENETRATION FIRESTOP SYSTEMS

- A. General:



1. Schedules below identify requirements for acceptable through penetration firestop systems based on barrier type, fire-resistive rating, and penetrant type. Each system must comply with building code and fire code as locally adopted and amended.
2. Requirements for single-membrane penetrations and through penetration firestops are identical. Unless otherwise noted, penetrants which pass through a single membrane, shall be treated the same as if it passed through the entire fire-resistive assembly.
3. Select each firestop system based on actual field conditions, including penetration type, shape, size, quantities and physical position within opening.
4. Refer to Plans for indication of the required ratings of fire-resistive wall, floor, and roof assemblies.
5. Indicated ratings are minimum and may be exceeded.
6. Firestop Assemblies at Fire-Rated Walls:
 - a. The minimum Fire (F) Rating for Firestop assemblies in walls shall equal that of the wall, but not less than 1-HR.
 - b. The minimum Temperature (T) Rating of Firestop assemblies in walls may equal zero.
 - c. Smoke Barrier: In addition to (F) Rating, (L) Rating of maximum 5 CFM per SF.
 - d. Non-rated walls and Smoke-Partitions with no fire-resistive requirement: Assembly with (L) rating.
7. Firestop assemblies at fire-rated floors and roofs:
 - a. Minimum Fire (F) and Temperature (T) Ratings of Firestop assemblies used in floors or roof shall equal hourly rating of floor or roof being penetrated, but not less than 1-HR.
 - 1) Exception 1: The T-rating may equal zero when portion of penetration, above or below floor, is contained within a wall.
 - 2) Exception 2: Firestops are not required for floor penetrations within a 2-hour rated shaft enclosure.
- B. Voids in wall with no penetrations:
 1. Limited to 1" openings max.
 2. Fill with approved through penetration firestopping system.
 3. Contractor's option: Patch void in wall with like construction.
- C. Penetrating Ducts with Dampers:
 1. Utilize only firestop materials which are included in damper's classification.
 2. Do not install firestop systems that hamper performance of fire dampers.
- D. Cable Trays and similar devices:
 1. Provide re-enterable products specifically designed for removal and re-installation at openings within walls and floors designed to accommodate voice, data and video cabling.
 2. Refer to Owner's Div 27 specifications.
- E. Electrical panels and devices, medical gas outlets and valve boxes, film illuminators, and other items recessed in to face of rated walls:
 1. Where electrical devices are placed on opposite sides of wall, and are less than 610mm 24 IN apart measured horizontally, install intumescent pads over back of devices in approved manner or maintain continuity of rated barrier within wall cavity surrounding recessed item.

2.4 FIRE-RESISTIVE JOINT ASSEMBLIES – GENERAL

- A. General:
 1. Where joint will be exposed to elements, fire-resistive joint sealant must be approved by manufacturer for use in exterior applications and shall comply with ASTM C920.
- B. Head-of-Wall Assemblies:
 1. General:
 - a. Use at top of fire-rated and smoke barrier walls and partitions where they abut floor and roof structures above.



- b. Select systems with D designation, rated for dynamic movement capability.
 - c. Select systems that can accommodate deflection of structure above.
 - d. Maximum Leakage for Fire-resistive Joints in Smoke Barriers: 5 CFM or less per linear foot as tested in accordance with UL 2079.
 - e. Seal non-fire-rated sound-control walls and smoke partitions with acoustical sealant as specified in Section 07 92 16.
- 2. Minimum F and T ratings:
 - a. The minimum fire rating for firestop assemblies in walls shall equal that of wall, but not less than 1-HR.
 - b. The minimum temperature rating of firestop assemblies in walls may equal zero.
 - 3. Acceptable Systems:
 - a. Metal stud and drywall partitions: Select system from UL HW-D-0000 Series.
 - b. Concrete and Masonry Walls: Select system from UL HW-D-1000 Series.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
- B. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, scale, laitance, rust, release agents, water repellents, and any other substances that may inhibit optimum adhesion.
- C. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
- D. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General:
 - 1. Install firestop systems in accordance with manufacturer's instructions and conditions of testing and classification as specified in UL or other acceptable third-party testing agency listing.
 - 2. Penetrations through fire-resistive floor assemblies shall be sealed with firestop system providing minimum Class 1 W-rating as tested in accordance with UL 1479 and ensure air and water resistant seal.
 - 3. Protect materials from damage on surfaces subjected to traffic.
 - 4. Install and seal penetrations (conduit, sleeves, slots, chases) into or through fire-rated barriers created by or made for or on the behalf of the Contractor to prevent the passage of smoke, fire, toxic gas, or water through the penetrations.
 - a. All through penetrations in a fire rated surface require a sleeve, regardless of penetration diameter or penetrating cable count.
 - b. The installation of fire rated membrane penetrations shall meet UL requirement, IBC Membrane Penetration requirement and Intermountain Healthcare master specification 26 05 33 Raceways, Cable Trays, and Boxes. "Ring and string" method, directed by the Owner, can only be used in non-fire-rated partitions.
 - 5. Provide approved fire-resistant materials to restore originally-designed fire- ratings to all wall, floor, and ceiling penetrations used in the distribution and installation for communications cabling system. Coordinate fire stopping procedures and materials with General Contractor. Following the pathway of others through compliant and non-compliant penetrations does not remove the requirement to maintain code-compliant fire stopping.



6. Provide and install intumescent mechanical systems in floor chases in an approved fashion in all openings.
 7. Provide and install, fire stop in an approved manner in all openings where there are penetrations through walls.
 8. Shall supply Owner with training manuals with instructions on methods of adding or removing cabling to/from fire stopped sleeves and chases.
 9. Provide manufacturer recommended material for rated protection for any given barrier.
 10. Shall laminate and permanently affix adjacent to chases the following information:
 - a. Manufacturer of fire stop system.
 - b. Date of installation/repair.
 - c. Part and model numbers of system and all components.
 - d. Name and phone numbers of local distributor and manufacturer's corporate headquarters.
 11. Solutions and shop drawings/submittals for fire stop materials and systems shall be presented to the General Contractor for written approval of materials/systems prior to purchase and installation.
 12. Materials shall be installed per manufacturer instructions, be UL-listed for intended use, and meet NEC and locals codes for fire stopping measures.
 13. The material chosen shall be distinctively colored to be clearly distinguishable from other materials, adhere to itself, and maintain the characteristics for which it is designed to allow for the removal and/or addition of communication cables without the necessity of drilling holes in the material.
 14. The fire stopping material shall maintain/establish the fire-rated integrity of the wall/barrier that has been penetrated.
- B. Identification Labels:
- a. Identify each firestop assembly as defined in Quality Assurance.
 - b. Do not locate identification labels, tags, or both, on finished surfaces or where exposed to view by public.

3.3 FIELD QUALITY CONTROL

- A. Owner shall engage a qualified independent inspection agency to inspect firestop systems in accordance with ASTM E2174, Standard Practice for On-site Inspection of Installed Fire Stops, and ASTM E2393, Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers.
- B. Construct mock-up on-site to include typical through penetration and fire-resistive joint applications for project.
- C. Maintain areas of work accessible until inspection by authorities having jurisdiction.
- D. Where deficiencies are found, repair or replace assemblies to comply with requirements.
- E. Do not paint sealants or any other firestop component.
- F. Notify the site Architect and Owner if existing conditions are non-conforming.
- G. Firestop material shall be packed into the annular space around penetrating object per manufacturer's installation instructions. The surface shall be tooled. Finger smearing is not allowed.
- H. Open conduit ends shall have sealant packed into the opening. Simply wrapping the end of the conduit is not allowed.
- I. Field testing of installed firestop is subject to forensic inspection per ASTM requirements. This means that the inspector will disassemble installed firestops to ascertain compliance with the manufacturer's installation instructions. The location is at the discretion of the inspector.



3.4 ADJUSTING AND CLEANING

- A. Remove equipment, materials and debris, leaving area in undamaged, clean condition.
- B. Clean surfaces adjacent to sealed openings free of excess materials and soiling as work progresses.
- C. Perform patching and repair of firestopping systems damaged by other trades.

END OF SECTION

SECTION 07 92 16
INTERIOR JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Sealants, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Definitions:
 - 1. Caulk and Caulking are synonymous with sealant work.
 - 2. Interior Wet Areas includes toilets, showers, kitchens and similar areas where sealant is subject to moisture.
- B. Seal joints which permit penetration of moisture or air, unless sealant work is specifically required under other sections.
- C. Provide sealants per following:
 - 1. Masonry control joints, and between masonry and other materials.
 - 2. Flooring joints.
 - 3. Isolation joints.
 - 4. Joints at penetrations of walls, floors and decks by piping and other services and equipment not requiring firestopping.
 - 5. Perimeters of door and window frames, louvers, grilles, etc.
 - 6. Between cabinets, casework, countertops and back splashes where adjacent to walls.
 - 7. Joints between dissimilar materials, to provide visually acceptable closures.
 - 8. Other joints where caulking, or sealant is indicated.
- D. American Society for Testing and Materials:
 - 1. ASTM C510 Standard Test Method for Staining and Color Change of Single- or Multicomponent Joint Sealants
 - 2. ASTM C711 Standard Test Method for Low-Temperature Flexibility and Tenacity of One-Part, Elastomeric, Solvent-Release Type Sealants
 - 3. ASTM C719 Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement
 - 4. ASTM C792 Standard Test Method for Effects of Heat Aging on Weight Loss, Cracking, and Chalking of Elastomeric Sealants
 - 5. ASTM C793 Standard Test Method for Effects of Laboratory Accelerated Weathering on Elastomeric Joint Sealants
 - 6. ASTM C910 Standard Test Method for Bond and Cohesion of One-Part Elastomeric Solvent Release-Type Sealants
 - 7. ASTM C920 Standard Specification for Elastomeric Joint Sealants
 - 8. ASTM C1193 Standard Guide for Use of Joint Sealants
- E. South Coast Air Quality Management District (SCAQMD), Rule #1168.
- F. Staining:
 - 1. Pre-test proposed sealants where used with following materials and where potential of staining may occur as result from use of those sealants:



- a. Stonework.
 - b. Architectural Precast.
 - c. Concrete Masonry.
2. Test in accordance with ASTM C1248 Standard Test Method for Staining of Porous Substrate by Joint Sealants.
3. Historical testing using same materials and cataloged by sealant manufacturer is acceptable.
4. Where testing suggests staining potential exists, reselect sealant and retest.
5. Certify staining potential has been evaluated.

1.3 MOCK-UPS

- A. Install sealers in mock-ups specified elsewhere, and required by following sections:
 1. Section 01 43 41 - PROTOTYPE MEDICAL ROOM MOCKUP

1.4 SUBMITTALS

- A. Shop Drawings:
 1. Sealant Schedule with the following information:
 - a. Generally describe locations requiring sealants (i.e. GWB to Aluminum Window).
 - b. List type of sealant, and name of product proposed for each location.
 - c. Include a blank Color Column on schedule for selection.
 - d. Architect to complete Color Column upon selection from submitted samples.
- B. Product Data:
 1. Performance characteristics and limitations.
 2. Recommended installation.
- C. Samples:
 1. Submit cured sample of each color with Sealant Schedule.
 2. Mock-up.
- D. Contract Closeout Information: Warranty.

1.5 WARRANTY

- A. Provide written warranty that sealant work will remain free of defects for a period of three (3) years from Date of Substantial Completion:
 1. Failure of water or air tightness constitutes defect.
 2. Loss of adhesion, cohesion or failure to cure constitutes defect.
 3. Remove defective work and materials and replace with new work and materials.
 4. Repair other work damaged as a result of defective sealant work at no additional expense to Owner.
 5. Non- prorated warranty to include labor and material.
 6. Warranty signed by Installer, Contractor, or both.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Polyurethane Sealants:
 1. Base: Tremco
 2. Optional:
 - a. Pecora
 - b. Sonneborn/ChemRex
 - c. Sika
 - d. Bondaflex Technologies



- B. Silicone Sealants:
 - 1. Base: As noted for individual items.
 - 2. Optional:
 - a. Bondaflex Technologies
 - b. Color Rite
 - c. Dow Corning
 - d. GE Silicones
 - e. Pecora
 - f. Sonneborn/ChemRex
 - g. Tremco
- C. Acoustical Sealant:
 - 1. Base: Hilti
 - 2. Optional:
 - a. Grabber
 - b. Pecora
 - c. STI
 - d. 3M
- D. Other Sealants: Base: As indicated.
- E. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. General:
 - 1. ASTM C920 Type S or M, Grade-NS, minimum Class 25.
 - 2. Non-staining sealant complying with ASTM C510.
 - 3. Where sealant is not exposed to view, use manufacturer's standard color which has best performance.
 - 4. Use non-sag sealant in vertical joints.
 - 5. Use self-leveling or non-sag sealant in horizontal joints.
 - 6. Before use of sealant, investigate its compatibility with surfaces, fillers and other materials in joint system.
- B. VOC Content of Interior Sealants:
 - 1. Comply with South Coast Air Quality Management District (SCAQMD), Rule 1168.
 - a. Sealants: 250 g/L.
 - b. Sealant Primers for Nonporous Substrates: 250 g/L.
 - c. Sealant Primers for Porous Substrates: 775 g/L
 - 2. Sealants shall contain no carcinogen or reproductive toxicant components present at more than 1 percent of total mass of the product as defined in California Office of Environmental Health Hazard Assessment's (OEHHA) list entitled Chemicals Known to the State to Cause Cancer or the Reproductive Toxicity, Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65).
- C. Elastomeric Sealant:
 - 1. Refer to Sealant Selection Guide for types required.
 - 2. Comply with VOC limits as required by local laws or specified otherwise.
- D. Casework Sealant: Solid Colors: Color-Sil by Color Rite; 100 percent silicone.
- E. Acoustical Sealant:
 - 1. Flexible, non-hardening.
 - 2. UL listed.
 - 3. Seal perimeter of sound rated partitions.



4. Seal perimeter and cover outside faces of electrical boxes and similar utilities in sound rated partitions.
5. Base Products:
 - a. Gun - CP 601S by Hilti
 - b. Spray - CFS-SP WB by Hilti
- F. Joint Cleaner, Primer, Bond Breaker: As recommended by sealant manufacturer.
- G. Backer Rod: Polyethylene, polyethylene jacketed polyurethane foam, flexible, non-absorbent, non-bituminous material recommended by sealant manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not proceed with installation of joint sealants under following conditions:
 1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 degF.
 2. When joint substrates are wet.
- B. Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
- C. Apply only to joints free of material which may inhibit bond.
- D. Apply to cementitious materials only when thoroughly cured and dry.

3.2 PREPARATION

- A. Clean joints and prime as required by sealant manufacturer.
- B. Install sealant after finish coating or covering is scheduled to be applied.
- C. Limit application to surfaces to receive sealants and mask edges of joints to protect adjacent surfaces.

3.3 INSTALLATION

- A. Install sealant backings to support sealants during application.
 1. Control joint depth.
 2. Break bond of sealant at bottom of joint.
 3. Provide proper shape of sealant.
 - a. Flush, not concave, per Intermountain Standards
 4. Do not leave gaps between ends of sealant backings.
 5. Do not stretch, twist, puncture, or tear sealant backings.
 6. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- B. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- C. Install sealants using proven techniques that comply with the following and at same time backings are installed:
 1. Place sealants to directly contact and fully wet joint substrates.
 2. Completely fill recesses in each joint configuration.
 3. Produce uniform, cross-sectional shapes and depths relative to joint widths allowing optimum sealant movement capability.



- D. Prime joint surfaces as recommended by sealant manufacturer for conditions:
 - 1. Limit application to surfaces to receive sealants.
 - 2. Mask off adjacent surfaces.
- E. Sub-caulk joints without suitable backstop, to proper depth.
- F. Tool sealants using sufficient pressure to fill voids.
- G. Remove excess sealant adjacent to joints.
- H. Hollow Metal Frames:
 - 1. Seal frames to wall.
 - 2. Seal frames to floor substrates and hard floor finishes.
 - 3. Do not seal frames to previously installed carpet and similar finishes.
 - 4. Seal hairline gaps where stops and rabbets of frame members intersect.
- I. Acoustical Sealant:
 - 1. General:
 - a. Apply acoustical sealant at joints, voids, and penetrations through wallboard to maximize sound control.
 - 1) Seal wallboard edges to adjacent construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant.
 - 2) Install acoustical sealant at both faces of partitions at perimeters and through penetrations.
 - 3) Comply with ASTM C919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
 - b. Refer to Section 07 84 00 for firestopping of through-wall penetrations.
 - 1) Provide firestop sealant where required in fire-rated assemblies.
 - a. Base of walls: Apply acoustical sealant to bottom edge of gypsum wallboard at floor.
 - b. Head of walls: Apply acoustical sealant to top edge of gypsum wallboard at building structure.



3.4 SEALANT USAGE GUIDELINES

Guide to Sealant Types - INTERIOR				
Location	Materials	Sealant Type	Base Product	Remarks / Exceptions
Interior (General)	Window Sills / Stools	100% silicone	Color-Sil Poly-Sil	--
	Cabinets and Casework to wall			
	Countertops and Backsplashes			
	Sinks in Countertops			
	Interior Alum Doors and Window Frame Perimeters	Multi-part, chemically curing Polyurethane	Tremco Dymeric 240FC	--
	Non-rated wall, floor and deck penetrations.			
	Hollow Metal Door and Window Frames	Siliconized Acrylic Latex (paintable)	Tremco Tremflex 834	Exception: Where sealant will not be subsequently painted and white color will not be visually compatible with adjacent finishes: Use Dymeric 240FC of matching color.
	Acoustical Sealant Joints at top and bottom terminations of Interior Walls	Acrylic	Hilti CFS-SP WB	--
		Silicone	Hilti CP 601S	
Interior Flatwork	Control Joints in Concrete Floors in Mechanical Rooms and other un-finished spaces	Multi-part Polyurethane	Tremco THC 900 / 901	Exception: Where subject to continual water emersion; use Vulkem 45 or 245
	Stone and Precast Flooring			
Interior Wet Areas	Porcelain, Ceramic Tile, Metals, and surfaces with Epoxy Paints	Silicone; Air cure	Tremco Tremsil 200	--
<p>1. The above is intended to be an overall guide. Additional conditions and materials may be required. Notify Architect if additional Guidance is required to select unlisted items.</p> <p>2. Optional sealant products shall offer same number of color choices as the Base Product listed.</p> <p>3. All of the conditions and materials listed may not necessarily apply to subject project.</p> <p>4. Not all project conditions may be addressed on above table; Refer also to other specification sections and install sealants where called for by other sections.</p> <p>5. Materials and Conditions conventionally occurring on Exterior but used on Interior (e.g. Brick Masonry on interior) may not be listed on this Table. Refer to Exterior Guide for appropriate sealant type.</p>				

END OF SECTION





DIVISION 08

OPENINGS



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SECTION 08 11 13
HOLLOW METAL (HM) DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Hollow Metal Doors and Frames in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Hollow Door and Frame Standards:
 - 1. ANSI A250.4 Test Procedure and Acceptance Criteria for - Physical Endurance for Steel Doors, Frames and Frame Anchors
 - 2. ANSI A250.8 / SDI 100 Recommended Specifications for Standard Steel Doors and Frames
 - 3. ANSI A250.11 Recommended Erection Instructions for Steel Frames
- B. Fire Rated Doors and Frames:
 - 1. Label and list for ratings indicated by ITS – Warnock Hersey, UL or other testing and inspection agency acceptable to authorities having jurisdiction.
 - 2. Physical label or approved marking shall be affixed to fire door or fire door frame, at an authorized facility as evidence of compliance with procedures of labeling agency.
 - 3. Where pairs of doors require fire rating (90 minute maximum), doors shall have passed appropriate test without the use of astragals.
 - 4. Positive Pressure:
 - a. Comply with Positive Pressure Requirements UL 10C, Category A or NFPA 252.
- C. Smoke and Draft Control Assemblies:
 - 1. Maximum Leakage: 3 CFM per SF of door face area when tested at pressure of 0.10 IN water per UL 1784.
 - 2. Applicability:
 - a. Doors in Smoke Partitions, Smoke Barriers and Corridor walls.
 - b. Doors forming part of an Elevator Lobby enclosure.
 - 3. Provide S-Labels on smoke and draft control openings.
- D. Sound Control Door Assemblies:
 - 1. Refer to Section 08 34 73.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Use same reference numbers for openings as those in Door and Frame Schedule in Drawings
 - 2. Indicate door elevations, gauges; frame configuration; anchor types and spacing; location of reinforcement and preparations for hardware, including items recessed within door edges; details of moldings, removable stops, glazing and louvers; details of conduit and preparations for power, signal, and control systems.



- B. Product Data:
 - 1. Include construction details, material descriptions, core descriptions, fire-resistance rating and finishes.
 - 2. Shop primer.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Hollow Metal Doors and Frames:
 - 1. Base:
 - a. Steelcraft Manufacturing.
 - 2. Optional:
 - a. Curries.
 - b. Ceco Door Products.
 - c. Philipp Manufacturing Company.
 - d. Republic Doors and Frames.
- B. Galvanizing repair coating:
 - 1. Base:
 - a. Tnemec.
 - 2. Optional:
 - a. ZRC Worldwide.
 - b. Sherwin Williams.
- C. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Steel sheet and strip:
 - 1. Typical: ASTM A568.
- B. Corrosion-resistant coating:
 - 1. Standard:
 - a. Hot-dip Galvannealed: A60 per ASTM A653.
 - b. Minimum zinc-iron alloy coating: 0.6 OZ/FT².
 - 2. Provide above corrosion-resistant coating at door and frame components where used at interior wet and humid locations as defined by following:
 - a. Interior openings in wet and humid areas:
 - 1) Openings to and from rooms with showers, tubs or pools.
 - 2) Openings to and from operating rooms, scrub areas, sub-sterile, trauma rooms, hydrotherapy rooms, and decontamination showers.
 - 3) Openings to and from soiled utility and soiled holding rooms.
 - 4) with sterilizer, Central Sterile Reprocessing department.
 - 5) Openings to and from loading docks, trash collection and compacting areas.
 - 6) Openings to ambulance and vehicular garages.
 - 7) Openings to and from rooms with sterilizers, autoclaves, tunnel washer equipment and similar Central Sterile Reprocessing equipment.
- C. Primer:
 - 1. Doors and frames shall be cleaned, phosphatized and finished as standard with one coat of baked-on rust inhibiting primer paint in accordance with ANSI A250.10.
 - 2. Primer shall be suitable and compatible as base for specified finish paints.



- D. Zinc-rich primer for repairing galvanized coating:
1. Tnemec Series 94-H20 Hydro-Zinc.
 2. ZRC Worldwide, Galvilit 221.
 3. Sherwin Williams Zinc Clad III HS 100.
 4. Galvanizing repair coating shall have a VOC content no greater than 250 g/L.
- E. Lead Sheet:
1. ASTM B29.
 2. Free from imperfections affecting performance.

2.3 HOLLOW METAL DOORS

- A. Comply with ANSI/SDI A250.8.
- B. Determination of performance level for each door:
1. Use level of HM door indicated for its location, size and other listed criteria.
 - a. Not all items below may apply to subject project.

Schedule of HM Door Levels			
Location	Additional Criteria	HMMA Level	Miscellaneous
Exterior Doors ¹ (flush)	Openings where each leaf is less than 47 IN	Level 3 (Extra Heavy-duty)	Galvanized / galvanized, Thermally Insulated
	Openings where one or more of the leaves exceeds 47 IN	Level 4 (Maximum-duty)	
Exterior Doors ¹ (stile and rail)	All	Level 3 (Extra Heavy-duty)	Galvanized / galvanized, Thermally Insulated
Interior Doors	Non-fire rated	Level 3 (Extra Heavy-duty)	--
	Fire rated	Level 3 (Extra Heavy-duty)	Labeled as indicated (w/out astragal wherever possible)
	Wet / Humid Areas ²	Level 3 (Extra Heavy-duty)	Galvanized / galvanized; Moisture-resistant core - Fire-resistant were required

General Notes:

Refer to Door Schedule for indication of the Door Type (i.e. Width, Fire Rating, Flush vs. Stile & Rail, etc)

Refer to Plans for door location (Exterior vs. Interior).

Where Hurricane or Tornado-resistant openings are specified: Refer to ADDITIONAL REQUIREMENTS for appropriate door/frame construction.

Footnotes:

1. Refer to Part 2.2 for definition of Exterior locations.
2. Refer to Part 2.2 for definition of Wet/Humid locations.

- C. Construction - Hollow Metal (HM) Doors:
1. Door Thickness: 1-3/4 IN.
 2. HM Door Level, per ANSI A250.8:
 - a. Level 4, Maximum-duty, physical performance Level A.
 - 1) Face Sheet Thickness: 0.067 IN (14 GA).
 - b. Level 3, Extra Heavy-duty, physical performance Level A.
 - 1) Face Sheet Thickness: 0.053 IN (16 GA).
 3. Typical Model, per ANSI-A250.8:
 - a. Model 2, Seamless.
 4. End closures at top and bottom of door:
 - a. Top: Flush closure top cap. Minimum Sheet thickness: 0.032 IN (20 GA).
 - b. Bottom: Flush closure. Minimum Sheet thickness: 0.032 IN (20 GA).
 - c. Bottom: Inverted channel. Minimum Sheet thickness: 0.053 IN (16 GA).



5. Cores:
 - a. Steel stiffeners where structurally required.
 - b. Exterior Doors:
 - 1) Thermally insulated core.
 - a) 1.0 LBS/CF Polystyrene.
 - b) Minimum R-value: 2.0 when tested according to ASTM C1363.
 - c. Interior doors:
 - 1) Non-rated doors: Kraft honeycomb laminated to face sheets.
 - 2) Rated doors: Fire resistant core as required by label.
 - 3) Wet/humid Areas: Moisture-resistant materials, fire resistant where applicable.
 - d. Specific materials used for above listed core types: Manufacturer's option.
 - e. Reinforce for Hardware.
 6. Vertical Door Edges:
 - a. Lock Stile Edges: Beveled 1/8 IN per 2 IN.
 - 1) Exception for inactive leaves: Fabricate inactive leaves with a square edge at the lock stile edge. Active leaves to be beveled per above.
 - b. Hinge Stiles Edge: Beveled 1/8 IN per 2 IN.
 - c. Exceptions for Double-Acting Doors: Provide convex, radiused edges at lock stiles and hinge stiles.
- D. Hardware Reinforcement (doors):
1. Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as door face sheets.
 2. Minimum thickness: As prescribed in ANSI/SDI A250.6; Upgrade as necessary for conditions such as door weight, size, frequency, etc. and as follows:
 - a. Butt Hinges: 0.167 IN (7 GA).
 - b. Continuous hinges: Reinforce with 0.067 IN (14 GA) thick x 1-1/4 IN wide strapping extending full height and welded to hinge edge of door.
 - c. Closers and Overhead Stops: 0.067 IN (14 GA).
- E. Lites:
1. Provide light kits which are labeled for intended opening.
 2. Fixed Stop:
 - a. Locate at exterior face.
 - b. Integral to door/frame.
 3. Removable Stop:
 - a. Locate on interior face.
 4. Screw-less snap-in stops or stops secured with countersunk Phillips head machine screws.
 5. Fixed louvers:
 - a. Base Product: FDLS by Anemostat.
 - b. Slat Design: Inverted split Y.
 - c. Minimum Free Air Flow: 50% Free Area.
 - d. Material: 0.042 IN (18 GA) 1 mm carbon steel.
 - 1) Finish: Baked Enamel; Standard Color to be selected by Architect.
 - 2) Finish: Baked Enamel; Custom Color to be selected by Architect.
 - e. Material: 0.042 IN (18 GA) 1 mm galvanized/galvannealed steel.
 - 1) Finish: Baked Enamel; Standard Color to be selected by Architect.
 - 2) Finish: Baked Enamel; Custom Color to be selected by Architect.
 - f. Material: #304 Stainless Steel with #4 finish.
 - g. Material: #316 Stainless Steel with #4 finish.
 - h. Factory installed and finished to match door.
 - i. Sizes and locations: As indicated.
 6. Louvers in exterior doors:
 - a. Weatherproof, stationary.



- b. Blades spaced 1-1/2 IN 38 mm OC.
 - c. Removable insect screens on interior face of doors, 14 x 18 IN 355 x 457 mm mesh rigid frame.
- F. Overlapping Astragals:
 - 1. Provide approved overlapping astragals where required by label but not provided in Section 08 71 00 Hardware.
 - 2. Weatherstripping: Specified in Section 08 71 00.
- G. Lead Lined Astragals:
 - 1. Provide overlapping LL Astragals at meeting stiles of Lead-Lined Pairs.
 - 2. Description: 2 plies of steel over one ply of 0.075 IN minimum sheet lead.
 - 3. Utilize UL-listed items where opening is also fire-rated.

2.4 HOLLOW METAL (HM) FRAMES

- A. General:
 - 1. Comply with ANSI/SDI A250.8 and with details indicated for type and profile in accordance with SDI 111.
 - 2. Fabricate frames with mitered or coped corners and 1/2 IN nominal backbend.
 - 3. Touch-up galvanized/galvannealed frames with zinc-rich primer.
- B. Fabricate frames as Face-Welded (modified ANSI definition):
 - 1. Face Joints: Continuously back-weld face joints (weld on concealed side).
 - a. Fill and finish exposed sides to be free of visible seams.
 - 2. Intersections of Rabbets, Stops and Soffit Joints: Fabricate to hairline joints. Stitch-weld on concealed side.
 - 3. Split type frames and knock-down type frames are not acceptable.
 - 4. Fasteners which are exposed-to-view are not acceptable.
- C. Determination of steel gauge for each frame:
 - 1. Per following schedule, use indicated minimum steel gauge as indicated for its location, size and other listed criteria.
 - 2. Note: Some items below may not apply to subject project.

Schedule of HM Frames			
Location	Criteria	Minimum Thickness	Miscellaneous
Exterior Frames ¹	Standard and Thermally Enhanced	0.067 IN (14 GA)	Galvanized / galvannealed
Interior Frames ¹	Non-fire rated	0.053 IN (16 GA)	---
	Fire rated	0.053 IN (16 GA)	---
	Frames for doors with automatic openers	0.067 IN (14 GA)	---
	Wet / Humid Areas ²	0.053 IN (16 GA)	Galvanized / galvannealed
General Notes: Gauge of frame listed is minimum. Use heavier gauge as required due to size, physical configuration or if required to meet fire label requirements. Refer to Door Schedule for indication of the Frame Type (i.e. Width, Single vs. Pair; Fire Rating, etc) Refer to Plans for door location (Exterior vs. Interior).			
Footnotes: 1. Refer to Part 2.2 for definition of Exterior locations. 2. Refer to Part 2.2 for definition of Wet/Humid locations.			



- D. Hospital Stops:
1. Provide where indicated.
 2. Description:
 - a. Cut out and fully welded.
 - b. Height from floor: 4-1/2 IN.
 - c. Termination condition at bottom of stop: 45 Deg beveled.
- E. Lead-lined frames:
1. Lead-lined Door Frames:
 - a. Minimum Thickness: 0.053 IN (16 GA).
 - b. Line with sheet lead.
 - 1) Thickness: Equivalent to lead thickness indicated for adjacent walls.
 - 2) Install additional sheet lead as required to ensure integrity of shielding at cutouts and preps for hardware.
 2. Lead-lined Window Frames:
 - a. Minimum Thickness: 0.053 IN (16 GA).
 - b. Line with sheet lead.
 - 1) Thickness: Equivalent to that indicated for adjacent walls.
 - c. Use lead lined stops at glazing.
- F. Lites:
1. Provide light kits labeled for intended opening.
 2. Fixed Stop:
 - a. Locate at exterior face.
 - b. Integral to door/frame.
 3. Removable Stop:
 - a. Locate on interior face.
 - b. Screwless, snap-in stops or stops secured with countersunk Phillips head machine screws.
- G. Silencers:
1. Specified in Section 08 71 00.
 2. Quantity:
 - a. Three on strike jamb of single frames.
 - b. Two per door for pair doors. Locate at head.
 3. Space per manufacturer's recommendations.
 4. Use plastic plugs to keep holes clear during construction.
- H. Hardware Reinforcement (frames):
1. Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.
 2. Minimum thickness: As prescribed in ANSI/SDI A250.6; upgrade as necessary for conditions such as door weight, size, frequency, etc. and as follows:
 - a. Butt Hinges: 7 GA.
 - b. Continuous hinges: Reinforce with 0.067 IN (14 GA) thick x 1-1/4 IN wide strapping extending full height and welded to hinge jamb door rabbet of frame.
 - c. Closers and Overhead Stops: 0.093 IN (12 GA) thick x 12 IN-long strapping welded to vertical flange of frame.
- I. Head Stiffeners for Double Egress Frames:
1. Purpose: To compensate for loss of stiffness at midspan due to discontinuity of head stops.
 2. Configuration: 12 IN long strapping welded to each vertical flange of frame.
 3. Minimum Thickness: 0.093 IN (12 GA).



4. Position stiffeners at mid-span of frame opening.
- J. Junction Boxes:
1. Definition: Sheet metal enclosure welded to back side of frames to facilitate pulling of wires and making electrical connections.
 2. Material: 0.032 IN (20 GA) sheet steel.
 3. Size and shape: As required by hardware device.
 4. Include knock-out to receive 1/2 IN conduit.
 5. Locate Junction Boxes in frames scheduled to receive electrified Security or Door Hardware devices or both.
 - a. Devices including, but not limited to: Electric Strikes, Maglocks, Door Position Switches, Current-conducting hinges, etc.
- K. Jamb Anchors:
1. General:
 - a. Material: ASTM A879 Commercial Steel, 4 OZ/SF coating; mill phosphatized.
 - 1) Exception for frames built into exterior walls: Steel sheet complying with ASTM A1008 or ASTM A1011, hot-dip galvanized according to ASTM A153, Class B.
 - b. Provide anchors in accordance with manufacturer's recommendations on fire rated doors.
 - c. Provide minimum number as indicated on following Table:

Jamb Anchors Minimum Quantity Required (per Jamb)	
Nominal Frame Height	Minimum Quantity per Jamb
Up to 60 IN	2
Between 60 IN and 90 IN	3
Between 90 IN and 120 IN	4
Between 120 IN and 150 IN	5
Taller than 150 IN	Add 1 additional for each 30 IN increase in height thereafter

2. Jamb Anchors for Stud-Framed walls:
 - a. Z-shaped clips, welded to inside of frames; not less than 0.042 IN (18 GA) thick.
 - b. Attach anchors to studs with screws.
 3. Jamb Anchors for Masonry walls:
 - a. Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 IN (18 GA), with corrugated or perforated straps not less than 2 IN wide by 10 IN long; or wire anchors not less than 0.184 IN (6 GA) thick.
 - b. Embed long leg into masonry wall as it is laid.
 4. Post-installed Expansion Type for In-Place Concrete or Masonry:
 - a. Minimum 3/8 IN countersunk, flat-head expansion bolts with expansion shields or inserts.
 - b. Include pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
 - c. Minimum embedment length: 1-3/4 IN.
- L. Floor Anchors:
1. Material: Same for Jamb Anchors but not less than 0.053 IN (12 GA) thick.
 - a. For anchors built into exterior walls, steel sheet complying with ASTM A1008 or ASTM A1011, hot-dip galvanized according to ASTM A153, Class B.
 2. Application:
 - a. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.



- b. Topped Slabs: Adjustable anchors with extension clips allowing not less than 2 IN height adjustment. Terminate bottom of frames at finish floor surface.
 3. Include concealed fasteners.
 4. Provide anchors in accordance with manufacturer's recommendations on fire rated doors.
- M. Additional Head Anchors for Double Egress Frames:
1. Provide two head frame anchors for Double Egress frames.
 2. Locate at third points of span.
- N. Spreaders:
1. Provide removable spreaders at bottom of door frames.
- O. Inserts, bolts and fasteners:
1. Manufacturer's standard units.
 2. Galvanize items built into exterior walls ASTM A153, Class C or D as applicable.
- P. Grout:
1. Portland cement-based grout mixture.
 2. Grout mixtures shall not contain gypsum.
- Q. HM frames in Masonry: Provide 4 IN header, where indicated , to match masonry coursing.

2.5 FABRICATION

- A. Factory-fit doors to suit frame openings, with most stringent criteria for uniform clearances in accordance with:
- a. NFPA 80 for fire rated doors.
 - b. NFPA 105 for smoke-control doors.
 - c. ANSI A250.8.
 - d. Locally adopted Building Code.
 - e. SDI 117.

Door To Frame Clearances Table		
Location		Clearance
Door to Frame @ top and sides		1/8 IN
Meeting Stiles at Pair Doors		1/8 IN
Face of door to face of Stop		3/32 IN
Door Bottom to Floor / Flooring	Top of floor covering	Up to 1/2 IN
	Non-combustible sills	3/8 IN
	Bare floors; No flooring or sills	Up to 3/4 IN

- B. Hardware Preparation:
1. Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to Door Hardware Schedule and templates furnished as specified in Section 08 71 00.
 2. Locate hardware indicated, or if not indicated, according to ANSI/SDI A250.8.
 3. Reinforce doors and frames to receive non-templated, mortised and surface-mounted door hardware.
 4. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
 5. Coordinate locations of conduit and wiring boxes for electrical connections with Division 16 Sections.



6. Remove mill scale and foreign materials, touch-up damaged galvanized or galvanized surfaces.
- C. Hollow Metal Doors:
 1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors.
 2. Exterior Doors: Provide drip leg at header.
 3. Exterior Doors set in Masonry: Provide masonry header to match brick coursing.
 4. Seal joints in top edges of doors against water penetration.
 5. Glazed Lites: Factory cut openings in doors.
 - a. Bottom of glazed panel shall be located 43 IN maximum above finish floor.
 - b. Do not exceed area allowed by code for rated assemblies.
 6. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated.
 7. Frame shall be insulated to the same standard as the wall it is installed in.
- D. Prime: Shop prime.
- E. Fire Labels:
 1. Affix permanent labels to fire rated units in accordance with testing agency requirements.
 2. Where labels are stamped or embossed directly into frame, ensure label will remain legible upon application of finishes.
 3. At openings where continuous hinges, or other items when scheduled and installed would conceal fire label, locate labels on alternative locations as allowed by listing agency and local authorities.
- F. Prepare frames for Door Position Switches (DPS):
 1. Coordinate locations with Security System provider.
 2. Locate DPS frame head approximately 4 IN from latching door edge.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine structure, substrates, and conditions under which work is to be installed for conditions detrimental to correct and timely completion.
- B. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION QUALITY CONTROL

- A. Initially set frames plumb, level and square.
- B. Verify plumb, level and square after walls are set and GWB has been installed, and make adjustments where required.
- C. Verify plumb, level and square again just prior to hanging doors, making adjustments as required. Do not hang doors if the frame is out of plumb, level and square. Contact the General Contractor for resolution. Verify door-to-frame clearances are within specified tolerances. The door to frame gap is 1/8" per NFPA 80 and 105 standards.
- D. Once set there is a maximum 1/8" tolerance for the frame to be separated from the flooring. Cementitious levelling compound shall be used to bring uneven substrate within tolerance across the width of the door jamb.

3.3 INSTALLATION

- A. Frames:



1. Place frames before construction of adjacent walls.
 - a. Exception: Where adjacent walls are cast-in-place concrete: Set frames after wall is constructed.
 2. Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Plumb: Plus or minus 1/16 IN, measured at jambs at floor.
 - b. Level: Plus or minus 1/16 IN per leaf, measured across width of header.
 - c. Square: Plus or minus 1/16 IN, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - d. Alignment: Plus or minus 1/16 IN, measured at jambs on horizontal line parallel to plane of wall.
 - e. Twist: Plus or minus 1/16 IN, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 3. Do not remove spreaders until surrounding wall construction is complete.
 4. After surrounding walls have been constructed, verify that frames are still in proper alignment.
 - a. Re-check for level, plumb, square, twist and other problems that will prevent proper fitting of doors.
 - b. Correct deficiencies before surrounding construction is allowed to proceed.
 - c. Coordinate with other trades to correct alignment problems.
 5. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.
 6. Insulate frames at all locations of thermal rated doors, STC-rated doors and doors indicated as SD. Refer to Door schedule.
 7. Verify frame alignment, and correct deficiencies prior to hanging doors.
 8. Install frames with removable glazing stops located on secure side of opening.
- B. Frame-to-Wall Anchors:
1. Utilize anchor type specified for wall condition.
 2. Align anchors at hinge centers on hinge jamb and at corresponding heights on strike jamb.
 3. Secure frame to wall per manufacturer's instructions.
- C. Prime Coat Touchup:
1. Immediately after erection, sand smooth rusted or damaged areas of primer coat.
 2. Touch up primer coat with compatible air drying primer.
 3. Leave surfaces smooth for finish painting.
- D. Field Painting of HM Frames and Doors:
1. Painting of Interior openings.
- E. Install Sealants:
1. Sealant:
 - a. Interior Sealants: Specified in Section 07 92 16.
 2. Seal frames to walls at jamb and header.
 3. Seal frames to floor slabs and hard floor finishes.
 4. Hairline gap at intersections of head and jamb frames intersections of rabbets and stops:
 - a. Fill exposed seam with painter's caulk.
- F. Install silencers.
- G. Install Between-the-Glass Blinds according to manufacturer's recommendations.

3.4 ADJUSTING AND CLEANING

- A. Alignment:
1. After surrounding walls have been constructed, verify frames remain in proper alignment.



2. Correct deficiencies before surrounding construction is allowed to proceed.
- B. Protection Removal: Immediately before final inspection, remove protective wrappings from doors and frames.
 - C. Leave work complete and in proper operating condition.
 - D. Verify that fire labels are intact, and readily visible.

END OF SECTION

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SECTION 08 14 16

FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Flush Wood Doors, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Source Limitations:
 - 1. Obtain flush wood doors through one source from a single manufacturer.
- B. Window and Door Manufacturer's Association (WDMA):
 - 1. I.S. 1A Industry Standard for Architectural Wood Flush Doors
- C. American National Standards Institute (ANSI):
 - 1. ANSI A115. W Series, Wood Door Hardware Standards.
- D. Fire Rated Door Standards:
 - 1. Label and list for ratings indicated by ITS – Warnock Hersey, UL or other testing and inspection agency acceptable to authorities having jurisdiction.
 - 2. Factory apply physical label or approved marking to fire door or fire door frame.
- E. Sound Rated Flush Wood Doors:
 - 1. Materials and construction identical to assemblies whose Sound Transmission Class (STC) ratings are determined according to ASTM E90 and ASTM E413 by a laboratory with accreditation for the specific test procedures from a signatory body to the International Laboratory Accreditation Cooperative Mutual Recognition Arrangement.
 - 2. Rested door is hung in frame as indicated and is fully operable with hardware and sound seals installed.
 - 3. STC rating: as schedule.
 - 4. Provide door, frame, sound seals, and glazing as needed to maintain STC rating of door assembly.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Indicate location, size, and hand of each door; elevation of each kind of door; location and extent of hardware blocking.
 - 2. Indicate dimensions and locations of cutouts.
 - 3. Indicate requirements for veneer matching.
 - 4. Describe factory finish and finish requirements.
 - 5. Indicate fire ratings for fire doors.
- B. Product Data:
 - 1. Include details of construction for each type of door.
 - 2. Include factory finishing specifications.
 - 3. Provide manufacturer's technical data for each type of door including details of core and edge construction, trim for openings and factory finishing specifications.
 - 4. Test reports for Sound Rated Flush Wood Doors to include:
 - a. STC test results from test method ASTM E90 and classification ASTM E413.



- b. Laboratory and test method accreditation references.
- C. Samples:
 - 1. Factory finishes applied to actual door face materials for each material and finish.
 - a. Provide one piece of specified finished work for each wood species and finish.
 - b. Minimum Size: 8 x 10 IN indicating finish.
- D. Contract Closeout Information:
 - 1. Warranty.

1.4 WARRANTY

- A. Provide written warranty for doors for full life of installation against defects including:
 - 1. De-lamination, warp, twist, bow, telegraphing, and other defects that may impair or affect performance of door for purpose intended, meeting allowable values prescribed by WDMA Standard.
 - 2. Remove and replace defective doors; include cost of removal of defective units, re-hanging and refinishing of replacement units.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Flush Wood Doors:
 - 1. Base:
 - a. Marshfield Door Systems
 - 2. Optional:
 - a. Oshkosh Door Company.
 - b. VT Industries.
 - c. Masonite Architectural.
 - d. Algoma Hardwoods
 - e. Eggers Industries
- B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 DESIGN CRITERIA

- A. Wood Door Manufacturers Association (WDMA):
 - 1. Performance: WDMA I.S.1A-11- Extra Heavy Duty.
 - a. Meet specified performance level without use of additional hardware blocking and without use of through bolts.
 - 2. Aesthetic Grade: WDMA I.S.1A-11 & AWI - Premium Grade except as modified.
- B. Thickness:
 - 1. 1-3/4 IN unless noted otherwise.

2.3 MATERIALS

- A. Veneer:
 - 1. Veneer thickness: 1/50 IN at 12 PCT moisture content.
 - 2. Veneer grade: HPVA Grade A.
 - 3. Veneer Species (both faces unless otherwise noted):
 - a. See Interior Finish Drawings
 - 4. Veneer cut:
 - a. Rotary Cut to match LRH Standard.
 - 5. Veneer leaf match:
 - a. Book match to match existing LRH Standard.
 - 6. Face assembly match:



- a. Running to match existing LRH Standard.
 - 7. Pair and Set match:
 - a. Running match to match existing LRH Standard.
 - 8. Door vertical edges: Veneer edge banding, same species as face, no joints.
- B. Core:
- 1. Select core types which comply with label for scheduled ratings, sizes and hardware devices.
 - 2. Bond cores to stiles and rails; drop-in, unbonded cores are not acceptable.
 - 3. Non-Fire Rated Doors:
 - a. PC-5, Extra Heavy Duty Wood Particleboard Core.
 - b. Fire-rated doors - 20 MIN:
 - 1) Core type indicated above for non-rated doors.
 - c. Fire-rated doors - 45, 60 and 90 MIN:
 - 1) Manufacturer's standard Fire Resistant Mineral Core construction as required by label and hardware schedule.
 - 2) Provide manufacturers standard edge to meet required fire rating.
 - 3) Include blocking as needed for surface applied hardware.
 - 4. Acoustical Doors:
 - a. High Density Particleboard and Insulation as required to achieve sound rating listed in Door and Frame Schedule.
 - 5. Stiles:
 - a. Provide manufacturers standard edge to meet required fire rating.
 - b. Fire rated doors: Fabricate stiles from fire retardant material as allowed by label.
 - c. Meeting stiles where concealed vertical rod (CVR) exit devices are scheduled.
 - 1) Avoid use of applied metal channels where label allows fire retardant material as an alternative.
- C. Rails:
- 1. Solid hardwood or structural composite lumber (SCL).
- D. Cross-banding:
- 1. Engineered wood or wood-based composite, securely bonded to core.
 - 2. Medium density fiberboard (MDF) not acceptable.
- E. Adhesives:
- 1. Face adhesive per WDMA TM-6.
 - 2. Utilize waterproof adhesives for doors indicated near potentially wet conditions.
- F. Lites:
- 1. Fire rated doors:
 - a. Provide lite kits and fire rated glass tested as part of door assembly and labeled for intended opening.
 - b. See Section 08 81 26 Interior Glass and Glazing for materials.
 - c. Locate bottom of glazed panel 43 IN maximum above finish floor.
 - d. Locate fixed stop at exterior face integral to door.
 - e. Locate removable stop on interior face.
 - f. Snap-in stops or stops secured with countersunk phillips head machine screws.
 - 2. Provide label as required for opening.
 - 3. Where doors are listed as STC 30 in the Door Schedule 'Remarks' column, use Anemostat LoPro or approved equal where lites are provided.
- G. Glazing stops:
- 1. Select assemblies certified for fire ratings indicated and physically compatible with glazing type indicated.



2. Fire rated doors:
 - a. Metal vision frames with wood veneer wrap.
 - b. Veneer of same species as door facing.
 3. Non-fire rated doors:
 - a. Solid hardwood.
 - b. Same species or compatible species with door facing.
- H. Glazing:
1. Glass specified in Section 08 81 26.
 - a. Non-Fire Rated and Non-Sound Rated Openings: 6mm (1/4 IN nom) Tempered Safety Glass.
 - b. Glass in fire rated wood doors to be factory installed by wood door manufacturer.
 - c. Glass in sound rated flush wood doors to maintain STC rating of door assembly.
- I. Miscellaneous Items:
1. Metal stile channels:
 - a. Nominal 5 IN metal edge channels at fire rated pairs equipped scheduled to receive concealed vertical rod (CVR) exit devices.
 - b. Use only where fire retardant wood stiles alone are insufficient to satisfy label.
 - c. Material and Finish: Stainless Steel. No. 4 Satin Brushed.
 - d. Concealed intumescent seals: Include where required by fire label.
 - e. Include overlapping metal astragal lip where opening is part of a smoke barrier.
 2. Overlapping astragals:
 - a. Provide approved overlapping astragals where required by label but not provided in Section 08 71 00, Door Hardware.
 3. Sound Seals:
 - a. Full perimeter gasketing system to maintain STC rating of door assembly.
 - b. Gaskets, threshold, hinges, door bottom, astragal, and other accessories as needed.
 - c. See specification 08 71 00.

2.4 FABRICATION

- A. Factory fit doors to suit frame openings with most stringent criteria for uniform clearances in accordance with:
1. National Fire Protection Association NFPA 80 for fire rated doors.
 2. National Fire Protection Association NFPA 105 for smoke control doors.
 3. American National Standards Institute ANSI A250.8.
 4. Locally adopted Building Code.
 5. Wood Door Manufacturers Association (WDMA) pre-fit clearances for factory fit doors.

Door To Frame Clearances		
Location		Clearance
Door to Frame at top and sides		1/8 IN
Meeting Stiles at Pair Doors		1/8 IN
Face of door to face of Stop		1/8 IN
Door Bottom to Floor / Flooring	Typical; all floor covering types	Up to 1/2 IN
	At non-combustible sills	3/8 IN
	Bare floors- No flooring or sills	Up to 3/4 IN

- B. Factory machine doors for hardware that is not surface applied.
1. Comply with final hardware schedules, shop drawings, and hardware templates.



2. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.
 3. Factory pre-drill pilot holes for surface applied items.
- C. Hardware Preparation:
1. Make cutouts accurately and neatly.
 2. Glazed lites:
 - a. Factory cut openings in doors.
 - b. Locate bottom of glazed panel 43 IN maximum above finish floor.
 - c. Do not exceed area allowed by code for rated assemblies.
 3. Provide two sets of glazing stop moldings for openings to completely cover cut edges.
 - a. Neatly miter stops at corners.
 4. Cut and trim openings through doors to comply with applicable requirements of referenced standard for kinds of doors required.
 5. Finish as appropriate for material and type:
 - a. Veneer wrapped stops: Finish to match face veneer on doors.
 - b. Solid wood stops: Finish to match face veneer on doors.
 6. Fill nail holes in wood stops.
- D. Top and Bottom Edges:
1. Render top and bottom edges smooth, non-absorptive and readily cleanable.
 2. SCL rail finish: Make smooth with the application of veneer tape, plastic laminate or clear sealer to finish rough or porous edges.
- E. Fire Labels:
1. Affix permanent labels to fire rated units in accordance with agency requirements.
 2. On openings where continuous hinges or other items would conceal label, place label in alternate location allowed by listing agency and authorities having jurisdiction.
- F. Finishes:
1. Comply with WDMA & AWI finish requirements.
 2. Completely finish doors at factory.
 3. Stain (STN):
 - a. Type: Manufacturer's standard type.
 - b. Stain color:
 - 1) Custom stain to match LRH Standard.
 - 2) System WDMA TR-6 catalyzed polyurethane.
 - 3) Sheen: 30 to 40.
- G. Vertical Door Edges:
1. Lock stile edges: Beveled 1/8 IN per 2 IN.
 - a. Fabricate inactive leaves with a square edge at lock stile edge.
 - 1) Active leaves to be beveled per above.
 2. Hinge stiles edge: Beveled 1/8 IN per 2 IN.
 3. Double acting doors:
 - a. Provide convex, radiused edges at lock stiles and hinge stiles.
 - b. Kerf for privacy gaskets.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Verify suitability of openings to accept installation.
- B. Verify frames comply with indicated requirements for type, size, location and swing characteristics and have been installed with level heads and plumb jambs.



- C. Reject doors with defects prior to hanging.
- D. Normalize wood doors to ambient conditions and to temperature and humidity levels recommended by manufacturer.
- E. Do not hang doors in frames set out of plumb, out of square, or out of parallel.
- F. Work with frame installer and wall installer to correct misalignment issues.
- G. Proceed with installation only after unsatisfactory conditions have been corrected.
- H. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION

- A. Comply with door manufacturer's written instructions, referenced quality standard, and as indicated.
- B. Drill pilot holes for screws attaching hinges, closers, lock hardware and other devices to stile or face of door.
 - 1. Diameter of pilot hole shall not exceed 90 PCT of the root diameter of the screw.
- C. Fit doors to frames and machine for hardware, to extent not previously worked at factory.
- D. Hardware: For installation, see Section 08 71 00, Door Hardware.
- E. Door, when closed, shall engage the frame door stop evenly from top to bottom.
- F. Frames at Sound Rated Flush Wood Doors:
 - 1. Solidly pack mineral wool insulation behind frames as needed to maintain STC rating of door assembly.
 - 2. Grout frames as needed to maintain STC rating of door assembly.

3.3 ADJUSTING

- A. Adjust and check doors for proper fit function and uniform clearance at each edge to swing and operate freely.
- B. Leave work complete and in proper operating condition.
- C. Ensure fire labels are intact, and readily visible.
- D. Adjust sound seals and door for full engagement of sound seals with no gaps or leaks when door is latched.

END OF SECTION



SECTION 08 31 13
ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Access doors and frames.
 - 2. Fire-rated access doors and frames.
 - 3. Lead-lined access doors and frames.
- B. Furnish labor, materials, tools, equipment, and services for Access Panels and Doors, as indicated, in accordance with provisions of Contract Documents.
 - 1. Provide where indicated on Drawings.
 - 2. Where not indicated on Drawings, provide access panels or doors at walls and inaccessible ceilings as required to permit access to equipment, devices, and piping requiring service, adjustment, or inspection.

1.2 REFERENCES

- A. Reference Standards:
 - 1. ASTM International (ASTM):
 - a. ASTM A36/A36M, Standard Specification for Carbon Structural Steel
 - b. ASTM A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
 - c. ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process
 - d. ASTM A666, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar]
 - e. ASTM A879/A879M, Standard Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface
 - f. ASTM A1008/A1008M, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
 - g. ASTM F2329, Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners
 - 2. International Code Council (ICC):
 - a. International Building Code (IBC).

1.3 SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details,[fire ratings,] material descriptions, dimensions of individual components and profiles, and finishes.
- B. Samples: For each type of access door and frame and for each finish specified, complete assembly minimum 6 by 6 inches in size.
- C. Product Schedule: For access doors and frames. Use same designations indicated on Drawings.
- D. Qualification Data: For testing and inspecting agency.



1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, Section 5.2.3.1.
 2. Submit copy of DHI Fire and Egress Door Assembly Inspector (FDAI) certificate.
- E. Record Documents: For fire-rated doors, list of applicable room name and number in which access door is located.

1.4 QUALITY ASSURANCE

- A. Fire-Rated Door Inspector Qualifications: Inspector for field quality control inspections of fire-rated door assemblies meets the qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:
1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

1.5 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace access doors and frame and hardware components that fail(s) in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Structural failures, including cracks, warping, bends, and out-of-square.
 - b. Faulty operation of hardware including smoke or sound seals and gaskets.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
 2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Access Doors and Frames: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection[and temperature-rise limit] ratings indicated, according to NFPA 252 or UL 10B.
- B. Gasketed Access Doors: Provide where required by Facilities Guidelines Institute for healthcare applications.

2.2 ACCESS DOORS AND FRAMES

- A. Interior Flush GFRG Access Doors with Concealed Flange:
1. Base Product: Subject to compliance with requirements provide GFRG Access Doors by one of the following:
 - a. Acudor.
 - b. Activar.
 - c. Babcock Davis.
 - d. Cendrex.
 - e. Karp.
 2. Description: Face of concealed-hinge door flush with frame, with concealed flange for gypsum board installation.
 3. Locations: Wall and Ceiling.
 4. Door Type Concealed-hinge, radius corner.
 5. Door and Frame Material: Unpainted glass-fiber-reinforced gypsum, with frames reinforced for hardware and fastenings.
 6. Latch and Lock: Cam latch, key operated.

2.3 FIRE-RATED ACCESS DOORS AND FRAMES

- A. Fire-Rated, Flush Access Doors with Exposed Flanges:



1. Base Product: Subject to compliance with requirements provide Fire-Rated Access Doors by one of the following:
 - a. Acudor.
 - b. Babcock Davis.
 - c. Cendrex.
 - d. J. L. Industries, Inc., a division of Activar Construction Products Group, Inc.
 - e. Karp.
 - f. Milcor.
 - g. Nystrom.
2. Description: Door face flush with frame, with a core of mineral-fiber insulation enclosed in sheet metal; with exposed flange, self-closing door, and concealed hinge.
3. Locations: At fire rated partitions indicated on drawings.
4. Fire-Resistance Rating: Not less than that of adjacent construction.
5. Uncoated Steel Sheet for Door: Nominal 0.036 inch 0.91 mm, 20 gauge, factory primed.
6. Frame Material: Same material, thickness, and finish as door.
7. Latch and Lock: Self-latching door hardware, operated by key.

2.4 LEAD-LINED ACCESS DOORS AND FRAMES

- A. Lead-Lined, Flush Access Doors with Exposed Flanges:
 1. Base Product: Subject to compliance with requirements provide Model KATR-LL by Karp Associates, Inc. or approved equal by one of the following:
 - a. Acudor.
 - b. Babcock Davis.
 - c. J. L. Industries, Inc., a division of Activar Construction Products Group, Inc.
 - d. Ray-Bar.
 2. Description: Door face recessed 1-1/2 inches to accommodate double layer of gypsum board, lead-lined, with exposed flange and continuous hinge.
 3. Locations: Locations in lead-lined walls and ceilings..
 4. Uncoated Steel Sheet for Door: Nominal 0.018 inch 0.46 mm, 26 gauge, factory primed.
 5. Frame Material: Nominal 0.060 inch 1.52 mm, 16 gauge, factory primed.
 6. Lead Lining: Provide lead lining for door and frame, thickness to match partition and as required in owner vendor's physicist's report.
 7. Latch and Lock: Flush door hardware, operated by key.

2.5 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879/A879M, with cold-rolled steel sheet substrate complying with ASTM A1008/A1008M, Commercial Steel (CS), exposed.
- C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum G60 Z180 or A60 ZF180 metallic coating.
- D. Stainless Steel Plate, Sheet, and Strip: ASTM A240/A240M or ASTM A666, Type 304. Remove tool marks, die marks, and stretch lines, or blend into finish.
- E. Stainless Steel Flat Bars: ASTM A666, Type 304. Remove tool marks, die marks, and stretch lines, or blend into finish.
- F. Aluminum Extrusions: ASTM B221/B221M, Alloy 6063.
- G. Aluminum Sheet: ASTM B209/B209M, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- H. Frame Anchors: Same material as door face.



- I. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel, according to ASTM A153/A153M or ASTM F2329 or stainless steel.

2.6 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.
 - 1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.
 - 2. For concealed flanges with plaster bead for full-bed plaster applications, provide zinc-coated expanded-metal lath and exposed casing bead welded to perimeter of frames.
- D. Latch and Lock Hardware:
 - 1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
 - 2. Keys: Furnish two keys per lock and key all locks alike.
 - 3. Mortise Cylinder Preparation: Where indicated, prepare door panel to accept cylinder specified in Section 08 71 00 - Door Hardware.
- E. Aluminum: After fabrication, apply manufacturer's standard protective coating on aluminum that will come in contact with concrete.

2.7 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - 1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.
 - 2. Factory Finished: Apply manufacturer's standard baked-enamel or powder-coat finish immediately after cleaning and pretreating, with minimum dry-film thickness of 1 mil 0.025 mm for topcoat.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.



3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- A. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.
- B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.
- C. Avoid locating access panels within animal holding rooms, procedure rooms, BSL-3 and BSL-4 laboratories and equipment rooms. Locate access panels in corridors, air locks, storage rooms or gowning rooms, if possible.

3.3 FIELD QUALITY CONTROL

- A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.
- B. Inspections:
 - 1. Fire-Rated Door Inspections: Inspect each fire-rated access door in accordance with NFPA 80, Section 5.2.
- C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.
- E. Prepare and submit separate inspection report for each fire-rated access door indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.4 ADJUSTING AND CLEANING

- A. Adjust access panels to operate easily without binding. Verify that integral locking devices operate properly.
- B. Remove panels and frames that are warped, bowed, or otherwise damaged, and replace with new components.
- C. On completion of access panel installation, clean interior and exterior surfaces as recommended by manufacturer.

END OF SECTION

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SECTION 08 71 00
DOOR HARDWARE

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. BHMA finish door hardware for hollow metal, wood, and aluminum doors.
- B. Accessories including but not limited to door stops, kickplates, seals, and thresholds.
- C. Removal of existing hardware at existing doors and frames and replacement with new hardware.

1.2 PRODUCTS SUPPLIED BUT NOT INSTALLED UNDER THIS SECTION

- A. Hardware templates for doors and frames.

1.3 RELATED SECTIONS

- A. Summary of Work: Division 01, applicable Sections.
- B. Masonry: Division 04, applicable Sections.
- C. Carpentry: Division 06, Section 06 10 53 – Rough Carpentry.
- D. Perimeter Sealants and Insulation: Division 07, applicable Sections.
- E. Division 8, applicable Sections including, but not limited to, Wood Doors; Hollow Metal Doors and/or Frames
- F. Section 08 71 13 – Automatic Door Operators.
- G. Divisions 26 through 28: Electrical rough in, wiring and connectors for electrified hardware including, but not limited to:
 - 1. Wire and connectivity from ceiling through frame to electrified hardware devices including non-08 71 00 task of providing wiring inside of doors.
 - 2. Section 08 71 13 “Automatic Door Operators”

1.4 UNDER THIS SECTION

- A. Hardware templates for doors and frames.

1.5 REFERENCES

- A. Conform to the following Referenced Standards and Requirements:
 - 1. IBC – International Building Code.
 - 2. ADA – Americans with Disabilities Act - 2010 Standards for Accessible Design.
 - 3. NFPA 80 – Standard for Fire Doors and other Opening Protectives.
 - 4. NFPA 101 – Life Safety Code.
 - 5. ANSI/BHMA 156.19 American National Standard for power high and low energy operated doors.
 - 6. ANSI A156 Series – Builders Hardware Manufacturers Association (BHMA) Standards Set.
 - 7. AAADM – American Association of Automatic Door Manufacturers.



1.6 COORDINATION:

- A. The hardware groups/sets specified in section 08 71 00 - Part 3 are intended to establish type and design standard when used together with the requirements of this Section, Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections. Examine Contract Documents and furnish proper hardware for door openings. Refer to specifications for clarification and detailed requirements and provide products and services in specifications even if not written in hardware groups/sets in Section 08 71 00 - Part 3.
- B. Coordinate work of this Section with other directly affected Sections involving manufacturer of any internal reinforcement for door hardware. In particular, coordinate door preparation in accordance with applicable regulatory and trade standards specified.
 - 1. Provide hardware templates to door and frame manufacturer. Provide two templates to those manufacturers who are not currently registered template book holders.
 - 2. Provide finish hardware schedule for use by the door and frame suppliers.
 - 3. Where hardware sets/groups have different information than the specifications, refer to the specifications and drawings for clarification and bid combined hardware sets/groups and Contract Documents/specifications. Provide combined materials/devices at time of submittals in addition to other coordination items:
 - a. Coordinate keying requirements as specified in this Section.
- C. Convene coordination meeting between all opening vendors and installers at least two weeks prior to purchasing doors, frames, door hardware, and electrical devices required for complete systems.
 - 1. Required attendance includes, but is not limited to, the following: Contractor, hardware supplier and/or installer, door supplier and/or installer, frame supplier and/or installer, auto operator vendor and/or installer, security card reader vendor and/or installer, and electrical contractor.
 - 2. Contractor shall be responsible for verifying that the door hardware accepted for installation is compatible for use with the doors and door-frames.
 - 3. For card reader interface with applicable door devices, security vendor and/or installer (coordinate accordingly) shall have a written agenda and plan on how scope related to electrified devices will be installed to have a complete wired and operational card access system. The card reader interface scope includes, but is not limited to, card reader input and output coordination on the electric locking device power supply, electric locking devices and connectivity, and confirmation of a complete, wired, and operational card access system. Provide all required relays and devices as part of the overall system in accordance system requirements at no additional cost.
 - 4. For auto operator interface with applicable door devices, auto operator vendor and/or installer (coordinate accordingly) shall have a written agenda and plan on how scope related to electrified devices will be installed to have a complete wired and operational auto operator system. The auto operator interface scope includes, but is not limited to, connectivity and inputs for push-plates, BEA BR3 or accepted equal required auto operator relays, electric locking devices, and confirmation of the complete, wired, and operational auto operator system. Provide all required relays and devices as part of the overall system in accordance with system requirements at no additional cost.
 - 5. Vendor and/or installer (coordinate accordingly) is not responsible for electrical-power (see electrical drawings) or FLS (fire/life safety) connectivity to above frame or back-of-house power supply (back-of-house meaning remote low voltage power). FLS connectivity only required for fire or smoke rated opening in particular functions shall meet Code as scheduled.



1.7 SUBMITTALS

- A. The hardware groups/sets specified in Section 08 71 00 - Part 3 are intended to establish type and design standard when used together with the requirements of this Section, Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections. Examine Contract Documents and furnish proper hardware for door openings. Refer to specifications for clarification and detailed requirements and provide products and services in specifications even if not written in hardware groups/sets in Section 08 71 00 - Part 3.
- B. For each opening submit coordinated (means and methods) requirements in accordance with Division 01 and a detailed door, frame and hardware schedule. See pre-hardware and hardware scheduling requirements below. Submittals that do not meet means and methods, including missing related doors/frames submittal/shop drawings, will be returned for correction before checking.
- C. Pre-Hardware Scheduling Tasks:
 - 1. Coordinate work of this Section with other directly affected Sections and scope.
 - 2. Provide required Division 08, means and method type work in accordance with Contract Documents at no additional cost to project, including Division 01 and language below. This Section supplier shall be provided with full documents, not just Section 08 71 00 Part 3 hardware group/sets as that process does not meet Contract requirements.
 - 3. Means and method type work includes, but is not limited to, coordination with plans and other specifications, templating, Section 08 71 00, and other Division 08 Section engineering and coordination. Starting submittal work or labor before means and method type work is completed does not constitute change orders.
 - 4. Provide RFIs (request for information) for clarification items before submittals. This Section is not to be a stand-alone submittal but requires multiple Sections and Drawings coordination before submittals will be reviewed.
 - a. Coordinate length and sizes for hardware devices before submittals, Verify the door hardware is compatible for use with the doors and door/frames.
 - b. Report all prevailing conditions that will adversely affect satisfactory execution of work before submittals.
 - 1) Example 1: If door stiles would inhibit the use of specified hardware, provide RFIs before starting detailed hardware headings or group submittal process.
 - 2) Example 2: Coordinate length and sizes for hardware devices before ordering materials (verify the door hardware is compatible for use with the doors and/or door/frames) included, but not limited to special templates and sizes of devices.
 - c. This Section clarification items (RFIs) shall be reviewed by a non-design team coordinator before sending to design team for review.
 - 1) For clarification items that are means and methods (directed to or from one vendor to another vendor, framer/installer), Contractor shall coordinate and answer or list questions that are not design scope.
 - 5. Multiple submittals for this Section work will not meet Contract requirements. Exceptions are as follows:
 - a. Frames that are required to be ordered early in the build process (under ten frames / openings required to meet project deadlines for early site work) may be broken into separate packages but remaining hardware in these packages will be rejected and not reviewed.
 - 6. Coordinate with door/frame internal reinforcement for door hardware. In particular, coordinate door preparation in accordance with applicable regulatory and trade standards specified.



7. Coordinate keying requirements with all openings with one Vendor. For keying scope, even if different Section door/frame scope packages are submitted with different hardware schedule submittals, only one Section 08 71 00 supplier is to oversee, coordinate, submit, furnish, and install keying. Coordinate per Section 08 71 00 and per means and methods before submits begin.
 8. To detail submittals and nomenclature for electrified hardware, review and coordinate electrical specifications and drawings for scope that could affect hardware selections:
 - a. Scope includes, but not limited to, auto operator locations if related to project and/or access control if related to project and/or electrical Divisions 25-28 and applicable Drawings.
 - b. For electrified hardware interface with non-Division 08 access control or electrified tasks, the non-Division 08 access control or security vendor task shall provide a written agenda/plan how access control or security scope will be installed for a complete and operational system. Written agenda shall include power requirements and additional relays at no additional cost.
 - c. For electrified hardware interface with non-Section 08 71 00 auto operator devices, the Section 08 71 13 auto operator vendor task shall provide a written agenda and plan how auto operator scope will be installed for a complete and operational system. Written agenda shall include power requirements and additional relays at no additional cost.
- D. Hardware Schedule:
1. Submit required vendor qualification letters and documentation (see above “QUALITY ASSURANCE”).
 2. Non-design team coordination and requirements:
 - a. Submittals for coordinated door/frame/hardware items, shall be submitted at the same time for review of total opening requirements. Do not submit Section 08 71 00 scope without coordinated door and frame packages and above RFI/clarification process tasks completed. Submittals that do not include related doors/frames will be returned for correction before checking.
 - b. Section submittals and/or shop drawings to be reviewed and have comments by non-design team (Contractor) before sending to design team. If submittals do not meet Contract requirements, return to hardware vendor for re-submittal. In many cases, unacceptable submittals are passed though without non-design team (Contractor) comments (coordinate per Contract).
 3. Submit hard copies of hardware schedule (number of copies per Division 01) as well as submit editable, PDF files via electronic email of ftp site process in Vertical Format as illustrated by the Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Horizontal-type schedules will be returned for correction before reviewing.
 - a. Shop drawings / hardware schedule shall clearly indicate each hardware group specified and manufacturer of each item proposed as well as each door number that the hardware is assigned to.



b. Vertical schedule format sample:

Heading Number 1 (Door Schedule or Architectural Assigned Hardware Group/Set number from part 3 = HW #__)				
1 Single Door #1 - Exterior from Corridor 101		Opening Size	90°	RH
Rating				
Quantity	Device Description	Device # (include specification language)	Finish	Manufacturer
4	Hinges		630	IVES
1	Lockset		630	SC
1	I/C Cylinders	Large Format I/C	626	SC
1	Permanent Core	Large Format I/C Everest 29	626	SC
1	Stop and Holder		626	TR
1	Door Silencers		GR	TR

4. Illustrations from manufacturer's catalogs and product data:
 - a. Provide cut sheets and product data with vertical format hardware submittal (same timeframe) as well as door and frame information to be reviewed as one submittal package. Manufacturer's hard copy as well as PDF catalog cut sheets and product data shall not be submitted before editable, PDF files vertical format hardware submittal. See above Sequence of Format requirement. Catalog cut sheets and product data sent as submittals before the typed-out nomenclature of hardware part numbers (vertical format hardware submittal) will be returned without review.
5. Provide hardware schedule and hardware templates to door and frame manufacturer. Provide two templates to those manufacturers who are not currently registered template book holders.
6. Wiring Information: Provide manufacturers' wiring information including manufacturers' door elevation diagrams for electrified hardware based on Door Hardware Institute (DHI) core class "Electrified Architectural Hardware" DHI class #COR133. Openings where only magnetic hold-opens or door position switches are specified do not require wiring information. Provide information with hardware schedule submittal for review. Provide detailed wiring diagrams with hardware delivery to jobsite.
7. Review of schedules does not relieve the Contractor of providing all hardware required for complete and proper execution of the Work, whether or not such hardware was inadvertently omitted from Submittal.

E. Vendor meetings or coordination prior to purchasing materials:

- a. Convene coordination meeting between all opening vendors and installers at least two weeks prior to purchasing doors, frames, door hardware, and electrical devices required for complete systems. Attendance includes but is not limited to hardware supplier and/or installer, door supplier and/or installer, frame supplier and/or installer, auto operator vendor and/or installer, security card reader vendor and/or installer, and electrical. If hardware changes are required due to these meetings, communicate changes to design team before ordering materials.

F. Templates:

1. Provide listing of manufacturer's template numbers for each item of hardware in hardware schedule.
2. Submit templates and "Reviewed Hardware Schedule" to door and frame supplier and others as applicable to enable proper and accurate sizing and locations of cutouts and reinforcing.



- G. Installation Instructions:
 - 1. Provide manufacturer's written installation and adjustment instructions for finish hardware.
 - 2. Send installation instructions to site with hardware.
- H. Contract Closeout Submittals: Include specific requirements indicated below.
 - 1. Operating and maintenance manuals: Submit three sets containing the following:
 - a. Complete information in care, maintenance, and adjustment, data on repair and replacement parts, and information on preservation of finishes.
 - b. Catalog pages for each product.
 - c. Name, address, and phone number of local representative for each manufacturer.
 - d. Parts list for each product.
 - e. Copy of final accepted hardware schedule, edited to reflect "As installed".
 - f. Copy of final keying schedule.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of Division 01.
- B. Deliver products in manufacturer's original containers, dry and undamaged, with seals and labels intact.
- C. Storage: Store materials in a cool and dry location, elevated from the ground and protected from the elements, and secured from theft or pilferage.

1.9 WARRANTY

- A. Comply with provisions of Division 01.

1.10 MAINTENANCE

- A. Provide special wrenches and tools applicable to each special hardware component.
- B. Provide maintenance tools and accessories supplied by hardware manufacturer.

PART 2 - PRODUCTS

2.1 FINISH

- A. Where hardware groups/sets have different information, refer to the following for clarification. Provide hardware groups/sets devices/finishes, along with added finishes below, as indicated on drawings and detailed requirements for each type of device:
 - 1. Typical BHMA finish designation references:
 - a. BHMA 630 – satin stainless steel.
 - b. BHMA 626 – satin chromium plated brass or bronze.
 - c. BHMA 628 – satin or dull aluminum, clear anodized (uncoated).
 - 2. Closers:
 - a. BHMA 689– Sprayed aluminum paint finish (back of house where specified).



2.2 EXISTING CONDITIONS AND PRODUCTS

- A. Examine Contract Documents and furnish proper finishes and services for each door opening (door, frame, and hardware).
- B. Existing Remaining Hardware:
 - 1. See Section 08 71 00 as well as Contract Documents for additional hardware requirements.

2.3 HARDWARE TEMPLATE

- A. Make templates for hardware to be applied to metal doors or pre-finished doors.
- B. Hinge templates shall conform to ANSI A156.7.
- C. Promptly furnish template information or templates to door and frame manufacturers.
- D. Coordinate hardware items to prevent interference with each other.

2.4 LEAD LINED APPLICATIONS

- A. Provide all hardware necessary to meet the requirements for lead lined applications. Where hardware groups/sets have different information, refer to the following for clarification. Provide hardware groups/sets devices along with added devices as indicated on Drawings and detailed requirements for each type of device. Provide all specifications even if not written in hardware sets/groups.
 - 1. Lead Protection: Lead wrap hardware penetrating lead-lined doors.
 - 2. Levers and roses shall be lead lined.
 - 3. Apply kick and armor plates with 3M adhesive #1357, as recommended by 3M Co., on lead-lined doors.
 - 4. Coordinate devices including, but not limited to, closer and/or overhead stop applications so that lead-lined door will have no penetration in lead. Through bolts shall be lead lined to meet application requirements.

2.5 FIRE RATED DOORS AND EXIT DOORS

- A. Where hardware groups/sets have different information, refer to the following for clarification. Provide hardware groups/sets devices along with added devices as indicated on drawings and detailed requirements for each type of device. Provide all specifications even if not written in hardware sets/groups.
- B. Provide all hardware necessary to meet the requirements of IBC 2018 for fire doors and exit doors, as well as to other requirements specified, even if such hardware is not specifically mentioned under Article "Hardware Schedule" of this Section.

2.6 SCREWS, BOLTS, AND FASTENING DEVICES

- A. Exposed head oval Phillips type screws in countersunk holes unless otherwise specified. Use screws, bolts, washers, grommets, nuts, and other fastening devices of appropriate length, type, head, metal, and finish as necessary for proper match and application of hardware.
- B. Threshold anchors shall be Flat Sleeve Anchors cadmium plated expansion anchor screw in one unit.

2.7 SUBSTITUTIONS



- A. Some products listed in this Section by brand name and model number have been established by the Owner as standard. No substitutions permitted for those products.

2.8 HANGING HARDWARE

A. Acceptable Manufacturers:

1. McKinney Products Co.
2. Stanley Works.
3. Hager Manufacturing.

B. Butt Hinges and Self-Closing Hinges:

1. Butt hinges shall be manufactured in accordance with ANSI/BHMA A156.1.
2. Self-closing hinges and pivots shall be manufactured in accordance with ANSI/BHMA A156.17.
3. Where hardware groups/sets have different information (number of hinges and sizing), refer to the following for clarification. Provide hardware groups/sets devices along with added devices as indicated on Drawings and detailed requirements for each type of device.
 - a. Butt hinges shall be manufactured in accordance with ANSI/BHMA A156.1.
 - b. Provide wide throw hinges where required:
 - 1) Whether new or existing openings (existing doors or frames to remain), submit and provide hinge widths sufficient to clear trim projection when door swings 180 degrees (all doors shall swing 180 degrees if wall allows).
 - 2) Utilize wide throw type hinges to clear frame or wall obstructions/cladding in order for doors to completely open (see 180 degree language above).
 - 3) Where a door closer device is specified and will be installed on pull side/hinged side of doors (i.e. closers will hit walls or other surfaces when door is completely open), provide wide throw type hinges to give sufficient pocket depth to hide closer behind door (do not pinch or crush closer between the door and wall surface).
 - 4) Confirm hinge sizing with frame and wall details.
 - c. Provide "weight/strength" as specified in hardware groups/sets in Part 3 (hinge nomenclature basis-of-design weight/strength).
 - d. For doors 1-3/4 inches thick and up to 36 inches wide, provide hinge height of 4-1/2 inches.
 - e. For doors 1-3/4 inches thick and 37 inches to 48 inches wide, provide heavy duty, four ball bearing hinges and height of 5 inches.
 - f. If hardware sets specify height (example: 5 inches tall at 36 inch wide door), provide height as specified for project standards at these locations.
 - g. Provide two butts for doors up to 60 inches high and one additional butt for each 30 inches of height or fraction thereof.
 - h. Provide non-removable pins at exterior doors.
 - i. Provide ball-bearing hinges (non-ball-bearing hinges are not acceptable).
 - j. Electric Hinges: Provide electrified hinges with certified UL Listed, concealed wires. Provide electric hinges with standardized wire colors to accommodate up to 12 wires (4, 6, 8 or 12 as required per to provide sufficient number of concealed wires to accommodate electric function of specified hardware). If additional wires are specified (more than needed for electrified devices), provide the wires specified.
 - k. For existing or retrofit openings, verify hinges in field before submittals. See additional specifications in part 3, hardware group sets as well as drawings for additional existing or retrofit requirements.



2.9 SECURING DEVICES (LATCHING SYSTEMS)

- A. Mortise Locksets, Latchsets, and Deadbolts:
 - 1. Acceptable Manufacturers:
 - a. Sargent Manufacturing (SA) - 8200 Series.
 - b. Owner's standard, no substitutions permitted.
 - 2. Levers:
 - a. Provide levers to return to door within 1/2 inch.
 - 3. Where hardware groups/sets have different information, refer to the following for clarification. Provide hardware groups/sets devices along with added devices as indicated on Drawings and detailed requirements for each type of device:
 - a. Locksets shall meet the requirements of ANSI/BHMA A156.13-1994, Operational Grade 1.
 - b. Provide only thumbturn devices that meet accessibility requirements (Sargent -LB series). No center pivoting thumbturns allowed.
 - c. If deadbolts or lockbolts are utilized on the project, devices shall be interconnected with the latching mechanism on all egress doors to provide single movement function to unlatch doors.
 - d. Backset: 2-3/4 inches. Provide minimum 1 inch throw stainless steel deadbolt Provide minimum 3/4 inch throw for latch bolt.
 - e. Strikes:
 - 1) Provide ANSI 4-7/8 inch standard strike.
 - 2) Provide curved lip-type strike at all locations if possible to prevent catching clothing or other objects on strike. Where required, provide detail and flat strike.
 - 3) Where required, provide extended lip strike so that the lock or latchset latch will not come in contact with frame or added trim on or adjacent to the frame. Example: Don Jo device #MEST-104, but provide submitted manufacturer equivalent extended lip strike.
 - 4) Existing Strikes:
 - a) Field verify existing strikes. Provide and install new ANSI 4-7/8 inch or standard 2-3/4 inch strikes to match existing frame preparation/template unless
 - f. Where indicated on Drawings, door schedule, or details provide lead lined devices.
- B. Exit Devices:
 - 1. Acceptable Manufacturers:
 - a. Von Duprin, building standard (provide unless the alternate VE pricing is accepted before submittals).
 - b. Alternate price to be reviewed before submitting hardware or door submittals:
 - 1) Sargent 8800 series
 - 2. Where hardware groups/sets have different information, refer to the following for clarification. Provide hardware groups/sets devices along with added devices as indicated on Drawings and detailed requirements for each type of device:
 - a. All exit devices shall be UL listed for panic. Exit devices for labeled doors shall be UL listed as "Fire Exit Hardware".
 - b. Provide ANSI A156.3, Grade 1; UL Listed
 - c. Provide cylinders for exit devices with locking trim and cylinder dogging. Provide cylinder dogging feature for non-rated exit devices.
 - d. Whether or not specified throughout project, verify if Electrical, IDF and other rooms with electrical coordination have 800 amps or more than 800 amps housed within the rooms. At these rooms, if lever locksets are specified, credit the locking device and provide the Von Duprin mortise-type panic device #9975NL-F x 996L-M x key override.



- e. Trim:
 - 1) Where lever trim is specified, provide lever design to match lockset levers.
- C. Electric Strikes:
 - 1. Acceptable Manufacturer:
 - a. HES Manufacturing, Inc.
 - 2. Provide electric strikes designed for use with the type locks shown at each opening where specified.
 - 3. Provide transformers and rectifiers for each strike as required. Verify voltage with electrical contractor.
 - 4. For all electric strike locations, provide HES "SmartPac III" In-Line Power Control or accepted equal product to meet specified requirements: 2005 SmartPac III device is an in-line power control that is capable of receiving input voltages from 12VAC to 32VAC or DC. The built-in bridge rectifier shall provide 12VDC or 24VDC output. Under continuous duty operation, the output VDC shall be reduced by 25 percent to extend the life of the electric strike. The SmartPac III includes an in-line fuse, MOV to protect against possible inrush and reverse surges, and a 2 second to 8 second adjustable timer. Standard features include selectable 12VDC or 24VDC output options, built-in bridge rectifier, built-in surge protection / voltage regulation, activation timer keeping strike energized for set period of time, adjustable from 2 seconds to 8 seconds, continuous duty timer reducing initial voltage by 25 percent after set period of time adjustable from 2 seconds to 8 seconds, providing cooler operation of strike.
- D. Flush Bolts and Dust Proof Strikes:
 - 1. Acceptable Manufacturers:
 - a. Rockwood.
 - b. Triangle Brass Manufacturing Company, Inc. (Trimco).
 - c. Ives Manufacturing.
 - 2. Where hardware groups/sets have different information, refer to the following for clarification. Provide hardware groups/sets devices along with added devices as indicated on Drawings and detailed requirements for each type of device:
 - a. Non-rated Openings: Where not specified in hardware sets provide supply two flush bolts for inactive leaf of pairs of locked and latched doors. Locate centerline of top bolt not more than 78 inches from finished floor. Provide dustproof strike for bottom bolts, type as required for floor condition.
 - b. Rated Openings: Where not specified in hardware sets provide automatic flush bolt set as applicable for inactive leaf of pairs of doors. Provide dustproof strike for bottom bolts, type as required for floor condition.
- E. Coordinators:
 - 1. Manufacturers:
 - a. Rockwood Products; ASSA ABLOY Architectural Door Accessories.
 - b. Triangle Brass Manufacturing Company, Inc. (Trimco).
 - c. Hiawatha, Inc. Manufacturing.
 - 2. Where hardware groups/sets have different information, refer to the following for clarification. Provide hardware groups/sets devices along with added devices as indicated on Drawings and detailed requirements for each type of device:
 - a. Provide coordinator for fire rated or smoke labeled pairs of doors equipped with automatic flush bolts and those with vertical rod/mortise lock fire exit device combinations with astragals.
 - b. Provide filler bars for total opening width, closer mounting brackets to allow proper installation of stop mounted hardware without damaging coordinator, carry bars, and special preparation for top latches where applicable.

2.10



KEY SYSTEMS (CYLINDERS, CORES AND KEYS)

- A. Where hardware groups/sets have different information refer to the following for clarification. Provide hardware groups/sets devices along with added devices as indicated on drawings and detailed requirements for each type of device (keying specifications below override hardware set/group nomenclature):
- B. Key Systems (Cylinders, Cores and Keys):
 - 1. Manufacturers:
 - a. Schlage Lock Co.
 - 2. For all locking or dogging devices, provide complete keying system whether or not specified in Section 08 71 00, Part 3 hardware sets including lock cores, mortise cylinders, and rim cylinders keyed as directed by Owner in submittal process. Key System shall be:
 - a. Patented Schlage Lock Co. - Large Format I/C Everest 29 SL
 - b. At doors for Pharmacy or Medication dispensing rooms provide keying with patented keyway not utilized by the rest of the facility.
- C. Keying Requirements:
 - 1. Provide keyed, construction cores and keys during the construction period.
 - a. Provide full sized cylinders or brass construction cores and brass keys at all interior and exterior doors. Plastic cores are not permitted
 - b. Construction control and operating keys and core shall not be part of the Owner's permanent keying system or furnished in the same keyway or key section as the Owner's permanent keying system. Permanent cores and keys (prepared according to the accepted keying schedule) shall be furnished to the Owner.
 - c. Note: doors for Pharmacy or Medication dispensing rooms provide keying with patented keyway not utilized by the rest of the facility
 - 2. Keying Meeting and Programming Schedule:
 - a. After hardware has been submitted and reviewed in accordance with Division 01 requirements and Section 08 71 00, arrange a keying matrix/programming meeting with Owner and hardware supplier/Vendor representing the Schlage Restricted Keyway system.
 - 1) Copies of the reviewed door and frame submittals shall be brought to the meeting with card reader and keyed doors highlighted for review.
 - 2) Follow procedures for keying meeting and programming schedule as outlined by the Door Hardware Institute. DHI procedures are based on example Door Hardware Institute core class entitled Masterkeying class #AHC200.
 - b. Keying meeting to produce a programming schedule/matrix based on the following:
 - 1) Furnish keys in the following quantities (total quantity of keys part of bid package):
 - a) 3 each Change keys each lock, core or cylinder.
 - b) 5 each Permanent Extractor keys.
 - c) 9 each Construction masterkeys.
 - d) 2 each Construction Core Extractor keys.
 - 2) Permanent keys and cores shall be stamped with the applicable key mark for identification. The visual key control marks or codes shall not include the actual key cuts.
 - 3) Permanent keys shall be stamped "Do Not Duplicate".
 - c. Furnish meeting notes and three compete, typed copies of keying and programming schedule to Owner for final review.
 - d. Furnish keying and programming schedule to Schlage manufacturing factory for production of cores, cylinders and other keyed devices.
 - 3. Transmit pinned cores/cylinders as well as cut grand masterkeys, masterkeys, change keys and other security keys to Owner by Registered Mail, return receipt requested.
 - 4. Install permanent cores in presence of Owner.



2.11 CLOSING DEVICE

- A. Surface Mounted Closers:
 - 1. Acceptable Manufacturers:
 - a. LCN Manufacturing – 4040XP Series as scheduled building standard (provide unless the alternate VE pricing is accepted before submittals).
 - b. Alternate price to be reviewed before submitting hardware or door submittals:
 - 1) Norton 7500
- B. Where hardware groups/sets have different information, refer to the following for clarification. Provide hardware groups/sets devices along with added devices as indicated on drawings and detailed requirements for each type of device:
 - 1. ANSI A156.4, Grade 1; UL Listed; meets UL 10C for positive pressure fire test.
 - 2. Closers shall have multi-size spring power adjustment to permit setting of spring from 1 through 6 with additional spring power available. Provide ADA compliant setting nomenclature during submittals as recommended by closer manufacturer.
 - 3. Submit correct closer type as to be able to install closers on non-public side of doors (examples include but are not limited to 1) interior side of storage/electrical type rooms; 2) not in corridors/public areas 3) stair side of stairway doors; and at exterior locations, install closers inside of building (in conditioned spaces)
 - 4. Installation Plates, Brackets, and Miscellaneous Adapters:
 - a. Existing Closer Covers: At door/opening locations where closer cover is missing, provide new closer cover.
 - b. Provide drop plates, brackets, or adapters for arms as required to suit details and install as directed by manufacturer's templates.
 - 1) Furnish and install drop plates at reverse bevel doors and at doors with 170 degrees to 180 degrees swing.
 - 2) Furnish and install blade, angle or applied stops as required where frame does not permit installation of the standard soffit plate (see example below, field verify brackets and shims required before submittals, provide written language in submittals for how areas requiring special brackets).

2.12 AUTOMATIC OPERATORS - SEE SECTION 08 71 13

2.13 STOPS AND HOLDERS

- A. Overhead Door Holder/Stops:
 - 1. Acceptable Manufacturers:
 - a. Rixson Manufacturing.
 - b. ABH Manufacturing.
 - 2. Where hardware groups/sets have different information, refer to the following for clarification. Provide hardware groups/sets devices along with added devices as indicated on Drawings and detailed requirements for each type of device.
 - a. Overhead Stops and/or Holders shall meet the requirements of BHMA A156.8, Type 1, Grade 1.
 - b. If overhead stops are specified in hardware groups/sets, do not provide wall or floor stops as alternative method of stopping door.
 - c. If manual overhead "stop and hold-open" type devices are specified on fire-rated doors, provide the non-hold open function at time of submittals. Manual hold opens not allowed on fire rated doors.
- B. Floor and Wall Door Stops/Holders and Bumpers:
 - 1. Acceptable Manufacturers:
 - a. Rockwood Products; ASSA ABLOY Architectural Door Accessories.
 - b. Hiawatha, Inc. Manufacturing.



- c. Triangle Brass Manufacturing Company, Inc. (Trimco).
- 2. Where hardware groups/sets have different information, refer to the following for clarification. Provide hardware groups/sets devices along with added devices as indicated on Drawings and detailed requirements for each type of device:
 - a. Stops, Bumpers and/or Holders shall meet the requirements of BHMA A156.16, Grade 1.
 - b. Coordinate with specifications in Division 05, 06, and/or 09 for required wall backing.
 - c. Existing Door Stops:
 - 1) At door/opening where stops and/or holders are existing, uninstall existing stops and provide new door stops as specified in Part 3 "hardware set/groups":
 - 2) Fill holes from current or previous renovations (concrete as required, car bondo, and/or sand and paint (per Division 09 for paint and primer requirements).
 - 3) At door/opening locations where existing "kick down" type stops and holders are on existing doors (old Basis-of-Design: Trimco 1220 series), uninstall existing "kick down" type stops and provide new door stops:

2.14 ACCESSORIES

- A. Kick/Mop Plates:
 - 1. Acceptable Manufacturers:
 - a. Rockwood.
 - b. Hiawatha, Inc. Manufacturing
 - c. Triangle Brass Manufacturing Company, Inc. (Trimco).
- B. Where hardware groups/sets have different information, refer to the following for clarification. Provide hardware groups/sets devices along with added devices as indicated on Drawings and detailed requirements for each type of device
 - 1. Size at single doors:
 - a. Push side of door two inch less than door width. Hardware set/group nomenclature: 2 inches LDW.
 - b. Pull side and one inch less than door width. Hardware set/group nomenclature: 1-inch LDW.
 - 2. At pairs of doors:
 - a. Width shall be one inch less than door width unless doors have protective edge guards or center mullions.
 - 3. Height shall be 10 inches, unless otherwise indicated.
 - 4. At all rated doors (UL smoke or fire), furnish protection plates with engraved UL listing information (example: Trimco added part #ULS added to all kickplates specified below that are on UL or rated doors/openings).
- C. Smoke Seals, Intumescent Seals, Sound Seals, and/or Weatherstripping.
 - 1. Acceptable Manufacturers:
 - a. Pemko Manufacturing, Inc.
 - b. National Guard Products (NGP).
 - c. Zero International.
 - 2. Where hardware groups/sets have different information, refer to the following for clarification. Provide hardware groups/sets devices along with added devices as indicated on Drawings and detailed requirements for each type of device:
 - a. Where there is the material options for seals, the following is the order of preference for seals:
 - 1) Provide Silicone at all available location: Silicone preferred material for sustainability and cleaning options (bleach and alcohols).
 - 2) Neoprene material to be submitted where preferred Silicone cannot be submitted.
 - 3) Vinyl seals or seals made with vinyl material is not acceptable (vinyl is poor with cleaner types, and therefore should be avoided unless there is no alternate).



3. No intumescent material is allowed on door frames. Where IBC 2018 requirements for positive pressure must be met, doors shall include all requirements as part of the door construction per 'Category A' guidelines as published by ITS/Warnock-Hersey. Only smoke gasketing applied around the perimeter of the frame to meet the 'S' smoke rating is permissible in instances where smoke control is required.

D. Door Silencers:

1. Acceptable Manufacturers:
 - a. Ives Manufacturing.
 - b. Triangle Brass Manufacturing Company, Inc. (Trimco).
 - c. Rockwood.
 - d. Hager Manufacturing.

2.15 POWER SUPPLIES, ELECTRIFIED HARDWARE, AND WIRES

A. Door Position Switches

1. Where hardware groups/sets have different information, refer to the following specifications for clarification and submit according to complete and intended electrified system per Contract Documents. See Architectural and Security drawings and specifications.
 - a. Coordinate door and frame preparations with door and frame suppliers.
 - b. Switches shall be installed in frame head approximately 4 inches from latching door edge. See security drawings for additional coordination.

B. Power Supplies, Wires, and Relays:

1. Where hardware groups/sets have different information (number of hinge wires and power supply information), refer to the following specifications for clarification and submit according to complete and intended electrified system per Contract Documents. See Architectural and Security drawings and specifications.
 - a. Coordinate use of power supplies with door and frame locations. Provide power supplies, relay, and battery backup units as part of the overall system in accordance with the manufacturer's warranty and system requirements. UL listed for applicable use; housed in an accepted enclosure; and provide both Class 1 and Class 2 outputs. At all doors with electric locking devices, if a power supply is not specified in the hardware set (Part 3 below), provide the following tasks and devices in pricing/cost (final to be selected and credit if required)
 - b. Output shall be filtered and regulated. Relay, timer, and logic modules shall be provided as required for interface to indicated security components, and shall be assembled, connected, and fully contained within the power supply enclosure.
 - c. Provide required connections to accommodate fire alarm/life safety system and/or security electronics for remote site monitoring of all electrified components and functions.
 - d. For all electric strike locations, provide HES "SmartPac III" In-Line Power Control or accepted equal product meeting specified requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and frames and verify mounting locations as indicated on shop drawings.
- B. Report unacceptable conditions to the Architect. Begin installation only when unacceptable conditions have been corrected.
- C. Existing Doors and Frames: Examine existing doors and frames scheduled for hardware replacement. Provide hardware necessary for completion of the work to conform with the intent



of this Section as to quality, function and code compliance.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's printed instructions and accepted shop drawings.
- B. Door-Floor Clearances:
 - 1. Unless otherwise shown, provide the following door-floor clearances:
 - a. Max 3/4" where no sill exists.
 - b. Max 3/8" above raised sill/threshold
 - 2. Undercut doors so that the sweeps still fit tight against the sill or threshold condition, but as the door opens and sweeps away from sill or threshold, the door bottoms do not rub on the floor. Metal installation parts of door bottoms are typically part of the door assembly and only the gap between the metal part and sill/threshold are seen as the undercut. Means and methods: coordinate as required for door and hardware with finish floors, toppings, thresholds and performance ratings.
- C. Hardware Placement:
 - 1. Unless otherwise shown or required by IBC 2018, ADA Act - 2010 Standards for Accessible Design and/or Title 24, place hardware at the following heights:
 - a. Hinges: Door and frame manufacturer's standard or existing location scope per additional specifications and plans.
 - b. Lever handles for latchsets, lockset and panic/exit device pull, lever trim:
 - 1) 38 inches above finish floor/surface.
 - 2) At existing openings, lever hardware shall be so mounted / centered between 36 inches and 44 inches above finished floor or ground.
 - 3) Verify manufacturer's template with door design.
 - 4) Verify in field site templates for existing doors and frames before submittals, provide written language in submittals for how areas requiring retrofit will be installed to meet IBC 2018.
 - c. Panic devices push bar:
 - 1) Panic hardware shall be so mounted / centered between 36 inches and 44 inches above finished floor or ground.
 - 2) Verify manufacturer's template with door design to meet IBC 2018 exterior, pull side trim.
 - 3) Verify in field site templates for existing doors and frames before submittals, provide written language in submittals for how areas requiring retrofit will be installed to meet IBC 2018.
 - d. Closers:
 - 1) To meet opening force requirements
 - 2) See installation below.
 - 2. Hardware for door handles, pulls, latches, locks, and other operating devices for use on means of egress doors shall comply with IBC 2018.
- D. Installation:
 - 1. Except for hinges, do not install hardware until painting and finishing work is completed.
 - 2. Pre-drill pilot holes in wood for screws. Drill and tap for surface mounted hardware on metal.
 - 3. Hinges: Set hinges snug and flat in mortises. Hand turn screws to flat seat – do not drive.
 - 4. Locksets: Install locks with keyways in proper position. Install levers, roses, and escutcheons firmly affixed.
 - 5. Closers:
 - a. To open and latch smoke or fire rated doors correctly (positive latch at all times for rated doors when door is not in use), install closer units per factory templates to meet



- manufacturer requirements.
- b. To meet non-rated opening/exterior opening force requirements as well as close and latch non-smoke non-fire rated doors:
 - 1) Closers are to be installed as close to the hinge side of door as possible by a trained installer per this Section, Part 1 "Quality Assurance, Installer Qualifications", install an authorized representative of manufacturers, minimum of five years successful experience installing closers to meet 5-pound opening force for non-rated door complexity".
 - 2) For non-smoke or non-fire rated doors, before installation of closers install one mockup door for each kind of closer application. Example: parallel, regular arm, stop arm and/or top-jamb arm application if specified. Confirm doors meet 5-pound opening force and still close door. This will ensure proper installation for doors to open at 5 pounds opening force before remaining non-rated opening closers are installed. The closer the closer is installed to the hinge, the better performance for 5 pound opening force, but still close and latch door.
 - c. Mount door closers for maximum swing but at non-rated doors to meet 5-pound opening force. At all possible openings, mount door closers for maximum swing of door before setting stops.
 - d. Mount door closers for maximum swing, but at non-rated doors to meet 5-pound opening force. Drawings may show doors open to only 90 degrees (Revit or CAD system set up), but unless noted or specified with limiter (stop arm devices below), all doors to open for maximum swing against adjacent 180 wall if nothing inhibits door from doing so. Include wide-throw hinges per specs and installation for 170-degree to 180 degree or maximum swing of door before installing stops.
- 6. Floor Stops: See notes on closers and hinges above. After auto operator or closer devices are installed, and door is opened as far as possible without #1) occupant excessive force on auto operator or closer; and #2) door does not hit adjacent wall or other surfaces, stops shall be installed at substantial completion a maximum of 4 inches from adjacent walls and as far away from the hinge point as possible (preference is to have stops installed just below lever or pull locations).
 - 7. Auto Door Bottom to not be adjusted until substantial completion. Door bottoms are to be raised to highest position while construction occurs so to not have rubber seal torn or damaged by debris under the door. At substantial completion, adjust door bottom to fully engage and touch the floor for proper sound dampening.
 - 8. Silencers: Set in place before adjusting strikes.
 - 9. Examine existing openings (frames and/or doors) scheduled for hardware replacement or refurbishment: Where hardware groups/sets have different information, refer to the following for clarification.
 - a. Provide hardware groups/sets devices along with added devices as indicated on drawings and detailed requirements for each type of device including, but not limited to, requirements in the above specification language, architectural plans, door schedule pages, door details pages and/or full specification documents.
 - b. Frame may have bent out of "plumb, square and true": Shim and adjust doors to swing per manufacturer's recommendations "plumb, square and true". Provide hardware necessary for completion of the work to conform with the intent of this Section as to quality, function, and code compliance.
 - c. Uninstall hardware at existing doors and do not re-install new or old hardware until painting and finishing work is completed.
 - d. After modifications and/or rehabilitation of fire or smoke or rated openings, re-certify door and frame labels through an approved UL listed agency such as Intertek



or equal recertification representative: Intertek re-certification company information:
Intertek main phone number 800-967-5352 web: www.intertek-etlsemko.com.

3.3 PAINT OR FIELD FINISHES

- A. Coordinate with Contact Documents including, but not limited to, Division 09 for paint and primer requirements.
- B. Fire rated labels on doors and frames shall not be painted.

3.4 ADJUSTING

- A. Adjust parts for smooth, uniform operation.
- B. Lubricate moving parts with manufacturer recommended lubricant.
- C. Replace units that cannot be adjusted and lubricated to operate freely and smoothly as intended for the application.
- D. Adjust door closer devices:
 - 1. Adjust closer operating.
 - a. Interior and Exterior Doors: not to exceed 5.0 pounds force.
 - b. When fire doors are required, the maximum effort to operate the door may be increased to the minimum allowed by the appropriate administrative authority, not to exceed 15 pounds opening force.
 - 2. Adjust closer delay and operating speeds to comply with requirements of 2018 IBC and ADA – Americans with Disabilities Act - 2010 Standards for Accessible Design.
 - a. Doors closers, when provided, shall have sweep period adjusted: minimum of 5 seconds for a door to close from the 90 degree position to the 12 degree position.
 - b. Doors with spring hinges require a minimum of 1.5 seconds to close from the 70 degree to the closed position.

3.5 CLEANING

- A. Clean as recommended by manufacturer. Do not use materials or methods which may damage finish or surrounding construction.

3.6 HARDWARE SCHEDULE

- A. Manufacturers Legend:
 - 1. MK - McKinney
 - 3. PE - Pemko
 - 6. RF - Rixson
 - 7. RO - Rockwood
 - 8. SA - SARGENT
 - 9. SU - Securitron
 - 10. VD - Von Duprin
 - 11. SC - Schlage
 - 13. HS - HES
 - 14. LC - LCN Closers
 - 15. NO - Norton

B.

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- C. The “Request-to-Exit” feature as described below is a security feature that announces / tells the security system if occupant is leaving the building interior area and similar to a motion-sensor the “Request-to-Exit” switch or device does not affect egress of the doors (unless noted, all doors in hardware group/sets are free egress at all times with no special knowledge to exit).
- D. Hardware Columns - Example (Legend):

Qty	Device Description	Device # (include specification language)	Finish	Manu
1	-----	-----	--	--

- E. The following hardware sets are intended to establish type and standard of quality when used together with the requirements of this Section (see above section and related sections including Division 01).
1. Examine Contract Documents and furnish proper hardware for door openings.
 2. Refer to Door Schedule on the Drawings for Hardware Group/Set assignments for each opening.

Blank space after a Group/Set is intentional to avoid, if possible,
splitting a Hardware Group/Set onto two pages.

Hardware Group/Set #201

___	Ea.	Hinge	T4A3786 (size & quantity per 08 71 00)	652	MK
1	Ea.	Active Leaf: Electric Power Transfer	CEPT-10	630	SU
1	Ea.	Inactive Leaf: Bolt System	#3825L top constant flush bolt x #3815L bottom bolt and dust proof strike device #3911	626/630	TR
1	Ea.	Active Leaf: Concealed Cable Rod Panic Device x Electrified Lever	RX-9950WDC x E996L x 06 Lever x LBL RX. Note: the 9950 required here must be ordered from factory in exact lengths for door heights. Any variation will cause malfunction of cable device	626	VD
1	Ea.	I/C Cylinders (Rim or Mortise)	20-757 or 20-763 x appropriate cam x blocking rings as required (rim or mortise type and quantity as required by locking device)	626	SC
1	Ea.	Permanent Core	20-740	626	SC
1	Ea.	Coordinator	2600 x brackets as req.	US28	RO
1	Ea.	Active Leaf: Surface Closer	4040XP Rw/PA	AL	LC
2	Ea.	Kick Plate	K1050 10" x 2" LDW (less door width) x B4E (beveled edges) UL at rated x counter sunk if door allows	630	RO
2	Ea.	Wall Stop	400	626	RO
1	Ea.	Gasketing	S88BL seals (head & jambs) by Pemko or approved	BL	PE
2	Ea.	Door Position Switch (also known as Alarm Contact, Door Contacts)	#679-05-WD or #679-05-HM (as required per door material) by Schlage manufacturing (coordinate with Divisions 25-28 and applicable drawings)		
1	Ea.	Power Supply Task 1 - If Existing, Site Power 24VDC Supply Is to Be Utilized:	Verify if an existing power supply or if the same power supply that runs the card reader unit can power the 24VDC locking device specified above. Typically, there is an existing power supply in an "Information Technology or IT closet" that can power the locking device. See below for new device if required		
1	Ea.	Power Supply Task 2 - If New Power Supply Is Required:	If there is not an existing power supply that can power the locking device, furnish and install #1) single gang power drop located above or near door (not in corridor or public view, but above ceiling line where possible); #2) provide #AQ-D-2-4-F-1-R-2 with PDB-8F/C Power Distribution Boards (PDB-4F/C & PDB-8F/C as required by system, means and methods coordinate before submittals) by Securitron manufacturing; #3) run conduit through frame		
1	Ea.	Request-to-Exit Sensor (see free egress note in above specifications)	Sensor/Contact part of above locking device (coordinate with Divisions 25 through 28 and applicable drawings).		
1	Ea.	Coordination task for security and/or electrical design and additional non-Division 08 Section scope (including but not limited to wire / connectivity from ground or ceiling	By security or electrical as required per Contract Documents: The electrified hardware specified above can be utilized for #1) non-card reader, remote access control applications (unlocked / locked remotely for open during business hours / locked after-hours) and #2) local card readers at openings as directed by architectural drawings, security or electrical. Coordinate with security or electrical Divisions 25 through 28 and applicable drawings as hardware does not include card reader locations.		



		through frame to electrified hardware)	
Note: Furnish all devices and components for hardware groups/set above in accordance with Contract Documents (including but not limited to additional hardware devices requirements in the above specification language, architectural plans and full specification documents).			

Hardware Group/Set #202

Note 1: In addition to the devices specified in hardware group/set below, also coordinate devices in specification Section 08 71 13 "Automatic Door Operators". Furnish and install doors, frames and related scope per complete Contract Documents.					
Note 2: Description of operation: Card reader acts as the actuator/push-plate on card-reader side of door and starts auto operator (door always locked from card reader side unless authorized card holder uses card reader to enter area)					
8	Ea.	Hinge	T4A3786 (size per 08 71 00)	652	MK
1	Ea.	Electric Power Transfer	CEPT-10	630	SU
1	Ea.	Inactive Leaf Bolt System	#3825L top constant flush bolt x #3815L bottom bolt and dust proof strike device #3911	626/ 630	TR
1	Ea.	Office/Entry Lock	LB 74 8205 LNL x Lead Lining	626	SA
1	Ea.	Electric Strike	1500C	630	HS
1	Ea.	I/C Cylinders (Rim or Mortise)	20-757 or 20-763 x appropriate cam x blocking rings as required (rim or mortise type and quantity as required by locking device). One cylinder to be used for auto operator on/off switch specified in 087113.	626	SC
1	Ea.	Permanent Core	20-740. One core to be used for auto operator on/off switch specified in 087113.	626	SC
1	Ea.	Coordinator	2600 x brackets (as req.)	US2 8	RO
1	Ea.	Auto Operator System	Stanley M-Force Series per Section 08 71 13		
2	Ea.	Kick Plate	K1050 10" x 2" LDW (less door width) x B4E (beveled edges) 3M adhesive	630	RO
1	Ea.	Wall Stop	400 at active leaf	626	RO
1	Ea.	Gasketing	S88BL seals (head & jambs) by Pemko or approved seal manufacturer	BL	PE
1	Ea.	Meeting Stile Seal	S772BL	BL	PE
1	Ea.	Edge Guard and Lead lined Astragal	#EG308 x EGT308-LL (templated for all coordinated hardware)	C	MR
1	Ea.	1500C Power Supply	Furnish and install #1) single gang power drop located above or near door (not in corridor or public view, but above ceiling line where possible); #2) provide #AQ-D-2-4-F-1-R-2 with PDB-8F/C Power Distribution Boards (PDB-4F/C & PDB-8F/C as required by system, means and methods coordinate before submittals) by Securitron manufacturing; #3) run conduit for complete wiring as required to meet manufacturer warranties		
1	Ea.	Coordination task for electrical design and additional non-Division 08 Section scope (including but not limited to wire / connectivity from ground or ceiling through frame to electrified hardware)	By security or electrical as required per Contract Documents: The electrified hardware specified above can be utilized for #1) non-card reader, remote access control applications (unlocked / locked remotely for open during business hours / locked after-hours) Coordinate with security or electrical Divisions 25 through 28 and applicable drawings		



Note: Furnish all devices and components for hardware groups/set above in accordance with Contract Documents (including but not limited to additional hardware devices requirements in the above specification language, architectural plans and full specification documents).

Hardware Group/Set #203

4	Ea.	Hinge	T4A3786 (size per 08 71 00)	652	MK
1	Ea.	Passage Latch	74 8215 LNL x Lead Lining	626	SA
1	Ea.	Overhead Stop	9 Series (sized -536 or sized required by door width)	689	RF
1	Ea.	Gasketing	S88BL seals (head & jambs) by Pemko or approved seal manufacturer	BL	PE

Note: Furnish all devices and components for hardware groups/set above in accordance with Contract Documents (including but not limited to additional hardware devices requirements in the above specification language, architectural plans and full specification documents).

Blank space after a Group/Set is intentional to avoid, if possible, splitting a Hardware Group/Set onto two pages.

Hardware Group/Set #204

Note 1: In addition to preparing existing doors and frames for hardware specified below (example: un-installing older hardware where new hardware is to be provided/replaced), fill abandoned holes per 08 71 00.Part 3 (after modifications and/or rehabilitation of fire or smoke or rated openings, re-certify door and frame labels through an approved UL listed agency such as Intertek or equal recertification representative: Intertek re-certification company information: Intertek main phone number 800-967-5352 web: www.intertek-etlsemko.com). Verify no sharp edges and doors swing smoothly, plumb and square so that the door easily closes and opens without edge of door hitting face of frame.

1	Ea.	Retrofit Rated Electric Strike and Power Controller	1500 series or as required for existing locking devices (verify in field before submittals and submit required devices) x 2005 SMART PAC III (coordinate with security divisions 25-28 and applicable plans)	630	HE
1	Ea.	Existing Locking Device with I/C Cylinders (Rim or Mortise)	Re-use existing		
1	Ea.	Permanent Core	Re-use existing		
1	Ea.	Power Supply Task 1 - If Existing, Site Power 24VDC Supply Is to Be Utilized:	Verify if an existing power supply or if the same power supply that runs the card reader unit can power the 24VDC locking device specified above. Typically, there is an existing power supply in an "Information Technology or IT closet" that can power the locking device. See below for new device if required		
1	Ea.	Power Supply Task 2 - If New Power Supply Is Required:	If there is not an existing power supply that can power the locking device, furnish and install #1) single gang power drop located above or near door (not in corridor or public view, but above ceiling line where possible); #2) provide power supply #PS902 x Schlage manufacturing; #3) run conduit through frame for complete wiring as required		
1	Ea.	REX Device (security / alarm notification)	Do to the electric strike and not an electric lock, the REX is to be above the door motion sensor by security (coordinate with Divisions 25-28 and applicable drawings).		
1	Ea.	Door Position Switch (also known as Alarm Contact, Door Contacts)	#679-05-WD or #679-05-HM (as required per door material) by Schlage manufacturing (coordinate with Divisions 25-28 and applicable drawings)		
1	Ea.	Coordination task for security and/or electrical design and additional non-Division 08 Section scope (including but not limited to wire / connectivity from ceiling through frame to electrified hardware)	By security or electrical as required per Contract Documents: <ul style="list-style-type: none"> - The electrified hardware specified above can be utilized for #1) non-card reader, remote access control applications (unlocked / locked remotely for open during business hours / locked after-hours) and #2) local card readers at openings as directed by architectural drawings, security or electrical. - Coordinate with security or electrical Divisions 25-28 and applicable drawings as hardware does not include card reader locations. 		

END OF SECTION

SECTION 08 71 13
AUTOMATIC DOOR OPERATORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. BHMA FINISH DOOR HARDWARE FOR SWING DOORS.
- B. ELECTRIFIED, SWINGING DOOR AUTOMATIC OPERATORS DEVICES.
- C. ACCESSORIES INCLUDING BUT NOT LIMITED TO ACTUATING CONTROLS AND SAFETY SENSORS AT DESIGNATED DOORS.

1.2 PRODUCTS SUPPLIED BUT NOT INSTALLED UNDER THIS SECTION

- A. HARDWARE TEMPLATES FOR DOORS AND FRAMES.

1.3 RELATED SECTIONS

- A. SUMMARY OF WORK: DIVISION 01, APPLICABLE SECTIONS.
- B. MASONRY: DIVISION 04, APPLICABLE SECTIONS.
- C. CARPENTRY: DIVISION 06, SECTION 06 10 53 ROUGH CARPENTRY.
- D. PERIMETER SEALANTS AND INSULATION: DIVISION 07, APPLICABLE SECTIONS.
- E. SECTION 08 71 00 – DOOR HARDWARE.
- F. DIVISION 8, APPLICABLE SECTIONS INCLUDING, BUT NOT LIMITED TO, WOOD DOORS; HOLLOW METAL DOORS AND/OR FRAMES; STOREFRONT; ALUMINUM DOORS AND/OR ALUMINUM FRAMES.
- G. DIVISIONS 26 THROUGH 28: ELECTRICAL ROUGH IN, WIRING AND CONNECTORS FOR ELECTRIFIED HARDWARE INCLUDING, BUT NOT LIMITED TO:
 - 1. Wire and connectivity from ceiling through frame to electrified hardware devices including non-08 71 13 task of providing wiring inside of doors.
 - 2. Automatic Door Operators e-power or emergency power connectivity scope (provide emergency power backup for auto operators).

1.4 PRODUCTS SUPPLIED BUT NOT INSTALLED UNDER THIS SECTION

- A. HARDWARE TEMPLATES FOR DOORS AND FRAMES.

1.5 REFERENCES

- A. THE PUBLICATIONS LISTED BELOW FORM A PART OF THIS SECTION TO THE EXTENT REFERENCED. THE PUBLICATIONS ARE REFERRED TO IN THE TEXT BY THE BASIC DESIGNATION ONLY.
 - 1. Refer to Architect's Division 01 for definitions, acronyms, and abbreviations.
 - 2. Unless otherwise noted; standards, manuals, and codes refer to the latest edition as of the issue date of this Project Manual.
- B. CONFORM TO THE FOLLOWING REFERENCED STANDARDS AND REQUIREMENTS:
 - 1. International Building Code (IBC 2018).



2. ADA – Americans with Disabilities Act - 2010 Standards for Accessible Design.
3. AAADM – American Association of Automatic Door Manufacturers.
4. NFPA 80 – Standard for Fire Doors and other Opening Protectives.
5. NFPA 101 – Life Safety Code.
6. ANSI/BHMA 156.19 American National Standard for power high and low energy operated doors.
7. ANSI A156 Series – Builders Hardware Manufacturers Association (BHMA) Standards.

1.6 COORDINATION

- A. COORDINATE WORK OF THIS SECTION WITH SECTIONS INVOLVING MANUFACTURER OF INTERNAL REINFORCEMENT FOR DOORS, FRAMES, AND HARDWARE.
 1. Coordinate work in this Section with work in related Sections.
 2. This Section’s hardware sets/groups as specified in Part 3 are intended to establish type and design standard when used together with the requirements of specifications, drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections. Where hardware sets/groups have different information than the specifications refer to the specifications and drawings for clarification and bid combined hardware sets/groups and Contract Documents/specifications (provide combined materials/devices at time of submittals).
- B. PROVIDE HARDWARE TEMPLATES TO DOOR AND FRAME MANUFACTURER. PROVIDE 2 TEMPLATES TO THOSE MANUFACTURERS WHO ARE NOT CURRENTLY REGISTERED TEMPLATE BOOK HOLDERS. CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING THAT THE DOOR HARDWARE ACCEPTED FOR INSTALLATION IS COMPATIBLE FOR USE WITH THE DOORS AND DOOR FRAMES.
- C. COORDINATE KEYING REQUIREMENTS AS SPECIFIED IN SECTION 08 71 00 “DOOR HARDWARE”.
- D. CONVENE COORDINATION MEETING BETWEEN ALL OPENING VENDORS & INSTALLERS AT LEAST TWO WEEKS PRIOR TO PURCHASING DOORS, FRAMES, DOOR HARDWARE AND ELECTRICAL DEVICES REQUIRED FOR COMPLETE SYSTEMS.
 1. Required attendance includes but is not limited to the following: Contractor; hardware supplier and/or installer; door supplier and/or installer; frame supplier and/or installer; auto operator vendor and/or installer; security card reader vendor and/or installer; and electrical.
 2. Contractor shall be responsible for verifying that the door hardware accepted for installation is compatible for use with the doors and door-frames.
 3. For card reader interface with applicable door devices, security vendor and/or installer (coordinate accordingly) to have a written agenda and plan on how scope related to electrified devices will be installed to have a complete wired and operational card access system. The card reader interface scope includes but is not limited to card reader inputs & output coordination on the electric locking device power supply, electric locking devices and connectivity as well as confirmation of a complete, wired and operational card access system. Provide all required relays & devices as part of the overall system in accordance system requirements at no additional cost to Owner.
 4. For auto operator interface with applicable door devices, auto operator vendor and/or installer (coordinate accordingly) to have a written agenda and plan on how scope related to electrified devices will be installed to have a complete wired and operational auto operator system. The auto operator interface scope includes but is not limited to connectivity & inputs for push-plates, BEA BR3 (or approved equal required auto operator relays), electric locking devices, as well as confirmation of the complete, wired and operational auto



operator system. Provide all required relays & devices as part of the overall system in accordance system requirements at no additional cost to Owner.

E. EXAMINE CONTRACT DOCUMENTS AND FURNISH PROPER HARDWARE FOR DOOR OPENINGS. EXAMPLE INCLUDES, BUT IS NOT LIMITED TO SYSTEM INTEGRATION:

1. Provide electrical interface control capability for card reader or keypad operation of swinging automatic entrances on doors with electric locking. Integrate swinging automatic entrances with other systems as required for a complete working installation
2. Where required for proper operation, provide a time delay relay to signal automatic door operator to activate only after electric lock system is released.
3. Electrical System Roughing-in: Coordinate layout and installation of swinging automatic entrances with connections to, power supplies and remote activation devices. Review details and conditions prior to ordering material.

1.7 SUBMITTALS

A. GENERAL:

1. Submit in accordance with Division 01.

B. PRE-HARDWARE SCHEDULE:

1. Report all prevailing conditions that will adversely affect satisfactory execution of work. Examine existing doors and/or frames scheduled for hardware replacement.

C. SUBMIT A DETAILED DOOR AND HARDWARE SCHEDULE ACCORDING TO THE FOLLOWING:

1. Hardware Schedule:
 - a. Submit hard copies of hardware schedule (number of copies per Division 01) as well as submit editable, PDF files via electronic email or ftp site process in vertical format as illustrated by the Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Schedules which do not comply will be returned for correction before checking. Horizontal-type schedules will be returned for correction before checking.
 - b. Hardware schedule shall clearly indicate each hardware group specified and manufacturer of each item proposed.
2. Provide two copies of illustrations from manufacturer's catalogs and data in brochure form.
3. Wiring Information: Provide manufacturers' wiring information including manufacturers' door elevation diagrams for electrified hardware based on Door Hardware Institute (DHI) core class "Electrified Architectural Hardware" DHI class #COR133. Openings where only magnetic hold-opens or door position switches are specified do not require wiring information. Provide information with hardware schedule submittal for review. Provide detailed wiring diagrams with hardware delivery to jobsite.
4. Review of schedules does not relieve the Contractor of providing all hardware required for the Work, whether or not such hardware was inadvertently omitted from Submittal.

D. TEMPLATES:

1. Provide listing of manufacturer's template numbers for each item of hardware in hardware schedule.
2. Submit templates and "Reviewed Hardware Schedule" to door and frame supplier and others as applicable to enable proper and accurate sizing and locations of cutouts and reinforcing.

E. INSTALLATION INSTRUCTIONS:

1. Provide manufacturer's written installation and adjustment instructions for finish hardware.
2. Send installation instructions to site with hardware.



F. CONTRACT CLOSEOUT SUBMITTALS (INCLUDE SPECIFIC REQUIREMENTS INDICATED)

1. Operating and maintenance manuals.
 - a. Complete information in care, maintenance, and adjustment, data on repair and replacement parts, and information on preservation of finishes.
 - b. Catalog pages for each product.
 - c. Name, address, and phone number of local representative for each manufacturer.
 - d. Parts list for each product.
 - e. Copy of final accepted hardware schedule, edited to reflect "As installed".
2. Copy of final keying schedule.
3. Maintenance data and devices:
 - a. Submit two copies of operator maintenance manuals that include the following items:
 - 1) ***Lubrication instructions.***
 - 2) ***Operator maintenance instructions.***
 - b. Provide special wrenches and tools applicable to each different or special component.
 - c. Provide maintenance tools and accessories supplied by manufacturer.

1.8 QUALITY ASSURANCE

A. OPERATOR DEVICE SUPPLIER QUALIFICATIONS: FIRM SPECIALIZING IN THE SUPPLY AND SERVICING OF INSTITUTIONAL AND COMMERCIAL LOW ENERGY OPERATOR DEVICES AND SLIDING AUTOMATIC DOORS; ACCREDITED BY MANUFACTURERS; AND HAVING A MINIMUM OF 3 YEARS DOCUMENTED EXPERIENCE. HARDWARE SUPPLIER TO FURNISH LIST OF AT LEAST 10 COMPLETED PROJECTS COMPLETE WITH DATE COMPLETED, PROJECT LOCATION AND PROJECT CONTACT INFORMATION.

B. MANUFACTURER QUALIFICATIONS AND DOCUMENTATION:

1. Operator Device Manufacturer Qualifications: Manufacturer specializing in manufacturing institutional and commercial high and low energy operator devices with a minimum 5 years with the following documented experience. Furnish list of at least 10 projects (past, finished projects). Include date completed, project location and references (past project contact information to determine if commercial high and low energy operator devices are acceptable).
2. Manufactured devices submitted must have a factory certified central dispatch service for warranty. System to be available 24 hours a day, 365 days per year to obtain malfunction information and dispatch appropriate service agency to the customer location.

C. INSTALLER QUALIFICATIONS AND DOCUMENTATION:

1. Company specializing in installing the products specified in this Section shall have minimum ten years experience and be a member of the American Association of Automatic Door Manufacturers (AAADM). A completed AAADM compliance form shall be submitted as proof of compliance with current ANSI/BHMA 156.19 American National Standard for power high and low energy operated doors as well as high energy operators. Doors shall be inspected and form shall be signed by an AAADM certified inspector prior to placing doors in operation.
2. Operator Device Installer qualifications: The installer of assembly shall be trained in the trade of installing and start-up of commercial high or low energy operator devices and sliding automatic doors. Supplier and Installer of door assemblies shall be authorized representative of manufacturers and have minimum of 5 years successful experience in detailing, supplying and installing commercial high and low energy operator devices and sliding automatic doors specified on projects of similar size, complexity and type to this Project.
3. Local certified distributor to install operator in accordance with current ANSI/BHMA



156.19 American National Standard for High and Low Energy Power Operated Doors and local applicable codes. For low energy applications, local certified distributor to install operator in accordance with ANSI 156.19, ANSI 117.1, NFPA 101 and local applicable codes.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. COMPLY WITH REQUIREMENTS OF DIVISION 01
- B. DELIVER PRODUCTS IN MANUFACTURER'S ORIGINAL CONTAINERS, DRY AND UNDAMAGED, WITH SEALS AND LABELS INTACT.
- C. STORAGE: STORE MATERIALS IN A COOL AND DRY LOCATION, ELEVATED FROM THE GROUND AND PROTECTED FROM THE ELEMENTS, AND SECURED FROM THEFT OR PILFERAGE.

1.10 WARRANTY

- A. COMPLY WITH PROVISIONS OF DIVISION 01
- B. UNLESS OTHERWISE SPECIFIED BELOW, FURNISH TO OWNER A WRITTEN MANUFACTURER'S 2 YEAR EXTENDED GUARANTEE FOR AUTOMATIC DOOR OPERATORS AGAINST DEFECTS IN MATERIALS AND WORKMANSHIP.

PART 2 - PRODUCTS

2.1 MATERIALS: GENERAL REQUIREMENTS

- A. THE SPECIFICATIONS ARE INTENDED TO COVER ALL DOORS IN THE PROJECT AND ESTABLISH A TYPE AND STANDARD OF QUALITY, BUT IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO FURNISH PROPER HARDWARE FOR ALL OPENINGS AND FOR A COMPLETE INSTALLATION. WHERE HARDWARE GROUPS/SETS HAVE DIFFERENT INFORMATION REFER TO THE FOLLOWING SPECIFICATIONS FOR CLARIFICATION AND DETAILED REQUIREMENTS (PROVIDE ALL DEVICES WHETHER SPECIFIED OR NOT IN HARDWARE SETS/GROUPS).

2.2 FINISH

- A. WHERE HARDWARE GROUPS/SETS HAVE DIFFERENT INFORMATION, REFER TO THE FOLLOWING FOR CLARIFICATION. PROVIDE HARDWARE GROUPS/SETS DEVICES/FINISHES, ALONG WITH ADDED FINISHES BELOW, AS INDICATED ON DRAWINGS AND DETAILED REQUIREMENTS FOR EACH TYPE OF DEVICE:
 - 1. Typical BHMA finish designation references:
 - a. BHMA 630 – satin stainless steel.
 - b. BHMA 626 – satin chromium plated brass or bronze.
 - c. BHMA 628 – satin or dull aluminum, clear anodized (uncoated).
 - d. BHMA 689 – Sprayed aluminum paint finish.
 - e. BHMA 693 – Sprayed black paint finish.

2.3 EXISTING CONDITIONS AND PRODUCTS

- A. EXAMINE CONTRACT DOCUMENTS AND FURNISH PROPER FINISHES AND SERVICES FOR EACH DOOR OPENING (DOOR, FRAME, AND HARDWARE).
- B. FIELD VERIFY EXISTING DOOR AND FRAMING SYSTEMS. DO NOT DEMO



EXISTING AUTO OPERATOR SYSTEMS, UNTIL COMPLETE ASSESSMENT AND REPORT VIA RFI PROCESS CAN ESTABLISH IF EXISTING OPERATORS CAN BE SALVAGED AND RE-USED OR NEW OPERATORS SPECIFIED BELOW ARE REQUIRED (FURNISH & SUPPLY DEVICE AND INSTALLATION PRICING FOR NEW OPERATORS AT THIS TIME).

2.4 HARDWARE TEMPLATE

- A. PROMPTLY FURNISH TEMPLATE INFORMATION OR TEMPLATES TO DOOR AND FRAME MANUFACTURERS.
- B. COORDINATE HARDWARE ITEMS TO PREVENT INTERFERENCE WITH EACH OTHER.

2.5 FASTENINGS

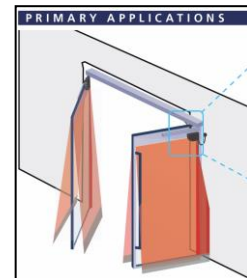
- A. FASTENINGS SHALL MATCH HARDWARE MATERIAL AND FINISH.
- B. USE SCREWS, BOLTS, WASHERS, GROMMETS, NUTS, AND OTHER FASTENING DEVICES OF APPROPRIATE SIZE, LENGTH, TYPE, HEAD, METAL AND FINISH AS NECESSARY FOR PROPER MATCH AND APPLICATION OF HARDWARE MACHINE SCREWS AND TAMPING SHIELDS FOR ATTACHING HARDWARE TO CONCRETE, STONE, OR MASONRY.
- C. PROVIDE NONFERROUS OR CORROSION-RESISTANT STEEL FASTENERS EXPOSED TO WEATHER.

2.6 SUBSTITUTIONS note to specifier: select from the following

- A. SOME PRODUCTS LISTED IN THIS SECTION BY BRAND NAME AND MODEL NUMBER HAVE BEEN ESTABLISHED BY THE OWNER AS STANDARD. NO SUBSTITUTIONS PERMITTED FOR THOSE PRODUCTS.

2.7 LOW ENERGY AUTOMATIC OPERATOR DEVICES

- A. OVERHEAD SURFACE OR CONCEALED MOUNTED DEVICES:
1. Stanley M-Force Series.
- B. CONTRACT DIRECTLY WITH MEMBER OF THE AMERICAN ASSOCIATION OF AUTOMATIC DOOR MANUFACTURERS (AAADM, NOT AS A SUB-CONTRACT TO THE DOOR SUPPLIER PER PART 1 QUALIFICATIONS).
- C. WHERE HARDWARE GROUPS/SETS HAVE DIFFERENT INFORMATION REFER TO THE FOLLOWING SPECIFICATIONS FOR CLARIFICATION AND DETAILED REQUIREMENTS:
1. Drop Plates, Brackets or Adapters (see snippet below with filler plate example)
 - a. Provide complete drop plates / brackets as required to suit details.
 - b. Do not install auto operators with space remaining between the wall and auto operator body. Provide non-ferrous, galvanized metal shims and/or metal space blocking between auto operator body and wall conditions.
 - c. Finished surface and edges of backer plates shall be smooth and dry Backer rods and finish sealants are only allowed where primer and paint can be applied so that daily cleaners can be utilized to clean surfaces without cleaners stripping sealants and/or paints.
 2. Provide required relays & devices as part of the overall system in accordance system requirements. Units shall have relay contact for interfacing products. Door operator shall have input line rating of 120VAC. unit shall have an internal circuit breaker switch to interrupt input power for servicing. Unit shall be U.L. Listed for automatic closing door. Unit shall be in compliance with the requirements of the Americans with disabilities act (ADA) and ANSI standards a117.1 and A156.19.
 3. Provide adjustment for opening, closing, and checking speeds, as well as length of time door remains open.
 4. Provide Automatic Operators with external controls as part of overall/complete system (see scheduled devices in Part 3 hardware sets):
 - a. Provide Automatic Operators with external "On/Off two-way switch" as part of overall/complete system. Low energy operator manufacturer to have rocker as both part of overall system and installed on auto operator external body above frame as well as wall mounted as directed in Part 3 hardware groups in this Sections.
 - b. Where pairs of doors have two separate Automatic Operators provide one external On/Off two-way switch to operate both doors/operators.
 5. Relays, timer, and logic modules Devices:
 - a. At all auto door operators locations, provide BEA device # BR3 relay, timer, and logic modules (required for interface to indicated security components; and shall be assembled, connected, and fully contained within the power supply enclosure).
 6. Safety Sensor Devices:
 - a. At specified low energy operators locations in hardware sets below, provide one safety sensor device at each leaf .
 - b. Design basis of design furnish and install BEA manufacturing #10LZRFLATSCAN-SWB or equal x required relays. Safety sensor devices installed on door as shown below. BEA manufacturing #10LZRFLATSCAN are handed. Throughout all project doors handing of devices is to be done per the plan view. Before submittals verify handing (provide correct handing). Provide installation back plates and devices as required for each type of door/frame condition (see



<https://www.youtube.com/watch?v=VAv7BU3BV8Q> x required relays.

- c. Safety sensor devices are not to be utilized for opening sensors (opening actuation by wall mounted push plates or separate infrared presence sensor as scheduled).
 - d. Sensor devices are to be active infrared presence/safety sensor. The function of device is to protect the door from closing on a person or object in the swing-area detection zone.
 - e. Provide additional lockout module devices as required as some of the newer auto operator device manufacturers have a built-in lockout (provide a fully functional system to meet design intent). Lockout module is typically determined by the door controller/control box).
 - f. Provide installation back plates and devices as required for each type of door/frame condition:
7. At doors with inactive auto flush bolt leaf, 08 71 13 Vendor to coordinate active door to open first, then inactive leaf to open second after flush bolts have disengaged.

D. PUSH PLATES & TOUCH-ACTIVATED AUTOMATIC DOOR CONTROLS:

1. Provide Automatic Operators devices with external Actuators. Card readers also to be utilized at exterior doors where indicated in drawings and as scheduled. Push-and-Go type features are not acceptable.
2. Acceptable Manufacturers: Wikk Industries, Inc., Greendale, WI, 877-421-9490, or equal.
3. Wave Motion/Touchless Push-Plates (also known as actuator devices), acceptable manufacturers and products: Camden Door Controls manufacturing: "CM-330/42" device as scheduled, or equal with wheelchair logo and wording "WAVE TO OPEN". Switches mounted outdoors or exposed to interior water/humidity shall be mounted with weather resistant integral rubber gasket and back box, supplied by the same manufacturer (provide weather resistant devices that have no gaps for water or ice to penetrate).
4. Products:
 - a. Push plate device as scheduled in part 3 below.
5. Where Hardware Groups/Sets have different information refer to the following specifications for clarification and detailed requirements:
 - a. Furnish and install touch-activated automatic door controls with Micro-Switches: double pull, double throw, dry-contact, momentary-action micro-switch.
 - b. Furnish and install touch -activated automatic door controls with international symbol of accessibility and lettering "push to open" engraved and applied in permanent blue enamel.
 - c. Mounting: flush-type compatible with touch-activated automatic door controls. Provide complete installation brackets or adapters for automatic operator actuators to suit application.
 - d. At each location where individual push plate device are provided (rather than "INGRESS'R) provide two push plates; the centerline of one push plate shall be 7 inches minimum and 8 inches maximum above the floor or ground surface and the centerline of the second push plate shall be 30 inches minimum and 44 inches maximum above the floor or ground surface. Each push plate shall display the international symbol of accessibility.



2.8 POWER SUPPLIES

- A. WHERE HARDWARE GROUPS/SETS HAVE DIFFERENT INFORMATION (NUMBER OF WIRES AND MISSING POWER SUPPLY DEVICES AND INFORMATION) REFER TO THE FOLLOWING FOR CLARIFICATION AND SUBMIT ACCORDING TO COMPLETE AND INTENDED ELECTRIFIED SYSTEM.
 - 1. Coordinate use of power supplies with door and frame locations. Provide power supplies, relays and battery backup units as part of the overall system in accordance with the manufacturer's warranty and system requirements.
 - 2. Output shall be filtered and regulated. Relay, timer, and logic modules shall be provided as required for interface to indicated security components; and shall be assembled, connected, and fully contained within the power supply enclosure.
 - 3. Provide required connections to fire alarm/life safety system and for remote site activation of all electrified components and functions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. THE OPERATOR INSTALLER SHALL EXAMINE THE AREAS AND CONDITIONS UNDER WHICH THE AUTOMATIC OPERATORS ARE TO BE INSTALLED, AND NOTIFY THE DESIGN PROFESSIONAL IN WRITING OF CONDITIONS DETRIMENTAL TO THE PROPER AND TIMELY COMPLETION OF THE WORK. DO NOT PROCEED WITH THE WORK UNTIL SATISFACTORY CONDITIONS HAVE BEEN CORRECTED.
- B. MEASUREMENTS: VERIFY ALL DIMENSIONS BY TAKING FIELD MEASUREMENTS BEFORE ANY MATERIAL IS FABRICATED AND SHIPPED TO THE JOB SITE.

3.2 INSTALLATION

- A. INSTALL ALL DEVICES IN ACCORDANCE WITH MANUFACTURER'S PRINTED INSTRUCTIONS AND APPROVED SHOP DRAWINGS. INSTALL ALL DEVICES LEVEL AND PLUMB.
- B. PROJECTING ITEMS: INSTALL OR RE-INSTALL WRAPPINGS FURNISHED BY THE MANUFACTURER.
- C. COORDINATE OPERATOR INSTALLATION WITH ELECTRICAL CONNECTION REQUIREMENTS.
- D. SEALANTS: FURNISH AND INSTALL ALL SEALANTS INDICATED OR REQUIRED TO COMPLETE INSTALLATION PER DIVISION 07.
- E. INSTALL EQUIPMENT PER CURRENT ANSI/BHMA A156.19 AMERICAN NATIONAL STANDARD FOR POWER ASSIST AND LOW ENERGY POWER OPERATED DOORS AND AS DIRECTED BY AMERICAN ASSOCIATION OF AUTOMATIC DOOR MANUFACTURERS (AAADM) RECOMMENDATIONS.
- F. PUSH PLATES & TOUCH-ACTIVATED AUTOMATIC DOOR CONTROLS:
 - 1. Install touch-activated automatic door controls at mounting height 3 inches above finished floor or as indicated on the Drawings.
 - 2. Mount touch-activated automatic door controls securely in place to supports with fasteners supplied by manufacturer.

3.3 TESTING, ADJUSTING & INSPECTION



- A. REPAIR OR REPLACE INSTALLATIONS WHICH DO NOT PERFORM ACCORDING TO MANUFACTURER'S PRINTED INSTRUCTIONS AND APPROVED SHOP DRAWINGS.
- B. ADJUST PARTS FOR SMOOTH, UNIFORM OPERATION. LUBRICATE MOVING PARTS WITH MANUFACTURER RECOMMENDED LUBRICANT. REPLACE UNITS THAT CANNOT BE ADJUSTED AND LUBRICATED TO OPERATE FREELY AND SMOOTHLY AS INTENDED FOR THE APPLICATION.
- C. ADJUST DOOR CLOSER DEVICES (INNER UNIT WITHIN AUTO OPERATOR DEVICES):
 - 1. Adjust closer delay and operating speeds to comply with requirements of IBC 2018 and the Americans with Disabilities Act Architectural Guidelines, Article 4.13.10.
 - 2. Door closers shall have sweep period adjusted so that from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3" from the strike.

3.4 CLEANING

- A. AFTER REPEATED OPERATION OF COMPLETED INSTALLATION, READJUST DOOR OPERATORS AND CONTROLS FOR SMOOTH, QUIET AND OPTIMUM OPERATING CONDITION AND SAFETY. CLEAN SURFACES PROMPTLY AFTER INSTALLATION. PROVIDE PROTECTIVE TREATMENT AND OTHER PRECAUTIONS REQUIRED THROUGH THE REMAINDER OF THE CONSTRUCTION PERIOD TO ENSURE THAT AUTOMATIC OPERATORS WILL BE WITHOUT DAMAGE OR DETERIORATION.
- B. DEFECTIVE WORK: REMOVE AND REPLACE ANY DEFECTIVE WORK THAT CANNOT BE PROPERLY REPAIRED, CLEANED OR TOUCHED UP.
- C. JUST PRIOR TO FINAL ACCEPTANCE OF BUILDING OR AS DIRECTED, REMOVE PROTECTIVE PAPER COVERINGS AND CLEAN AND POLISH HARDWARE.


3.5 HARDWARE GROUP/SETS

- A. CONFIDENTIALITY NOTICE: ALL PAGES IN THIS DOCUMENT ARE COPYRIGHT MATERIAL BY OPENING CONSULTANTS, INC. 2024. THIS DOCUMENT IS SOLELY FOR THE INTENDED RECIPIENT AND MAY CONTAIN CONFIDENTIAL OR PRIVILEGED INFORMATION (INTELLECTUAL PROPERTY FOR CONTRACTED PROJECTS AND NOT FOR USE WITH ANY OTHER PROJECT OR CHANGED FOR THIS PROJECT WITHOUT WRITTEN CONSENT OF OCI PERSONNEL).
- B. THE FOLLOWING HARDWARE SETS ARE INTENDED TO ESTABLISH TYPE AND STANDARD OF QUALITY WHEN USED TOGETHER WITH THE REQUIREMENTS OF THIS SECTION (SEE ABOVE SECTION AND RELATED SECTIONS INCLUDING DIVISION 01).
 - 1. Examine Contract Documents and furnish proper hardware for door openings.
 - 2. Refer to Door Schedule on the Drawings for Hardware Group/Set assignments for each opening.

Blank space below and after a Group/Set is intentional to avoid, if possible,
splitting a Hardware Group/Set onto two pages



For doors assigned hardware #202 on the door schedule, provide the following:

Note 1: In addition to the devices specified in hardware group/set below, also coordinate devices in specification Section 08 71 00 "Door Hardware" (furnish & install doors, frames and related scope per complete Contract Documents).			
1	Ea.	Surface Overhead Low Energy Operator System	Per Section 08 71 13 and the following: Stanley M-Force Series to be on push-side of door application: <ul style="list-style-type: none"> - Clear anodized finish (arms and mounting plates included in matching finishes). - Provide installation plates, arms and covers as required per conditions including, but not limited to deeper frame conditions/reveal and/or hanging devices (pivot/hinge as specified in 08 71 00). Show deeper frame conditions/reveal and/or hanging devices in shop drawings during submittals
1	Ea.	Safety Sensors	BEA manufacturing #10LZRFLATSCAN series per above specification x required relays x installation brackets
2	Ea.	Upper Wave Motion /Touchless Automatic Actuators (also known as Push-Plates) 	- AT INTERIOR ONLY furnish and install #CM-33_/42 series device by Camden manufacturing. Part #s of not exact with Camden, see picture to right and the following descriptions submit correct, all-black #CM-33_/42 device: hardwired x single pole, double throw, dry-contact, momentary-action micro-switch, with wheelchair logo and added text "WAVE TO OPEN"
1	Ea.	Card Reader Side-of-Door (description of operation)	Card reader acts as the actuator/push-plate on card-reader side of door and starts auto operator (door always locked from card reader side unless authorized card holder uses card reader to enter area)
1	Ea.	Above frame On/Off two-way switch on operator body	On/Off two-way switch per specifications.
1	Ea.	Relay Device, Various inputs & outputs interface task (required connectivity & required wires)	Provide BEA BR3, 10-BR3 or approved equal relay device: operator vendor/installer to interface all inputs and outputs on the power supply (interfaces to all applicable devices). Operator vendor/installer to interface all inputs & outputs (including but not limited to power supplies & BR3-type devices to all other inputs & output devices)
1	Ea.	Coordination task for security and/or electrical design and additional non-Division 08 Section scope (including but not limited to wire / connectivity from ground or ceiling through frame to electrified hardware)	By security or electrical as required per Contract Documents: The electrified hardware specified above can be utilized for #1) non-card reader, remote access control applications (unlocked / locked remotely for open during business hours / locked after-hours) and #2) local card readers at openings as directed by architectural drawings, security or electrical. Coordinate with security or electrical Divisions 26 and 28 and applicable drawings as hardware does not include card reader locations.
Note 2: Furnish all devices and components for hardware groups/set above in accordance with Contract Documents including, but not limited to, additional hardware devices requirements in the above specification language, architectural plans, and full specification documents.			

END OF SECTION



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SECTION 08 81 26

INTERIOR GLASS GLAZING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Interior Glass and Glazing in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. Glass Standards:
 - a. ANSI Z97.1.
 - b. CPSC 16 CFR 1201.
 - c. GANA Glazing Manual.
 - 2. Flat Glass:
 - a. ASTM C1036 Standard Specification for Flat Glass.
 - b. Float glass: Type I, Quality q3 and Class 1 unless otherwise indicated.
 - c. Figured glass: Type II, Quality q7, Form 3 and Class 1, Finish f1 and Pattern p2 unless otherwise indicated.
 - d. Mirror glass and one-way vision glass: Type I, Quality q1 or q2, Class 1 and coated for purpose.
 - 3. Flat Glass, Heat Treated, Coated and Uncoated:
 - a. ASTM C1048 Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.
 - b. Heat strengthened glass: Kind HS, Type I, Quality q3, Class 1 and Condition A unless otherwise indicated.
 - c. Tempered glass: Kind FT, Type I, Quality q3, Class 1 and Condition A unless otherwise indicated.
 - d. Heat strengthened – tempered glass: Kind HS-FT, Type 1, Quality q3 and Condition A unless otherwise indicated.
 - 4. Fire Rated Assemblies:
 - a. Where glazing products are used in fire-rated assemblies, comply with requirements of specific assembly specified in other sections of these Specifications.
 - b. Underwriters Laboratories, Inc. (UL):
 - 1) UL 9 – Fire Tests of Window Assemblies.
 - 2) UL 10B – Fire Tests of Door Assemblies.
 - 3) UL 10C – Positive Pressure Fire Tests of Door Assemblies.
 - c. Fire Protective Rated Glass:
 - 1) Each lite shall bear permanent, non-removable label of UL certifying use in tested and rated fire protective assemblies.
 - d. Door Assemblies:
 - 1) Comply with NFPA 80 and listed and labeled by testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, tested in accordance to NFPA 252.
 - 2) Positive Pressure Compliance: UL 10C.
 - 3) Fire Protective Glazing Products for Door Assemblies: Products identical to those tested per UL 10B, labeled and listed by UL.
 - e. Window Assemblies:



- 1) 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 257.
- 2) Positive Pressure Compliance: UL 10C.
5. Laminated Glass:
 - a. ASTM C1172 Standard Specification for Laminated Architectural Flat Glass.
 - b. Laminated Glass Design Guide, by the Glass Association of North America (GANA).
6. Sound Rated Glazing:
 - a. Materials and construction identical to assemblies whose Sound Transmission Class (STC) ratings are determined according to ASTM E90 and ASTM E413 by a laboratory with accreditation for the specific test procedures from a signatory body to the International Laboratory Accreditation Cooperative Mutual Recognition Arrangement.
 - b. Tested glazing is hung in frame as indicated.
 - c. Minimum STC: As indicated.

1.3 SUBMITTALS

- A. See Section 01 33 00 for requirements.
- B. Product Data:
 1. For each type of material and accessory.
 2. Sound Rated Glazing test reports to include:
 - a. STC test results from test method ASTM E90 and classification ASTM E413.
 - b. Laboratory and test method accreditation references.
- C. Samples:
 1. Provide one (1) 12 IN x 12 IN example of each specified type of glass.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Glass Products:
 1. Base:
 - a. AGC Industries
 2. Optional:
 - a. Guardian Industries
 - b. Pilkington
 - c. Vitro Glass
 - d. Saint-Gobain
- B. Fire Rated Glass Ceramic:
 1. Base:
 - a. Technical Glass Products (TGP).
 2. Optional:
 - a. Safti First
 - b. Vetrotech
- C. Radiation Resistant Glass:
 1. Base:
 - a. Ray-Bar Engineering Corp.
 2. Optional:
 - a. Nelco.
 - b. McGrory Glass
 - c. Radiation Protection Products (RPP).
 - d. Technical Glass Products (TGP).



D. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 MATERIALS

A. Glass Materials:

1. Comply with indicated standards.
2. See Glass Types Schedule for listing of types.
3. Materials specified in Glass Types Schedules are minimum acceptable products.
4. Single manufacturer produce individual glass types used in fabrication of insulating units.
5. Manufacturer or fabricator determine if materials should be heat strengthened or fully tempered at non-hazardous locations that do not require safety glazing and provide accordingly.

B. Glazing Compounds:

1. Nonsag, nonstain type.
2. Pigmented to match frame units not requiring painting.
3. Compatible with adjacent surfaces.
4. For use in setting glass: Neutral-cure Silicone sealant.
5. Sealant tape:
 - a. Butyl rubber sealant tape or ribbon having a continuous neoprene shim.
6. Gaskets:
 - a. Polyvinyl chloride or neoprene.
 - b. Extruded, flexible, of profile and hardness required to receive glass and provide a watertight installation.

C. Installation Setting Blocks and Spacers:

1. EPDM or Neoprene, compatible with sealants used.
2. Setting blocks: 80-90 durometer.
3. Spacers: 40-50 durometer.
4. Compressible filler stock: Closed cell jacketed rod stock of synthetic rubber or plastic foam.
5. Shims, clips, springs, angles, beads, attachment screws and other miscellaneous items: As indicated or required.

2.3 GLASS TYPES SCHEDULE

A. Refer to Interior Glass Types Schedule for basic description of mark numbers indicated on Drawing.

B. Refer to Drawings for depiction of unit sizes and locations.

C. Upgrade basic type conditions in accordance with following rules:

1. Heat treatment upgrade based on physical size of unit:
2. Heat strengthened or fully tempered units between 55 and 70 SQFT.
3. Fully temper units exceeding 70 SQFT.
 - a. Strengthen annealed glass where units exceed length or width limitations or both as recommended by glass manufacturer.
4. Heat treatment upgrade based on locations which are potentially hazardous to occupants:
 - a. Upgrade units to fully tempered, Kind FT, glass as required by any one of following:
 - 1) When required by local Codes.
 - 2) When specifically indicated on Drawings.
 - 3) Locations requiring Safety Glass, Kind FT, by 16 CFR 1201 and ANSI Z97.1:
 - a) Units installed in doors, sash, transom or other operable units.
5. Units where any part of unit is within 18 IN, measured vertically, above a floor line, sidewalk, paver, or other walking surface located within 3 FT of the glass unit, measured horizontally.



6. Units in sidelights and other units located adjacent to and within 48 IN of either jamb of door or other operable units; this includes adjacent lites that are in perpendicular plane to door.
7. Other conditions requiring heat treatment upgrades:
 - a. Units which will be exposed to irregular sun or shade combinations or both shall be Kind HS or better.
 - b. Where glass manufacturer recommends heat treatment coatings or tints specified.
 - c. Where required to resist lateral loads.

2.4 INTERIOR GLASS TYPES SCHEDULE

- A. Type T - Tempered:
 1. Clear tempered float.
 2. Thickness: 6 MM min.
- B. Type HT - Heat strengthened tempered glass:
 1. Clear heat strengthened tempered float.
 2. Thickness: 6 MM min.
- C. Type C8 – Laminated Fire and Safety Glass:
 1. Laminated, wireless, UL labeled for assembly indicated.
 2. Impact and safety rated per ANSI Z97.1 and CPSC 16CFR1201.
 3. Thickness: 8 MM laminated minimum.
 4. Surface: Polished.
 5. Sound Transmission Class (STC): not less than 35.
 6. Base Product: FireLite Plus by Technical Glass Products.
- D. Type RR – Radiation-Resistant Glazing:
 1. Composition: Lead-barium, polished float glass containing not less than 60 PCT heavy metal oxides, including not less than 48 PCT lead oxide by weight.
 2. Color: Clear.
 3. Provide glass units of sufficient thickness to provide same radiation shielding as adjacent wall areas. Provide single or multiple plies as necessary.
- E. Type STC - Glazing:
 1. Application at STC-rated door assemblies:
 - a. Maintain STC rating of door assembly per Section 08 14 16 and Section 08 34 73.
 - b. See Door and Frame Schedule for door assembly STC rating.
 - c. Provide minimum STC 30 glass at Sound Dampening doors.
 2. Glass make-up as required.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine framing or glazing channel surfaces, backing, stop design, and conditions under which glazing is to be installed.

3.2 INSTALLATION

- A. Do not install glass with edge damage.
- B. Contractor is responsible for correct glass size for each opening, within tolerances and dimensions established.
- C. Comply with recommendations of manufacturers, except where more stringent requirements are indicated.



- D. Comply with GANA Glazing Manual.
- E. Install sealants as recommended by sealant manufacturer.
- F. Install setting blocks in adhesive or sealant.
- G. Provide spacers inside and out, of proper size and spacing, for glass size, except where gaskets are used for glazing.
- H. Minimum Bite:
 - 1. Monolithic, 6 MM glass: 10 MM minimum bite.
 - 2. For other sizes: Refer to Table C of AAMA's Aluminum Curtain Wall Design Manual, Volume 6, Glass and Glazing.
- I. Sealant Depth: Equal to sealant width.
- J. Prevent sealant exudation from glazing channels.
 - 1. Leave void at heel or install filler at jambs and head.
 - 2. Do not leave void or install filler at sill.
- K. Miter cut and bond gasket ends together at corners.
- L. Immediately after installation, attach crossed streamers to framing held away from glass.
- M. Do not apply anything to surfaces of glass.
- N. Install spandrel units from exterior of building.
- O. Remove and replace damaged glass.

3.3 CLEANING AND PROTECTION

- A. Wash and polish glass on both faces not more than 7 days prior to final completion of work in each area.
- B. Comply with glass manufacturer's recommendations and GANA 01-0300.

END OF SECTION

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DIVISION 09

FINISHES



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SECTION 09 22 16
NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Non-Structural Metal Framing in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Member of Certified Steel Stud Association (CSSA), Steel Stud Manufacturers Association (SSMA) or Steel Framing Industry Association (SFIA).
- B. ASTM International (ASTM):
 - 1. ASTM A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - 2. ASTM C645 Standard Specification for Nonstructural Steel Framing Members.
 - 3. ASTM C754 Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
 - 4. ASTM A1003 Standard Specification for Steel Sheet, Carbon, Metallic and Nonmetallic-Coated for Cold-Formed Framing Members.
- C. Provide studs and accessories of type tested and listed for construction indicated.
- D. Sound Rated Assemblies:
 - 1. Materials and construction identical to assemblies whose Sound Transmission Class (STC) ratings are determined according to ASTM E90 and ASTM E413 by a laboratory with accreditation for the specific test procedures from a signatory body with accreditation for the specific test procedures from a signatory body to the International Laboratory Accreditation Cooperative Mutual Recognition Arrangement.
 - 2. STC rating: as indicated.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Provide copies of manufacturer's specifications and installation instructions for each type of material and accessory required.
 - a. Where fire resistance classification is indicated, submit copies of nationally recognized testing laboratory listings of products proposed for use.
 - b. Include data required to show specification compliance.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Non-structural Metal Framing:
 - 1. Base:
 - a. Telling Industries



2. Optional:
 - a. CEMCO Steel Framing and Metal Lath
 - b. ClarkDietrich Building Systems
 - c. Custom Stud Inc.
 - d. Marino/WARE
 - e. MRI Steel Framing LLC.
 - f. The Steel Network
- B. Isolation Strip Material:
 1. Base: Reflectix, Inc.
 2. Optional: Saint-Gobain
- C. Interlocking Grid Support Systems for Gypsum Board Ceilings:
 1. Base:
 - a. USG Corporation
 2. Optional:
 - a. Armstrong
 - b. Chicago Metallic
- D. Sound Isolation Clipse:
 1. Base:
 - a. Kinetics Noise Control.
 2. Optional:
 - a. PAC International.
 - b. Sound Isolation Company.
- E. Stud Wall Isolation Strip:
 1. Base:
 - a. Kinetics Noise Control.
 2. Optional:
 - a. Regupol.
 - b. AcoustiGuard.
- F. Other manufacturers desiring approval comply with Section 00 26 00.
- G. Products proposed for use in fire-rated assemblies: Approved by nationally recognized testing laboratory.

2.2 DESIGN CRITERIA

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
- B. Select steel studs in accordance with manufacturer's standard load tables and following design pressures and maximum deflections:

PERFORMANCE CRITERIA		
Use Condition ²	Design Pressure	Maximum Deflection
Wall enclosing stairs, elevator hoistways, and other vertical shafts	10 LBS/SF	L/120
Wall enclosing vestibules, ground floor lobbies, and similar spaces subject to intermittent exposure to exterior wind conditions	15 LBS/SF	L/240
Walls scheduled with Tile Backer Board, Moisture-resistant, or Abuse-Resistant Gypsum Wallboard	5 LBS/SF	L/360



Walls scheduled to receive Tile, lath and plaster, or veneer plaster. ¹		
Typical Interior Walls/Partitions (those not listed above)	5 LBS/SF	L/240
Interior Ceilings, Soffits and Bulkheads	5 LBS/SF	L/360
Footnotes: 1. Limit deflection to L/360 where wall cladding on either face is any of the following: Ceramic Tile, Stone Tile, Porcelain Tile, Thin Brick, Lath & Plaster, Simulated Masonry, Adhered-stone, Veneer Plaster and similar brittle finishes which are prone to movement-induced cracking. 2. Where elements meet multiple conditions; Use most stringent Deflection and Design Pressure values.		

2.3 MATERIALS

A. Metal Studs and Floor Tracks:

1. C-shaped studs and tracks roll-formed from corrosion-resistant galvanized steel conforming to ASTM C645.
2. Galvanized: ASTM A653/A653M, G40.
3. Stud and track depths: As indicated by wall type.
4. Minimum flange width: 1-1/4 IN.
5. Minimum thickness: 33 mil (20 GA), except as follows:
 - a. Provide heavier thickness to comply with performance criteria.
 - b. Provide heavier thickness where specifically indicated.
6. In lieu of greater stud thickness, design may employ diagonal braces above ceiling to reduce overall span and thus stiffen wall frame.
 - a. Coordinate locations with building services items.
 - b. Do not employ studs with stud thickness less than allowed by fire resistance-rated assemblies.
7. High strength 50KSI studs shall comply with design criteria of equivalent thickness standard 33KSI studs listed.
8. Base products: Drywall Framing System by Telling Industries.
9. Optional products, high strength steel: Viper Stud by Telling Industries.

B. Head of Wall Accessories:

1. Configure to accommodate deflection of superstructure without inducing axial loading on partition wall.
2. Maintain structural integrity, fire and smoke-resistance, and sound control as required by each wall.
3. Slotted top deflection track:
 - a. Deep leg, vertically slotted track.
 - b. Cold-formed sheet steel; galvanized; ASTM A653 G60.
 - c. Thickness: 33 mil (20 GA) minimum so long as performance requirements can be met.
 - d. Width: As required for studs sizes indicated.
 - e. Depth: Minimum 2-1/2 IN down-standing legs with 1/4 IN wide by 1-1/2 IN high slots spaced 1 IN on center.
4. Z-bars, cold formed channels and clips:
 - a. Accommodate thickness of spray-applied fire-resistive materials.
5. Fasteners suitable for attachment to superstructure.
6. UL-listed fire resistant components tested for compliance with requirements indicated.
7. Firestopping Materials:
 - a. Sealants, sprays, intumescent strips and forming materials.
 - b. Coordinate with sealants specified in Section 07 84 00 and Section 07 92 16.
 - c. Intumescent applications: Factory or field applied.

C. Shaftwall Framing:



1. C-T or C-H shaped studs with U or J shaped tracks.
 2. Material: Galvanized steel complying with ASTM A653, G40.
 3. Thickness: 33 mil (20 GA) minimum.
 4. Size: 2-1/2, 4, and 6 IN minimum as indicated.
 5. Stud spacing: 24 IN.
 6. Structural design criteria:
 - a. Select stud with properties necessary to limit deflection to L/240 deflection at load of 10 PSF.
 - b. Use larger size and thickness to satisfy span and deflection criteria.
 7. Shaftwall assembly with gypsum wallboard specified in Section 09 29 00:
 - a. Fire resistance rating: 2 HRS in accordance with ASTM E119.
 - b. Sound transmission class: Minimum STC 47 in accordance with ASTM E90.
 8. Base product: CT Cavity Shaftwall Studs by Telling Industries.
- D. Z-Bar Standoff Clips:
1. 33 mil (20 GA) galvanized steel.
 2. Provide Z-bars for attachment of top track to superstructure elements which are to be protected with sprayed fireproofing.
 - a. Size: 2 IN x 2 IN x 2 IN.
 3. Length:
 - a. As required to accommodate beam and deck fireproofing.
 - 1) At structural steel member: Length equal to flange width of structural steel member.
 - 2) At steel deck: Minimum length equal to partition width, or as required to span steel deck flutes.
 - b. Extend length of Z-bar to accommodate partition offset that will not clear fireproofed steel beam.
 4. Base product: ZFC by Telling Industries.
- E. Furring Channels:
1. Hat-shaped sections.
 2. Galvanized: ASTM A653, G40.
 3. Sizes: 7/8 IN and 1-1/2 IN, as indicated.
 4. Minimum Thickness: 33 mil (20 GA); Use heavier gauge as dictated by conditions.
 5. Base product: DWFC by Telling Industries.
- F. Sound Isolation Clips:
1. For use with 7/8 IN Furring Channels.
 2. Rubber isolation bushing enclosed by galvanized steel brackets.
 - a. Brackets to be secured to primary framing members (studs or joists) by screws.
 - b. Rubber bushing to accept 7/8 IN Furring Channels running perpendicular to primary framing members.
 3. Load capacity.
 - a. Clips shall have capacity to support wall or ceiling weights as constructed.
 - b. Select clips, furring channels, fasteners, and spacing to support imposed loads.
 4. Base Product: Model Iso-Max Sound Isolation Clips by Kinetics Noise Control.
- G. Z-Furring:
1. Z-shaped sections, attached to structural parent wall.
 2. Galvanized: ASTM A653, G40.
 3. Sizes: 1, 1-1/2, 2 and 2-1/2 IN, as indicated.
 4. Thickness: 18 mil (25 GA) minimum.; Use heavier gauge as dictated by conditions.
 5. XPS foam insulation
 6. Base product: ZFC by Telling Industries.



2.4 ACCESSORY ITEMS

- A. Wire Ties: Minimum thickness: 43 mil (18 GA) soft annealed, galvanized.
- B. Track Fasteners: Power driven type, to withstand minimum 190 LB shear when driven.
- C. Closure:
 - 1. Continuous 33 mil (20 GA) galvanized closure angle to receive vapor retarder and vapor retarder tape.
- D. Isolation Strip Material:
 - 1. Non-absorbent, foam padding to prevent direct contact between metal framing and exterior concrete or masonry.
 - 2. Thickness: 0.40 mil minimum .
 - 3. Install continuous strips in widths to match steel framing and furring.
 - 4. Base product: Sill Sealer by Reflectix, Inc.
- E. Metal Blocking:
 - 1. C-shaped modified track runners.
 - a. Roll-form from corrosion-resistant galvanized steel.
 - b. Conform to ASTM C645.
 - 2. Galvanized: ASTM A653, G40.
 - 3. Backing height: 6 IN minimum.
 - 4. Flange width: 1-1/4 IN minimum.
 - 5. Thickness: 33 mil (20 GA) minimum.
 - 6. Base product: Drywall Track by Telling Industries.
- F. Knee Wall Brace:
 - 1. Steel tube and baseplate bolted to concrete floor slab with tube projecting vertically; concealed within framed walls to provide structural stability for knee walls.
 - 2. Material: Cold-rolled steel tube and base plate, fully welded.
 - 3. Tube: 3 x 3 x 1/8 IN.
 - 4. Base plate: 3-1/2 x 8 x 3/8 IN.
 - 5. Provide 4 expansion bolts with minimum 3-1/2 IN embedment.
 - 6. Overall height: Wall height less 2 IN, or as otherwise indicated.
 - 7. Base product: SKB by Pittcon.
- G. Stud Wall Isolation Strip:
 - 1. Resilient pad to reduce sound transmission at wall/floor and wall/ceiling junctions.
 - 2. Provide between top track and structure and between bottom track and structure where indicated.
 - 3. Fasteners, resilient bushings, and other accessories as recommended by manufacturer.
 - 4. Base product: Wallmat by Kinetics Noise Control.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine supporting structure and conditions under which system will be installed.
- B. Correct conditions detrimental to proper installation.
- C. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION - GENERAL

- A. Layout and install metal framing accurate to dimensions indicated in drawings.



- B. Installation Standard: ASTM C754, except comply with framing sizes and spacing indicated.
- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.
- F. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- G. Extend all framing full height from track to track. In particular, soffit framing shall extend full height. Exposed, cut off studs prohibited.
 - 1. Exception: Where partitions are indicated to terminate at, or just above, suspended ceilings.
 - 2. Continue framing around ducts and similar items which penetrate partitions.
- H. Utilize slip-type head track assemblies where framing extends to overhead structural supports.
 - 1. Configure to resist lateral loads while accommodating deflection of overhead building superstructure without inducing axial loading on partition framing.
- I. Size floor tracks and head track assemblies to match studs.
 - 1. Align floor track and deflection track.
 - 2. Secure floor track and deflection track to structure in accordance with manufacturer's instructions and regulatory requirements.
 - 3. Secure at corners and at ends.
- J. Position studs vertically engaging floor track and head of wall deflection track.
- K. Space studs maximum 16 IN on center.
- L. Provide additional studs at corners, partition intersections and terminations of partitions, and at each side of control joints.
- M. Positively anchor studs to floor tracks with self-tapping pan head screws, or stud clinching tool on both flanges of each stud.
- N. Anchor studs to deflection track with wafer head screws on both flanges of each stud.
 - 1. Maintain deflection gap between top of stud and top of slotted track.
 - 2. Install screws at centerline of slot and secure allowing vertical movement.
- O. Anchor fire rated partitions as required by fire resistance design, and firestopping design.
- P. Align stud knockouts to facilitate running of wires and conduit.
- Q. Where partitions abut vertical structural elements, provide perimeter relief per Gypsum Association GA-600, Figure 8.
- R. Head-of-Wall:
 - 1. Provide slotted top track for walls extended to structure.
 - 2. Secure top track to superstructure with 0.145 IN x 1 IN powder actuated fasteners located 16 IN on center maximum.
 - a. Pre-fit forming material that may be required as a part of a fire-resistive joint system.
 - 3. Where partitions attach to structural elements that are scheduled to receive Spray-applied Fire Resistive Materials (SFRM):
 - a. Install Z-bar to underside of steel beams and steel deck before application of sprayed fireproofing.
 - b. Locate Z-bars perpendicular to line of partition, spaced maximum 16 IN on center.



- c. Attach each Z-bar with two 0.145 IN x 1 IN powder-actuated fasteners located minimum 1 IN from ends of Z-bar.
 - d. After fireproofing, secure top track to Z-bars with No. 8 x 5/8 IN wafer head framing screws spaced maximum 16 IN on center.
- 4. Where fire-rated partitions are offset and will not clear fireproofed steel beam, extend Z-bar outrigger horizontally from bottom of beam out to minimum 2 IN beyond width of head-of-wall.
 - a. Attach 3/4 IN expanded metal lath continuous, width of top of Z-bar outriggers prior to fireproofing steel beam to accommodate sprayed fireproofing.
- 5. Cut vertical studs 5/8 IN short to create a deflection gap when installed into top track.
 - a. Secure vertical studs to top track with No. 8 x 9/16 IN wafer head framing screw at each stud flange, screwing through track slots for positive stud connection.
- 6. Secure Gypsum Wallboard to vertical studs; do not secure Gypsum Wallboard to top track directly.
- 7. Prepare wall for installation of seals, firestopping, or both:
 - a. Fire-rated Walls: Prepare for fire-resistive joint assemblies specified in Section 07 84 00.
 - b. Non-fire rated partitions including Smoke Partitions: Prepare for Acoustical Sealant specified in Section 07 92 16.
- S. Furring Channels:
 - 1. Install furring channel systems, directly attached to parent walls.
 - 2. Install channels at maximum 16 IN OC.
 - 3. Provide additional framing at openings, cutouts, corners, and control joints.
 - 4. Fasten to masonry walls with cut nails.
 - 5. Fasten to concrete with power driven fasteners.
 - 6. Space fasteners not more than 24 IN OC, staggered on opposite flanges of furring channels.
- T. Sound Isolation Clips:
 - 1. Install per manufacturer's instructions.
 - 2. Where electrical device, outlet, and service boxes are fastened to framing with Sound Isolation Clips:
 - a. Leave a gap between the gypsum wallboard and the electrical device, outlet, or service box to avoid short-circuiting of the Sound Isolation Clips.
 - b. Seal the gap with Acoustical Sealant.
- U. Stud Wall Isolation Strip:
 - 1. Install per manufacturer's instructions.

3.3 FRAMING AT OPENINGS

- A. Control Joints (CJ):
 - 1. Install additional stud, maximum 1/2 IN from jamb studs.
 - 2. Do not fasten extra stud to track or jamb stud.
 - 3. Refer to specification Section 09 29 00 for control joint locations.
- B. Prefabricated headers, jambs, and sill framing systems option:
 - 1. Proprietary opening framing systems may be considered as an alternative to conventionally fabricated framing.
 - 2. Pre-approved Products:
 - a. HDS Framing System by ClarkDietrich.
 - b. Quick Frame Rough Opening System by Marino/ Ware.
- C. Door Openings:
 - 1. 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.



2. Unless indicated otherwise, extend jamb studs through suspended ceilings and secure laterally to overhead structure.
 3. Jamb Studs:
 - a. Install two studs, toe-to-toe, at each jamb, unless otherwise indicated.
 - b. Minimum thickness of jamb studs: 30 mil (20 GA) at openings.
 - c. Securely attach jamb studs to door frames.
 4. Headers:
 - a. Openings less than 4 FT wide:
 - 1) Cut-to-length section of floor runner above and below wall openings.
 - 2) Split flanges and bend webs at ends.
 - 3) Overlap and screw attach jamb studs to frames.
 - b. Openings over 4 FT wide:
 - 1) Cut-to-length, horizontal box beam studs above and below wall openings.
 - 2) Design for actual span and loading.
 - c. Incorporate miscellaneous steel members, and wood blocking, specified in Section 06 10 53, where indicated.
 5. Control Joints at head of jambs:
 - a. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2 IN clearance from jamb stud to allow for installation of control joint in finished assembly.
- D. Other Framed Openings:
1. Frame openings other than door openings the same as required for door openings, unless otherwise indicated.
 2. Install framing below sills of openings to match framing required above door heads.
 3. Headers and Sills:
 - a. Openings less than 4 FT wide:
 - 1) Cut-to-length section of floor runner above and below wall openings.
 - 2) Split flanges and bend webs at ends.
 - 3) Overlap and screw attach jamb studs to frames.
 - b. Openings over 4 FT wide:
 - 1) Cut-to-length, horizontal box beam studs above and below wall openings.
 - 2) Design for actual span and loading.
 - c. Incorporate miscellaneous steel members and wood blocking, specified in Section 06 10 53, where indicated.
 4. Cripple Studs:
 - a. Install cut-to-length intermediate vertical studs above and below openings.
 - b. Spacing: As indicated for typical full-length studs.

3.4 WALL BACKING AND BLOCKING

- A. Metal Wall Backing: Provide in-wall metal wall backing reinforcement where following items are mounted to interior walls and interior face of exterior walls:
 1. Crash rails, chair rails, wall bumpers, and similar wall protection devices.
 2. Contractor and Owner-furnished equipment indicated to be wall-mounted.
 3. Toilet accessories that do not include proprietary backing devices.
 4. Toilet partitions and lockers.
 5. Markerboards, tackboards, and chalkboards.
 6. Other wall-mounted items where backing is indicated by details or specification.
 7. Wall-mounted furniture in coordination with owner's vendor.
- B. Wood Wall Blocking: Specified in Section 06 10 53.
- C. Coordinate mounting height, location, and coverage with item to be supported.
- D. Determine material width according to item to be supported.



- E. Provide in-wall metal wall backing material to interior metal stud walls specified herein and Exterior stud walls.
- F. Attachment: Minimum 2 - #10 sheet metal screws at each stud.

3.5 INSTALLATION - CEILING

- A. Install in compliance with manufacturer's recommendations.
- B. Provide required items to support and trim out neatly, flush or recessed mechanical and electrical items.
- C. Frame openings in ceiling support system to accommodate access panels and similar openings and penetrations.
 - 1. Completely frame openings with closed channel side of stud facing opening for support of recessed mechanical and electrical items.

3.6 INSTALLING CEILING SUPPORT SYSTEMS

- A. Install suspension system components in sizes and spacings indicated on Drawings, but not less than required by referenced installation standards for assembly types and other assembly components indicated.
- B. Isolate suspension systems from building structure where abutting or penetrated by building structure.
- 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, counter-splaying, or other equally effective means.
 - 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
 - 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 - 4. 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. Grid Suspension Systems:
 - 1. Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces.
 - 2. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.



3. Install suspension systems that are level to within 1/8 IN in 12 FT measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION

SECTION 09 29 00

GYPSUM WALLBOARD

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Gypsum Wallboard in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. ASTM International (ASTM):
 - 1. ASTM C475 Joint Compound and Joint Tape for Finishing Gypsum Board.
 - 2. ASTM C840 Application and Finishing of Gypsum Board.
 - 3. ASTM C954 Steel Drill Screws for Application of Gypsum Panel Products or Metal Plaster Bases.
 - 4. ASTM C1002 Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases.
 - 5. ASTM C1047 Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
 - 6. ASTM C1396 Standard Specification for Gypsum Board.
 - 7. ASTM C1629 Abuse-Resistant Non-decorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels.
 - 8. ASTM D3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
 - 9. ASTM E84 Surface-Burning Characteristics of Building Materials.
 - 10. ASTM E90 Sound Transmission Testing.
 - 11. ASTM E119 Fire Tests of Building Construction.
 - 12. ASTM E413 Classification for Rating Sound Insulation.
 - 13. ASTM F2547 Standard Test Method for Determining the Attenuation Properties in a Primary X-ray Beam of Materials Used to Protect Against Radiation Generated During the Use of X-ray Equipment
- B. Gypsum Association (GA):
 - 1. GA-216 Application and Finishing of Gypsum Panel Products.
 - 2. GA-234 Control Joints for Fire-Resistance Rated Systems.
 - 3. GA-238 Guidelines for Prevention of Mold Growth on Gypsum Board.
- C. Fire Resistant Rated Assemblies:
 - 1. For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.
 - 2. Provide materials listed by UL, or other approved testing laboratory, for construction and rating type indicated.
- D. Sound Rated Assemblies:
 - 1. Materials and construction identical to assemblies whose Sound Transmission Class (STC) ratings are determined according to ASTM E90 and ASTM E413 by a laboratory with accreditation for the specific test procedures from a signatory body to the International Laboratory Accreditation Cooperative Mutual Recognition Arrangement.
 - 2. STC rating: as indicated.
 - 3. Facility Guidelines Institute (FGI):



- a. FGI Guidelines For Design and Construction of Healthcare Facilities:
 - 1) Sound and Vibration Requirements.
 - b. 2010 FGI Guidelines For Design and Construction of Healthcare Facilities.
- E. Radiation Shielding Assemblies:
 - 1. National Council on Radiation Protection and Measurement (NCRP):
 - a. NCRP Report No. 147 Structural Shielding and Design Evaluation for Medical Use of X-rays and Gamma Rays of Energies up to 10MeV
 - b. Comply with requirements of local, state, or federal regulatory agencies where building or safety standards or criteria exceed NCRP Report Numbers 49 and 147.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's specifications for each type of material and accessory.
- B. Samples: For the following products:
 - a. Trim Accessories: Full-size Sample in 12-inch 300-mm length for each trim accessory indicated.
 - b. Textured Finishes: Manufacturer's standard size sample for each textured finish indicated and on same backing indicated for Work.
- C. Informational Submittals:
 - 1. Submit Certification Letter on Contractor's letter head signed by Contractor indicating that all materials incorporated into this Project comply with requirements specified in this Specification or are accepted equivalent products.

1.4 QUALITY ASSURANCE

- A. Radiation Shielding Assemblies:
 - 1. Fabricator-Installer Qualifications:
 - a. Not less than 10 years of experience in successful fabrication and installation of radiation protection similar to work specified.
 - 2. Certification:
 - a. Furnish certificate of compliance signed by Manufacturer and Fabricator-Installer stating materials are in accordance with Contract Documents and physicist shielding report.
- B. Mockups: Before beginning gypsum board installation, install mockups of at least 100 square feet in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Install mockups for the following:
 - a. Each level of gypsum board finish indicated for use in exposed locations.
 - b. Each texture finish indicated.
 - 2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
 - 3. Simulate finished lighting conditions for review of mockups.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Gypsum Wallboard:
 - 1. Base:
 - a. Georgia Pacific (GP).



2. Optional:
 - a. American Gypsum.
 - b. CertainTeed.
 - c. National Gypsum Company (NGC).
 - d. United States Gypsum (USG).
- B. Lead Product Suppliers:
 1. Base:
 - a. A&L Shielding.
 2. Optional:
 - a. NELCO.
 - b. Ameray.
 - c. Radiation Protection Products.
 - d. Ray Bar Engineering.
 - e. Mayco.
- C. Drywall Trim Accessories:
 1. Base:
 - a. United States Gypsum (USG)
 2. Optional:
 - a. ClarkDietrich
 - b. Phillips Manufacturing
 - c. Structus Building Technologies
- D. Specialty Drywall Trim:
 1. Base:
 - a. Pittcon Industries.
 2. Optional:
 - a. Fry Reglet Corp.
 - b. Gordon, Inc.
- E. Foam Tape:
 1. Base:
 - a. As noted.
- F. Sound Attenuation Batts (SAB):
 1. Base:
 - a. As noted.
- G. Acoustical Seal for Wall Boxes:
 1. Base:
 - a. Kinetics Noise Control.
 2. Optional:
 - a. QuietRock by Pabco.
 - b. ATS Acoustics.
 - c. Soundproofing Company.
 - d. Trademark Soundproofing.
- H. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Furnish in maximum available lengths, consistent with installation requirements.
 1. Long Edge: Tapered.
 2. Short Ends: Square.
- B. Upgrade listed types to fire rated equivalent products when used in fire rated assemblies.



- C. Provide listed GWB products to mold and moisture resistant types, where wallboard is installed in Electrical, Communication Rooms, Mechanical shafts, Stair Shafts and similar locations where wallboard is installed prior to building being weather-tight.
- D. Exterior Gypsum Sheathing: Specified in other Section.
- E. Framing and suspension systems for Gypsum Board Ceilings: Specified in Section 09 22 16.
- F. Firestopping: Specified in Section 07 84 00.
- G. Thermal Insulation: Specified in other Division 07 sections.
- H. Interior face of exterior walls and rooms where moisture or high humidity is present:
 - 1. Mold and moisture resistant gypsum panels (MR GWB).
 - 2. Gypsum panels, with glass mat facer per ASTM C1658.
 - 3. Thickness: 5/8 IN 15 mm.
 - 4. Mold-resistance score: 10 per ASTM D3273.
 - 5. Apply continuously to interior face of exterior stud walls prior to framing interior partitions and ceilings.
 - 6. Where MR wallboard is scheduled in fire rated walls, provide approved fire-resistive products with comparable moisture-resistance.
 - 7. Base product:
 - a. DensArmor Plus Interior Panel and DensArmor Plus Fireguard Interior Panel Fireguard by Georgia Pacific.
- I. Interior Partitions and Ceilings:
 - 1. Gypsum panels – Type X:
 - a. ASTM C1396.
 - b. Thickness: 5/8 IN 15 mm.
 - c. Type X core.
 - d. Base product:
 - 1) ToughRock Fireguard X Gypsum Wallboard by Georgia Pacific.
 - 2. Gypsum panels – Mold and moisture resistant (MR GWB):
 - a. Gypsum panels with paper facer per ASTM C1396.
 - b. Thickness: 5/8 IN 15 mm.
 - c. Mold-resistance score: 10 per ASTM D3273.
 - d. Base Product: ToughRock Mold-Guard and ToughRock Mold-Guard Fireguard X by Georgia Pacific.
 - e. Utilize approved fire-resistive products where mold and moisture resistant wallboard is scheduled in Fire Rated Walls.
 - 3. Shaftwall Liner Panel, Fire rated:
 - a. Panel size: 1 IN x 24 IN 25 mm x 610 mm wide.
 - b. Type X core.
 - c. Mold and moisture resistant:
 - 1) Mold-resistance score: 10 per ASTM D3273.
 - 2) Fiberglass coated glass mats, both faces per ASTM C1658.
 - d. Base product:
 - 1) DensGlass Ultra Shaftliner by Georgia Pacific.
 - 4. Lead Lined Gypsum Wallboard (LLGWB):
 - a. Lead sheet factory laminated to gypsum board carrier.
 - 1) Panel size: 48 inches 1220 mm wide by manufacturer's standard lengths, with lead edge flanges.
 - b. Gypsum wallboard substrate:
 - 1) ASTM C1396



- 2) 5/8 inches 16 mm thick
 - 3) Type X.
 - c. Lead Sheet:
 - 1) Unpierced, ASTM B749, alloy UNS L51121, chemical-copper lead.
 - 2) Lead Thickness: As indicated in owner vendor physicist's report.
 - a) Variation in sheet thickness: Less than 3 percent.
 - d. Accessories:
 - 1) Applied lead sheet as prescribed by UL, to compensate for loss of integrity at seams and transitions.
 - a) Lead Battens: 2 inches wide strips.
 - b) Lead Tabs: 2 inches by 5 inches
 - c) Sheet lead to wrap electrical outlets, pipes, ducts, and similar penetrations.
 - 2) Extend lead accessories 1 inch beyond edge of gypsum panel.
 - e. Related radiation shielding enclosure items specified elsewhere:
 - 1) Lead-lined steel frames: Specified in Section 08 11 13.
 - 2) Lead-lined wood doors (wood veneer faced): Specified in Section 08 14 16.
 - 3) Lead-lined glazing: Specified in Section 08 81 26.
- J. Trim:
- 1. Interior Trim:
 - a. Material: Galvanized or aluminum coated steel sheet, rolled zinc, paper faced galvanized steel sheet, or paper faced structural laminate.
 - b. Material for wet areas: Zinc.
 - c. Shapes:
 - 1) Corner bead.
 - 2) LC-Bead: J-shaped; exposed long flange receives joint compound.
 - 3) L-Bead: L-shaped; exposed long flange receives joint compound.
 - 4) U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - 5) Control joint.
 - 6) Curved-Edge Corner bead: With notched or flexible flanges.
 - 7) Other items as indicated.
- K. Joint Treatment Materials:
- 1. Use product types recommended by wallboard manufacturer for each condition.
 - 2. Materials compatible with other compounds applied previously or on successive coats.
 - 3. Provide dust control products in occupied areas or adjacent to occupied areas.
 - 4. Joint tape:
 - a. Interior gypsum wallboard: Paper.
 - b. Tile-backing panels: As recommended by panel manufacturer.
 - 5. Joint compounds for interior gypsum wallboard:
 - a. Setting-type joint compound:
 - 1) Filling open joints and voids.
 - 2) Embedding tape and first coat over joints, fasteners and trim flanges.
 - 6. Lightweight setting-type joint compound:
 - a. Second coat.
 - b. Final, skim coat on surfaces receiving a Level 5 finish.
 - c. Drying-type all purpose joint compound:
 - 1) Second and third coats.
 - 2) Final, skim coat, on surfaces receiving a Level 5 finish.
 - d. Spray-applied coating compound:
 - 1) Final, skim coat, on surfaces receiving a Level 5 finish.
 - 7. Joint compounds for moisture resistant gypsum wallboard:
 - a. Setting-type joint compound:
 - 1) Filling open joints and voids.



- 2) Embedding tape and first coat over joints, fasteners and trim flanges.
- b. Lightweight setting-type joint compound:
 - 1) Second and third coats.
 - 2) Final, skim coat on surfaces receiving a Level 5 finish.
- L. Acoustical Materials:
 - 1. Provide where indicated.
 - 2. Minimum nominal thickness: As required to achieve STC indicated for wall systems.
 - 3. Density: As required to achieve STC indicated for wall systems.
 - 4. Sound attenuation batts (SAB):
 - a. Mineral fiber.
 - b. Commercial sound blanket, ASTM C665, Type I, un-faced, produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - c. Surface burning characteristics per ASTM E84:
 - 1) Maximum flame spread: 10.
 - 2) Maximum smoke developed: 10.
 - d. Fire rated assemblies: Select SAB materials and thicknesses that that are approved for use in assemblies listed.
 - e. Acoustically rated assemblies: Select SAB materials and thicknesses that that are approved for use in assemblies listed.
 - f. Batt insulation products shall contain no added formaldehyde, including urea formaldehyde, phenol formaldehyde, and urea-extended phenol formaldehyde.
 - g. Base Product: Sound Attenuation Batt Insulation by Owens-Corning;
 - 5. Acoustical Seal for Wall Boxes:
 - a. Moldable putty.
 - b. Non-hardening.
 - c. Thickness: 1/8 inch.
 - d. Maintain STC indicated for acoustical assembly.
 - e. Adhere to back of electrical device, outlet, and service boxes in acoustical assemblies.
 - f. Base product: IsoBacker by Kinetics Noise Control.
- M. Interior joint sealants, including acoustical sealants:
 - 1. See Section 07 92 16.
- N. Fasteners:
 - 1. Bugle head screws: ASTM C1002 for use with maximum 22 GA 0.76 mm metal stud framing.
 - 2. Self-tapping bugle head screws: ASTM C954 for use with minimum 20 GA metal framing.
 - 3. Type S for gypsum wallboard to metal; Type G for gypsum wallboard to gypsum wallboard.
 - 4. Screws used with backer boards: As recommended by panel manufacturer.
- O. Laminating Adhesive:
 - 1. Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
 - 2. Manufacturer's recommended type for use with selected materials, mildew resistant, non-staining type, and with a VOC content of 50 g/L or less.
 - 3. Adhesives shall contain no carcinogen or reproductive toxicant components present at more than 1 percent of total mass of the product as defined in the California Office of Environmental Health Hazard Assessment's (OEHHA) list entitled Chemicals Known to the State to Cause Cancer or the Reproductive Toxicity, Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65).
- P. Foam Tape:
 - 1. PVC 1/2 x 1/4 IN 13 x 6 mm: With pressure sensitive adhesive; Norseal.



- 2. EPDM 1/2 x 1/4 IN 13 x 6 mm: With pressure sensitive adhesive; Cellular rubber by Gasket Dynamics.
 - Q. Backing for Control Joints:
 - 1. Fire rated board.
 - R. Sealer for Moisture Resistant Gypsum Wallboard:
 - 1. Manufacturer's standard compound.
 - 2. Use at joints, cut edges and screw penetrations.
 - 3. Sealer shall have VOC content no greater than 100 g/L.
-
- S. Framing and suspension systems for Gypsum Board Ceilings: Specified in Section 09 22 16.
 - T. Firestopping: Specified in Section 07 84 00.
 - U. Thermal Insulation: Specified in other Division 07 sections.
 - V. Interior Expansion Joint Covers: Specified in other Sections.

PART 3 - EXECUTION

3.1 INSPECTION AND PREPARATION

- A. Examine supporting structure and conditions prior to wallboard installation.
- B. Correct unsatisfactory conditions.
- C. Start of installation constitutes acceptance of conditions and responsibility for performance.

3.2 INSTALLATION – GENERAL

- A. Comply with ASTM C840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Repairs:
 - 1. Laminated GWB patching and repairs not allowed for any wall type. Install replacement GWB in line with the face of existing GWB.
 - 2. Repairs shall extend from center of stud to center of stud.
 - 3. Do not add backer studs behind small patches.
 - 4. Sealant does not substitute for the required GWB repairs.
- C. Remove loose materials and vacuum stud cavity prior to enclosing stud space.
- D. Acceptance of prior work:
 - 1. Contact the site Architect if there are any pipe penetrations through the floor without visible firestop sealant.
 - 2. Contact the site Architect if the metal framing has been damaged, cut or spliced.
- E. Install wallboard vertically with edges over metal stud framing members and similar framing support members.
- F. Bring boards into contact but do not force into place.
- G. Stagger edge joints on opposite side of partition so they occur on different framing members.
- H. Stagger joints in multi layer applications not less than one support from previous layer.
- I. Seal ends, cutouts and screw penetrations of moisture resistant boards with sealer.
- J. Install wallboard over metal framing studs and similar framing support members at interior face of exterior walls full height from floor to structure above.



- K. Wallboard installation prior to building being weathertight:
 - 1. Replace scheduled GWB products to their mold-resistant counterparts.
 - a. Products proposed are subject to Architect approval.
 - 2. Exposure time shall be limited by manufacturer requirements.
- L. Sound Insulation:
 - 1. Install sound insulation in walls from floor to structure above, where sound rated walls are indicated.
 - 2. Install in thicknesses and densities necessary to achieve STC rating of assembly.
 - 3. Fill cavities where studs are installed nested or toe-to-toe.
 - 4. Fill boxed headers, door jambs and nested king studs.
 - 5. Pack spaces around electric boxes and other penetrations to maintain full sound rating.
 - a. Fill small voids that remain with Acoustical Sealant.
 - 6. Pack spaces around ductwork, piping, and other through-wall penetrations in acoustical assemblies.
 - a. Fill small voids that remain with Acoustical Sealant.
- M. Acoustical Seal for Wall Boxes:
 - 1. Fully cover back and sides of electrical device, outlet, and services box.
 - 2. Partially overlap the stud.
 - 3. If gypsum wallboard is in place, pack putty into gaps between electrical box and gypsum wallboard slightly overlapping the inner gypsum wallboard surface.
 - 4. If gypsum wallboard is to be installed after putty, overlap the front edge of the electrical box so the putty is compressed around the edges of the box as the wallboard is installed.
- N. Curved Partitions:
 - 1. Space studs or furring to prevent flat areas between framing at curved surfaces.
- O. Wall Reveals:
 - 1. Install reveal wall channels and/or aluminum framing as recommended by manufacturer.
- P. Screw Placement:
 - 1. Proceed with attachment from board center toward ends and edges.
 - 2. Space maximum 8 IN 200 mm OC at edges and 12 IN 300 mm OC in field of board.
 - a. Use closer screw spacing if required by UL.
 - b. Fasten wallboard to each stud where multiple studs are installed at door jambs.
 - 3. Secure wallboard to vertical studs; do not secure to top track directly.
 - a. Follow top track manufacturer's screw pattern requirements.
 - b. Install additional framing if required.
 - c. Top track is specified in Section 09 22 16.
 - 4. Set screws between 3/8 IN and 1/2 IN 10 mm and 13 mm from edges.
 - 5. Drive screws so head rests in slight dimple without cutting face paper or fracturing core.

3.3 INSTALLATION - TRIM ACCESSORIES

- A. For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Interior Trim:
 - 1. Install in following locations:
 - 2. Cornerbead: Use at outside corners.
 - 3. J-Bead or LC-Bead: Use at exposed panel edges.
 - 4. L-Bead: Use where wallboard abuts dissimilar surfaces and where indicated.
 - 5. Curved-Edge Cornerbead: Use at curved openings.

3.4 INSTALLATION - RADIATION SHIELDING



- A. Verify shielding materials meet project requirements prior to installation.
- B. Install in accordance with manufacturer's recommendations and UL requirements.
- C. Perform corrective work to achieve complete radiation isolation, including repair or replacement of finishes.
- D. Typical Procedure:
 - 1. Construct per UL approved design when fire rating is indicated.
 - 2. Install lead battens to inside face of stud flange.
 - 3. Screw lead-lined wallboard to studs.
 - 4. Space screws 8 inches OC at edges and 12 inches OC in field.
 - 5. Install 2 inches wide sheet lead strip behind joints.
 - a. Install at door and window frame perimeters.
 - b. Overlap lead minimum 1 inch.
 - 6. Adhesively install additional wallboard layers listed in wall type.
- E. Fire Rated Assembly, UL U430 or U465:
 - 1. 1 Hour.
- F. Installation and Protection at Penetrating Items:
 - 1. Provide lead shields to maintain continuity of protection.
 - 2. Provide lead linings, sleeves, shields, and other protection in thickness not less than that required in assembly being penetrated.
 - 3. Secure shields at penetrations using adhesive or wire ties but not penetrating fasteners unless indicated on Drawings.
 - 4. Cut wall penetration covers from lead sheet of equal or greater thickness than backing on adjacent wall panels and size to cover penetrations with laps 1 inch minimum wide.
 - 5. Adhesively apply lead sheet penetration covers on penetrating boxes and raceways and return penetration covers to backside of lead-backed wall panels with 1 inch minimum laps.
 - a. Do not use penetrating fasteners unless indicated otherwise.
 - 6. Outlet boxes and conduit:
 - a. Cover or line with lead sheet lapped over adjacent lead lining at least 1 inch.
 - b. Wrap conduit with lead sheet not less than 10 inches from box.
 - 7. Duct openings:
 - a. Unless otherwise indicated, line or wrap ducts with lead sheet for distance from partition or ceiling or both equal to three times the largest opening dimension.
 - b. Lap lead sheet with adjacent lead lining at least 1 inch.
 - 8. Duct Penetrations where lead sheet less than 1/8 inches thick and where duct shielding is less than 24 inches wide:
 - a. Wrap ducts with wall penetration covers; lap lead joints 1 inch minimum.
 - b. Secure lead sheet in place with 1 inch minimum width steel bands spaced not more than 12 inches on center.
 - c. Do not cut into lead sheet with tightening steel bands.
 - 9. Duct penetrations, where lead sheet is greater than 1/8 inches thick or where duct shielding is greater than 24 inches wide:
 - a. Laminate wall penetration covers to fire retardant treated plywood or other similar structural panels conforming to shape of duct, lapping lead joints 1 inch minimum.
 - b. Secure lead laminated panels to ducts with mechanical fasteners located at duct seams and corners.
 - c. Where necessary to prevent lead laminated panels from overloading duct supports, independently suspend panels from hangers secured to overhead building structure.
 - d. Cover fastener heads with lead sheet matching thickness of adjacent lead.
 - 10. Piping:



- a. Unless otherwise indicated, wrap piping with lead sheet not less than 10 inches from point of penetration.

3.5 INSTALLATION - SHAFTWALL

- A. Install shaft walls in compliance with UL and Gypsum Association description.
- B. Provide shaft wall systems permitting entire erection procedure from outside shaft.
- C. Provide special metal runner angles and channels, and studs or splines spaced per manufacturer's requirements.
- D. Comply with requirements for thickness of metal and thickness of wall, for heights of wall indicated.
- E. Use maximum practical board lengths.
- F. Projections in Elevator Hoistways:
 - 1. Inspect elevator shafts to determine if projections greater than 4 IN 100 mm exist.
 - 2. At projections 4 IN 100 mm and greater:
 - a. Install GWB bevels sloping 75 degrees from horizontal.
 - b. Support GWB with metal studs.
- G. Access Panels and Doors:
 - 1. Locate where required as indicated.
 - 2. See Section 08 31 16.

3.6 CONTROL JOINTS

- A. General:
 - 1. Install Control Joints in location indicated and as described in this article. Even if control joints are not depicted on architectural drawings, they shall be provided as specified in this article. Refer to architect's typical control joint details for assembly requirements.
 - 2. Install suitable backing material to maintain required rating where Control Joints occur in fire or sound rated assemblies.
- B. Partitions:
 - 1. Extend control joints continuous full height of partition or wall.
 - 2. Provide vertical control joints on both wall faces which align with door frames, window frames, and similar opening as follows:
 - a. Single Doors and Cased Opening:
 - b. Locate CJ's at both jambs, from head of opening to top of partition.
 - c. Pair doors:
 - 1) Locate CJ's at both jambs, from head of opening to top of partition.
 - 2) Exception: Control Joints are not required where partition forms a cross-corridor condition.
 - d. Doors with adjacent sidelights:
 - 1) Locate CJ's at both jambs from head of opening to top of partition, and, from sill to floor at sidelight jambs.
 - e. Sliding doors:
 - 1) Locate CJ's at both jambs, from head of opening to top of partition.
 - f. Punched windows less than 30 FT 9 m in width:
 - 1) Both jambs from head of opening to top of partition, and from sill edge to floor.
 - g. Ribbon windows greater than 30 FT 9 m in width:
 - 1) Both jambs from head of opening to top of partition, and from sill edge to floor.
 - 2) Locate additional intermediate CJ's so maximum distance between CJ's does not exceed 30 FT 9 m apart.



3. Provide additional vertical Control Joints, spaced no more than 30 FT apart from each other, from opening-related CJ's, or from corners.
4. Provide horizontal control joints at partitions which are more than one story in height:
 - a. Locate horizontal Control Joints where partitions bypass each intermediate floor.
 - b. Align control joint with floor line, unless otherwise indicated.

3.7 WALLBOARD FINISHING

- A. Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration.
- B. Pre-fill open joints and voids, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
- D. Where bead abuts exterior metal window frames or other metal components, separate from other material by use of foam tape.
- E. Remove residual joint compound from adjacent surfaces.
- F. Apply Joint Compound and Tape in accordance with fire rated design.
 1. Apply joint treatment compound in accordance with manufacturer's directions.
 2. Fill joints, screw heads, and internal corners with compound.
 3. Extend joint system vertically from floor to extent described as follows:
 - a. Fire Walls, Barriers, and Partitions: Extend to full height of wall.
 - b. Smoke Barriers and Partitions: Extend to full height of wall.
 - c. Interior face of exterior wall (non-rated): Extend to full height of wall.
 - d. Other interior partitions (non-rated): Extend to 6 IN above ceiling.
 4. Refer to Drawings for indication of partition heights.
- G. Level 5 Finish:
 1. Trowel skim coat of joint compound leaving a thin film covering the entire surface, in accordance with manufacturer's recommendations.
 2. Make surfaces free of tool marks and ridges.
 3. Locations:
 - a. Throughout, unless noted otherwise.
 - b. Surfaces using MRB or other wallboard types with a glass mat facer on finished side.
- H. Glass Mat, Water Resistant Backing Panels:
 1. Finish according to manufacturer's written instructions.
- I. Cementitious Backer Units:
 1. Finish according to manufacturer's written instructions.
- J. Repairs:
 1. After painter has applied primer to wallboard surfaces, repair and refinish defective areas.
 2. If wallboard is damaged, or surfaces are roughened, repair or replace.

3.8 FIRE AND SMOKE WALL IDENTIFICATION

- A. Identify walls indicated on Drawings as having a required fire or smoke rating.
 1. Follow guidelines set in Chapter 7 of International Building Code.
 2. Permanently identify rating and type of barrier with stencil and paint in contrasting, 3 IN letters in a manner acceptable to authority having jurisdiction.
 3. Text for fire and smoke barriers: "X HOUR FIRE AND/OR SMOKE BARRIER—PROTECT ALL OPENINGS".
 4. Add a vertical line where a wall rating changes.



5. The wall stencils shall be located so as not to be blocked from view or covered by other work.

3.9 PROTECTION

- A. Protect installed wallboard from water damage during construction.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.
- D. Prior to finishing, walls shall be inspected for visible mold growth.
 1. Replace affected portions.

END OF SECTION

SECTION 09 51 00
ACOUSTICAL & CEILING TILE MATERIALS (AM)

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Acoustical and Ceiling Tile Materials (ACT) in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. ASTM International (ASTM):
 - 1. ASTM C635 Standard Specification for Metal Suspension Systems.
 - 2. ASTM C636 Standard Specification for Installation of Metal Ceiling Suspension Systems.
 - 3. ASTM E580 Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions
- B. Site Classification and Seismic Design Categories as defined in the International Building Code.
- C. 2010 FGI Guidelines For Design and Construction of Healthcare Facilities.
- D. Acoustical performance:
 - 1. Materials and construction identical to units whose Noise Reduction Coefficient (NRC) and Ceiling Attenuation Class (CAC), as applicable, are determined according to ASTM C423, ASTM E1414 / E1414M, and ASTM E413 by a laboratory with accreditation for the specific test procedures from a signatory body to the International Laboratory Accreditation Cooperative Mutual Recognition Arrangement.
 - 2. NRC with type E-400 mounting: as indicated.
 - 3. CAC: as indicated.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's product data that products comply with acoustical properties indicated on Drawing I101J: Interior Finish Legend.
 - 2. Test reports for acoustical performance to include, as applicable:
 - a. NRC test results from test method ASTM C423.
 - b. CAC test results from test method ASTM E1414 / E1414M and classification E413.
 - c. Laboratory and test method accreditation references.
- B. Samples:
 - 1. Three samples of each type of tile listed in Drawing I101J: Interior Finish Legend.
- C. Contract Closeout Information:
 - 1. Maintenance data.
 - a. See Section 01 78 23.
 - 2. Interior finish fire performance data:
 - a. Provide for each finish material and type specified:
 - 1) Manufacturer's printed information including:
 - a) Fire class.
 - b) NFPA test number.
 - c) Photograph.
 - d) Proof of purchase.



- e) See Section 01 78 26.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Steel Suspension Systems:
 - 1. Base:
 - a. Armstrong World Industries.
 - 2. Optional:
 - a. USG.
 - b. Chicago Metallic.
- B. Ceiling Tile
 - 1. Base:
 - a. Armstrong World Industries
 - b. Optional:
 - 1) USG.
 - 2) CertainTeed.
- C. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS - ACOUSTICAL SUSPENSION SYSTEMS

- A. Suspension Systems:
 - 1. Heavy duty systems, ASTM C635.
 - 2. Main runner jointing by spliced, interlocking ends, tab locks, pin locks, or other suitable connections.
 - 3. Cross runners interlocking with main runners.
- B. Hanger Wire:
 - 1. General:
 - a. Pre-stretched, with a yield stress load of at least 5 times design load, but not less than 0.106 IN (12 GA).
 - b. Utilize continuous lengths, without kinks and splices.
 - 2. Galvanized Steel:
 - a. Galvanized, soft annealed steel wire conforming to ASTM A641.
 - 3. Stainless Steel:
 - a. Type 304, soft annealed steel wire conforming to ASTM A641.
 - b. Use where aluminum ceiling grid is specified.
- C. Provide moldings wherever ceiling meets walls, partitions, other vertical elements, and other types of ceilings or ceiling fixtures. No additional trim is required at ceiling mounted fixtures with integral flange trim.
 - 1. Glazing Channel: At full height window provide Armstrong's Axiom Glazing Channel or approved equal.
 - 2. Transition Molding: At locations where underside of lay-in ceiling is scheduled to align with underside of bulkhead provide Armstrong's Acoustical and Drywall Transition Molding 7902 or approved equal.
- D. Attachment Devices:
 - 1. Anchors in Concrete:
 - a. Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to 5 times that imposed by ceiling construction, as determined by testing per ASTM E488 or ASTM E1512.



- b. Acceptable types: Cast-in-place, post-installed expansion anchors and post-installed bonded anchors.
 - c. Material: Carbon-steel components zinc plated to comply with ASTM B633, Class Fe/Zn 5 for Class SC 1 service condition.
 - 2. Power-Actuated Fasteners in Concrete:
 - a. Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E1190.
- E. Suspension systems
 - 1. CG-1: Exposed grid, non-rated:
 - a. Description: Galvanized, double web steel, main and cross runners.
 - b. Face width: 15/16 IN.
 - c. Base Product:
 - 1) Prelude XL, by Armstrong.
- F. Framing and suspension systems for Gypsum Board Ceilings:
 - 1. Specified in Section 09 22 16.

2.3 MATERIALS - CEILING TILES

- A. General: See interior Finish Legend for design standard manufacturer/product selections.
 - 1. Scheduled finishes to be factory applied.
 - 2. Class A incombustible units.
 - 3. Fire rated units (when used): UL labeled.
 - 4. Edges uniformly fabricated, true, square.
 - 5. Sizes as required to fit scheduled suspension system.
 - 6. Standard tile size: See Reflected Ceiling Plan.
 - 7. Adhesive shall have a VOC content no greater than 50 g/L.
 - a. Adhesives shall contain no carcinogen or reproductive toxicant components present at more than 1% of total mass of the product as defined in the California Office of Environmental Health Hazard Assessment's (OEHHA) list entitled Chemicals Known to the State to Cause Cancer or the Reproductive Toxicity, Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65).
 - 8. Sealants: VOC content No greater than 250 g/L.
 - a. Sealants shall contain no carcinogen or reproductive toxicant components present at more than 1% of total mass of the product as defined in the California Office of Environmental Health Hazard Assessment's (OEHHA) list entitled Chemicals Known to the State to Cause Cancer or the Reproductive Toxicity, Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65).
- B. Ceiling Tile – Mineral Fiber:
 - 1. Base:
 - a. Ultima by Armstrong.
 - 2. Surface Texture: Fine.
 - 3. Surface Finish: Factory applied acrylic latex paint on durabrite acoustically transparent membrane
 - 4. Light Reflectance (LR): ASTM E 1477; White Panel: Light Reflectance: 0.88.
 - 5. Lay-in style: Minimum 5/8 IN thick, refer to Interior Finish Legend on I101 for lay-in style.

2.4 FABRICATION

- A. Intersections between Main Tees and Cross Tees: Butt cut and notch as required.
- B. Perimeter Wall Angles:



1. Miter inside and outside corners.
- C. Include components and accessories necessary resist seismic loads and dead loads of items such as light fixtures and air diffusers.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify suitability of substrate to accept installation.
- B. Examine installation site for unevenness or irregularities that would affect quality and execution of work.
- C. Installation constitutes acceptance of responsibility for performance.

3.2 PREPARATION

- A. Consult other trades involved before start of ceiling work, to determine areas of potential interference.
- B. Coordinate ceiling layout with work penetrating acoustical ceiling systems.
- C. Coordinate with sprinkler head spacing.
- D. Do not start installation until interferences have been resolved.
- E. Look for specific layout dimensions noted on the drawings. If dimensions not noted then center grid in room in both directions. In healthcare projects, match light locations shown on the drawings. Notify the site Architect if there are any questions.

3.3 INSTALLATION TOLERANCES

- A. Comply with ASTM C635: Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
- B. Maximum deviation from level plane: Not to exceed 1/8 IN in 10 FT with no load applied.
- C. Maximum Bow: Not to exceed 1/32 IN in 2 FT.
- D. Maximum Camber: Not to exceed 1/32 IN in 2 FT.
- E. Maximum Twist: Not to exceed 1 Degree in 2 FT.

3.4 INSTALLATION - SUSPENSION SYSTEM - GENERAL

- A. Install suspension system in accordance with manufacturers' instructions.
- B. Grid layout: See Reflected Ceiling Plans.
 1. Install grid square with room and with grid center lines or acoustical panel center lines coinciding with center lines of room, each direction.
 - a. Acoustical panel dimension at perimeter walls: Not less than 6 IN.
 - b. In case of conflict with lighting plan, contact Architect.
- C. Do not use defective or damaged materials.
- D. Leave suspension system ready to accept installation of acoustic materials.

3.5 INSTALLATION – WALL ANGLES

- A. Install wall angles where ceilings meet walls, partitions, other vertical elements, and other types of ceilings.
 1. Secure wall angles to wall construction at stud locations.



- a. Maximum spacing from terminal ends: 3 IN.
- b. Draw fasteners tight against vertical surfaces.
2. Level tolerance: not more than 1 in 1000.
3. Miter cut inside and outside corners.
4. Install with leg supporting bottom flange of runners.
5. Provide transition molding in lieu of wall angles where lay-in ceiling is scheduled to be flush with adjacent bulkheads.

3.6 INSTALLATION – HANGER WIRES

- A. Provide hangers and inserts necessary to support ceiling suspension systems and ceiling dead loads.
- B. Coordinate location and alignment with work of other trades.
- C. Install hanger wires plumb to main tees and cross tees.
 1. Do not suspend any part of suspension system from ducts, pipes, conduit, equipment, cable tray, etc.
 2. Provide supplementary suspension system (ie. Trapeze) where necessary to support ceilings beneath pipes, ducts, equipment, etc. Trapeze method to be reviewed and approved by Architect.
 3. Splay hangers no greater than 30 degrees from vertical to avoid obstructions or other conditions that prevent plumb, vertical installation.
 4. Offset horizontal forces by bracing or counter splaying.
- D. Space hangers to prevent eccentric deflection and rotation due to loads from items in or on ceiling
 1. Provide additional hangers to support lighting fixtures.
 2. Provide additional hangers within 6 IN of end of main runners.
 3. Do not bear runners on walls or partitions.

3.7 INSTALLATION – MAIN RUNNERS

- A. Utilize wall angles to align and receive terminal ends of main tees without transferring load to Wall Angle.
- B. Space main tees as indicated, and as required to receive lay-in panels and fixtures.
- C. Support terminal ends of main tees by wires located within 6 IN from boundary walls.
- D. Suspend main tees from building superstructure with hanger wires specified.
- E. Stagger splices in adjacent main runners.

3.8 INSTALLATION – CROSS RUNNERS

- A. Space cross tees as indicated, and as required to receive lay-in panels and fixtures.
 1. Install cross runners with a positive interlock.
- B. Utilize wall angles to align and receive terminal ends of Cross Tees without transferring load to Wall Angle.
- C. Support terminal ends of cross tees by wires located within 6 IN from boundary walls.
- D. Suspend main tees from building superstructure with hanger wires specified.

3.9 INSTALLATION – LAY-IN ITEMS

- A. Install acoustic materials into suspension system in accordance with manufacturer's instructions.
- B. Install lay-in panels, fixtures, diffusers, grilles, and similar items in a manner that will not compromise performance of the suspension system.



1. Provide supplemental hangers for fixtures which exceed manufacturer's published load data.
 - a. Supplemental hanger systems shall be approved by Building Official.
- C. Field cut as required to fit materials to grid.
- D. Make cuts square and true.
- E. Do not install damaged units.
- F. Replace damaged tiles. Use of color match sprays or sealants not allowed.

3.10 CLEANING

- A. Perform cleaning and replacement of defective units in time to avoid delay in progress of work and before final completion of work.
- B. Carefully clean soiled surfaces.
- C. Remove and replace irregular, discolored, defective or damaged components at no additional expense to Owner.
- D. Plan for an allowance to replace damaged ceiling tiles from trade damage.

3.11 PROTECTION

- A. Protect installed materials from damage.

3.12 SCHEDULE OF CEILING TILES

- A. See Interior Finish Legend Drawing I101.

END OF SECTION

SECTION 09 65 16

RESILIENT SHEET FLOORING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Sheet Vinyl Flooring (SV), as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Applicator Qualifications:
 - 1. Experienced in installation of sheet flooring using heat welded seems.
- B. ASTM International (ASTM):
 - 1. ASTM D2047 Standard Test Method for Static Coefficient of Friction of Polish Coated Flooring Surfaces as Measured by the James Machine.
 - 2. ASTM E648 Standard Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.
 - 3. ASTM E662 Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials.
 - 4. ASTM F970 Standard Test Method for Static Load Limit.
- C. National Fire Protection Association (NFPA):
 - 1. NFPA 253 Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.
 - 2. NFPA 258 Recommended Practice for Determining Smoke Generation of Solid Materials.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Seaming Diagram.
- B. Product Data:
 - 1. Manufacturer's product data indicating adhesives comply with applicable VOC regulations.
- C. Samples:
 - 1. Submit samples for following items as specified in Drawing Finish Schedule.
 - 2. Three samples of each sheet goods selected.
- D. Contract Closeout Information:
 - 1. Warranty
 - 2. Maintenance data:
 - a. See Section 01 78 23.
 - 3. Interior finish fire performance data:
 - a. Provide for each finish material and type specified:
 - 1) Manufacturer's printed information including:
 - a) Fire class.
 - b) NFPA test number.
 - c) Photograph.
 - 2) Proof of purchase.



- 3) See Section 01 78 26.

1.4 WARRANTY

- A. Provide written warranty that material will be free from manufacturing defects for a period of five (5) years from date of purchase.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Sheet Vinyl Flooring (SV):
1. Base:
 - a. Mannington Commercial Resilient .
- B. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 DESIGN CRITERIA

- A. Fire and Smoke Rating:
1. Critical Radiant Flux, per ASTM E648 / NFPA 253:
 - a. Class I, not less than 0.45 W/cm².
 2. Smoke Developed: 450 or less per ASTM E662 / NFPA 258.

2.3 MATERIALS

- A. Resilient Sheet Vinyl (SV) flooring:
1. Solid polyvinyl chloride sheet floor covering, minimum 0.080 IN overall thickness.
 2. ASTM Standard:
 - a. ASTM F1913.
 3. Static coefficient of friction: 0.6.
 4. Static Load Limit:
 - a. 750 PSI.
- B. Integral Cove Base:
1. Height: 6 IN.
 2. Metal cove cap strip:
 - a. Material: Aluminum or not corrosive metals suitable for conditions.
 - b. Static Conductive applications: Properly ground metal caps or use Plastic Caps.
 - c. MRI Rooms: Use Plastic Caps (in lieu of metal) for MRI Scan Rooms.
- C. Sealers:
1. Provide sealers as recommended by flooring manufacturer.
- D. Adhesive:
1. Provide adhesives as recommended by flooring manufacturer.
- E. Adhesive, hard-set polyurethane or epoxy:
1. Hard-setting product recommended by flooring manufacturer to assure adhesion.
- F. Leveling Compound:
1. Cementitious type as recommended by flooring manufacturer.
 2. Verify compatibility with moisture content of concrete.



PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine surfaces for defects, irregularities and conditions under which flooring is to be installed.
- B. Verify substrates are free of materials that may affect adhesion.
- C. Identify cracks and other surface defects which need repair prior to application of floor system.
- D. Inspect substrate for markers, paint and similar materials used for layout by others and take remedial action as necessary to remove layout line work to prevent bleed-through.
- E. Verify floors are level or meet indicated slope.
- F. Do not proceed with installation until unsatisfactory conditions have been corrected.
- G. Installation indicates acceptance of substrates and responsibility for performance.

3.2 PREPARATION

- A. Coordinate installation with requirements of Section 07 16 04 Concrete Floor Moisture Testing, and Section 07 16 05 Water Vapor Emission Control System.
- B. Prepare substrate in accordance with manufacturer's instructions.
- C. Fill construction joints and other non-moving joints with product approved by manufacturer of flooring system.
- D. Where necessary fill or level floors with leveling compound and feather minimum 4 FT- 0 IN.
- E. Coordinate leveling with vapor emission control system provider.

3.3 INSTALLATION

- A. Apply flooring in accordance with manufacturer's printed instruction.
- B. Utilize hard set adhesive in the following rooms:
 - 1. Surgery, OR, Delivery Rooms and Procedure Rooms.
 - 2. Other areas indicated.
 - 3. Utilize conventional adhesive in remaining locations.
- C. Install flooring and base as indicated for rooms:
 - 1. Include area under and behind equipment.
 - 2. Provide integral coved base for walls, columns, pilasters, furred spaces, and casework, etc.
- D. Minimize accumulation of air contaminants that cannot be removed prior to occupancy.
- E. Install after wall finishes.
- F. Provide sheets in one room or area from one production run.
- G. Install in maximum possible sizes.
- H. Install in adhesive with accurate, tight seams.
- I. Weld to adjacent vinyl sheet flooring and weld joints between sheets.
- J. Remove excess rod with sharp knife and buff to match adjacent surfaces.
- K. Locate transition strip directly under door when in closed position where seam occurs in door openings.



- L. Utilize transition strip specified in respective section where abutting materials are carpet, ceramic tile, quarry tile, stone tile and similar.
- M. Where sheet vinyl flooring abuts thicker finish flooring materials, feather leveling compound for approximately 12 IN for each 1/8 IN of rise so finished surfaces align.

3.4 PROTECTION

- A. Restrict heavy traffic for 48 HRS.
- B. Do not expose to water for 30 days.
- C. Protect floors from rolling loads by covering with hardboard or plywood.
- D. Protect the floor with un-dyed, untreated building paper until final inspection.

3.5 CLEANING

- A. When final building cleanup is being accomplished clean flooring and base in accordance with manufacturer's instructions.

END OF SECTION

SECTION 09 91 23 INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Interior Painting, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Comply with Intermountain Healthcare Construction Standards, December 31, 2018 edition. Paint material shall be confirmed with the Facility to verify matching of materials in stock.
- B. Definitions:
 - 1. "Paint" and "painting" refer to applied coatings.
 - 2. Finished room or space: Room or space indicated to receive a finish on Drawing **I101J** Interior Finish Plans.
 - 3. Mechanical work: Work included in Mechanical Specification Divisions.
 - 4. Electrical work: Work included in Electrical Specification Divisions.
- C. Work Included:
 - 1. Interior surfaces in finished rooms or spaces, unless indicated not to be painted or indicated to be painted under other sections.
 - 2. Mechanical and electrical work:
 - a. Interior, **visible** mechanical and electrical equipment not completely factory finished.
 - b. In finished rooms and spaces: Exposed ductwork, piping, insulated piping, conduit, busways, raceways, and associated accessories.
 - c. Where duct surfaces are visible through grilles or diffusers, paint interior surfaces of ducts flat black.
 - 3. Above ceiling wall type stencils.
- D. Work Not Included:
 - 1. Do not paint operable mechanical or plumbing items.
 - 2. Do not paint electrical conduit, boxes etc.
 - 3. Do not paint any wire. Non-compliance is subject to wire replacement at the discretion of the Owner.
 - 4. Do not paint firestop sealant.
 - 5. Do not paint labels of any kind.
- E. Standard of workmanship: Before proceeding, finish following items with specified materials for approval as standard of quality for completed work:
 - 1. One room in each basic color scheme.
 - 2. One area or item of each color.
- F. Environmental Standards:
 - 1. Green Seal GS-11, Paints.
 - 2. Green Seal GS-03, Anti-Corrosive Paints.
 - 3. South Coast Air Quality Management District, Rule 1113, VOC content limits for Clear Wood Finishes, Floor Coatings, Stains and Shellacs.



4. ASTM D2486, Standard Test Method for Scrub Resistance of Interior Latex Flat Wall Paints.
5. ASTM D2805, Standard Test Method for Hiding Power of Paints by Reflectometry.

1.3 SUBMITTALS

- A. Product Data:
 1. Manufacturer's data for each paint type to be applied indicating conformance to specifications.
- B. Samples:
 1. Three 8 1/2 IN x 11 IN samples of each color and finish as noted in Drawing **I101J** Interior Finish Legend.
- C. Contract Closeout Information:
 1. Maintenance data:
 - a. See Section 01 78 23.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Provide paint as product of one manufacturer as far as possible.
- B. Paint, stain, and coating systems listed are Sherwin Williams unless noted otherwise.
 1. Use comparable performance, environmental, and aesthetic requirements for paints by Optional manufacturers.
 2. Manufacturers listed in Room Finish and Color Schedule are for color reference only.
 3. Use MPI rating for comparison.
- C. Paints shall not contain cadmium or lead.
- D. Paints:
 1. Base:
 - a. Sherwin-Williams – Single Source Provider
 - b. As noted on Drawing I101J.
- E. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Paints and Stains:
 1. As Scheduled in Part 3.
 2. Unscheduled items: Bring to the attention of Architect.
 3. Colors: As noted in Interior Finish Schedule.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine surfaces for defects and correct to prevent unsatisfactory results.
- B. Verify compatibility of intermediate and topcoat finishes applied over surfaces primed by others.
- C. Commencement of work constitutes acceptance of surfaces and responsibility for performance.



- D. Do not paint items having complete factory finish with exception of items noted in Drawing I-001 Interior Notes and Finish Legend.

3.2 PREPARATION

- A. Verify surfaces are clean, dry and free of foreign materials which will affect adhesion or appearance.
- B. Remove mildew and neutralize surface.
- C. Eliminate efflorescence before painting.
- D. Prior to painting, test surfaces with moisture meter.
 - 1. Paint when moisture is within paint manufacturer's acceptable limits.
 - 2. Move furniture, furnishings, equipment and other items as required to paint existing surfaces.
 - a. Coordinate storage location with Owner.
 - b. Coordinate mechanical, electric or plumbing service interruptions with other trades and Owner.
 - c. Replace furniture, furnishings and equipment to original location.
- E. Wood:
 - 1. Sand surfaces receiving finish with 180-grit, or finer sand paper.
 - a. Remove fingerprints and marks.
 - b. Produce smooth texture.
 - c. Prepare grain to receive finish.
 - 2. Remove dust.
 - 3. Opaque Finishes:
 - a. Back prime wood trim with penetrating sealer.
 - b. Seal knots, pitch and resinous sapwood.
 - 4. Stain and Clear Finishes:
 - a. Treat wood with compatible washcoat prior to stain application.
 - b. Putty nail holes and minor defects, to match finish wood color.
- F. Ferrous Metal and Hollow Metal:
 - 1. Follow requirements of SSPC SP1 and SP3 except where higher preparation levels are indicated.
 - 2. Wire brush, or grind as necessary to remove shoulders at edge of sound paint to prevent telegraphing.
 - 3. Touch up damaged shop coats.
 - 4. Caulk hollow metal frame joints, corner seams, intersections of rabbets, stops, and soffit joints prior to painting.
- G. Galvanized Metal and Non-anodized Aluminum:
 - 1. Follow requirements of SSPC SP1 except where higher preparation levels are indicated.
 - 2. Treat surfaces with galvanized surface cleaner as recommended by primer and topcoat manufacturer.
- H. Gypsum Wallboard:
 - 1. Repair minor irregularities.
 - 2. Avoid raising nap of paper.
 - 3. Apply prime coat.
 - 4. Correct areas showing defects after application of primer.
 - 5. Re-prime refinished areas.
- I. Concrete and Masonry:
 - 1. Repair minor defects.



2. Remove oil from concrete.
3. Block Filler:
 4. Comply with manufacturer's recommended coverage rates for conditions encountered.
 5. Provide complete cover with recommended coating system.
 6. Fill pinholes and minor surface defects.
 7. Apply by brush, roller or sprayer.
 - 1) Back-roll spray applied filler with roller or squeegee.

3.3 APPLICATION

- A. Remove and protect hardware, accessories, plates, fixtures, finished work, and similar items, or provide ample in place protection.
- B. Touch up abraded areas of shop prime coats, suction or hot spots in plaster, gypsum wallboard, concrete block, and concrete before painting.
- C. Provide coverage to hide.
 1. Evenly spread and smoothly flow on for full, smooth cover.
 2. Apply additional coats where undercoats show until paint film is of uniform finish and color.
- D. Back prime wood trim with penetrating sealer.
- E. Apply additional coats in accordance with manufacturer's instructions.
- F. Finish closets and semi-exposed surfaces to match nearest adjoining surfaces.
 1. Include surfaces behind grills.
- G. Upon completion of painting, replace removed items and remove protection.

3.4 PROTECTION AND CLEANUP

- A. Provide WET PAINT signs.
- B. Protect adjacent work from damage by painting and finishing work.
- C. Remove temporary protective wrappings, after completion of operations.
- D. Clean, repair or replace, and repaint damaged work.

3.5 SCHEDULE - INTERIOR PAINT SYSTEMS

- A. Gypsum wallboard, walls & ceilings:
 1. Latex Semi-Gloss Finish - Low Odor – 0 VOC:
 - a. Sherwin-Williams:
 - ➔ 1st Coat: ProMar 200 zero VOC Primer, B28W-2600
 - 2) 2nd Coat: ProMar 200 zero VOC Semi-Gloss, B31-2600
 - ➔ 3rd Coat: ProMar 200 zero VOC Semi-Gloss, B31-2600
- B. Metal stairs, handrails, and guardrails; Miscellaneous metals (ferrous, primed, zinc-coated, and aluminum):
 1. Water based urethane, Gloss Level 6 Gloss.
 - a. Sherwin Williams:
 - 1) Primer coat: Recommended by topcoat manufacturer for each substrate.
 - 2) Intermediate coat: Acrolon 218 HS Acrylic Polyurethane, B65-600 Series.
 - 3) Topcoat: Acrolon 218 HS Acrylic Polyurethane, B65-600 Series.
- C. Duct surfaces visible through grilles or diffusers:
 1. Interior Latex Gloss Level 1 Flat:
 - a. Sherwin Williams:



- 1) Primer: Pro-Cryl Universal Primer, B66-310 Series.
 - a) Color: Gray.
 - 2) Topcoat: ProMar 400 Interior Latex Flat, B30W400 Series.
 - a) Color: Flat Black.
- D. Metal doors and frames:
1. Waterborne acrylic, Gloss Level 5 Semi gloss:
 - a. Sherwin Williams:
 - 1) Primer coat: Recommended by topcoat manufacturer for each substrate.
 - 2) Intermediate coat: Pre-Catalyzed Waterbased Epoxy, K46-150 Series.
 - 3) Topcoat: Pre-Catalyzed Waterbased Epoxy, K46-150 Series.
- E. Structural steel, exposed:
1. Water based urethane, Gloss Level 6 (Gloss):
 - a. Sherwin Williams:
 - 1) Primer coat: Recommended by topcoat manufacturer for each substrate.
 - 2) Intermediate coat: Acrolon 218 HS Acrylic Polyurethane, B65-600 Series.
 - 3) Topcoat: Acrolon 218 HS Acrylic Polyurethane, B65-600 Series.
 - a) Clear coat: Diamond-Clad Clear Coat Urethane, B65 Series.

3.6 SCHEDULE – INTERIOR PAINTING OF SMOKE CONTAINMENT COMPONENTS

- A. This article pertains to certain items specified in Smoke Containment Systems.
1. Paint items as scheduled.
 2. Utilize spray application, with approved high temperature paint not exceeding 5 mil DFT.
 3. Obtain written application instructions from manufacturer of Smoke Containment System.

END OF SECTION

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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 Sherwin Williams Paint 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 Intermountain Healthcare - related projects
- Upon opening an Intermountain Healthcare 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):_____

Intermountain Healthcare Job Account number (To be assigned):_____

Name and Address of Intermountain Healthcare 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.)_____





DIVISION 10

SPECIALTIES



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SECTION 10 26 00
WALL PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Wall Protection Specialties, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Single Source Responsibility:
 - 1. Provide components of the wall protection system manufactured by same company to ensure compatibility of color, texture and physical properties.
- B. ASTM International (ASTM):
 - 1. ASTM B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
 - 2. ASTM D1308 Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes
 - 3. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials
- C. American Architectural Manufacturers Association (AAMA):
 - 1. AAMA 611 Voluntary Specification for Anodized Architectural Aluminum

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Show locations, extent and installation details of handrails, crashrails, wall guard and corner guards.
 - 2. Show methods of attachment to adjoining construction.
- B. Product Data:
 - 1. Manufacturer's standard literature indicating systems and products specified.
- C. Samples:
 - 1. Material samples of each color and texture listed for wall protection in Interior Finish Legend (Drawing sheet I101J).
- D. Contract Closeout Information:
 - 1. Maintenance data.
 - 2. Interior finish fire performance data for each item and type specified:
 - a. Manufacturer's printed information including:
 - 1) Fire class.
 - 2) NFPA test number.
 - 3) Photograph.
 - 4) Proof of purchase.



PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Wall Protection Specialties:
 - 1. Base:
 - a. Koroguard.
- B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. The following general material requirements apply to polyester resin wall protection devices.
 - 1. Cover Material:
 - a. High-impact, rigid polyester resin, homogeneous color throughout entire thickness, free of embedded foreign material, and having a blemish free surface.
 - 2. Retainer assemblies:
 - a. Class II anodized 6063-T6 aluminum.
 - 3. Pre-fabricated, color-matched end caps
 - a. Rigid polyester resin.
 - b. Mechanically secured with concealed fasteners.
 - 4. Prefabricated gasket with aluminum sub-base.
 - 5. Fasteners:
 - a. Non-corrosive and compatible with aluminum retainers and wall construction.
 - 6. Resistant to alkali, chemicals, cleaning agents and light.
 - 7. Color match wall protection components.
 - 8. Fire performance characteristics:
 - a. UL-listed, Class A
 - b. Flame Spread Index: Less than 25.
 - c. Smoke Developed: Less than 450.

2.3 2-PIECE CORNER GUARDS (CG)

- A. 0.078 IN thick, high-impact, rigid polyester material with end caps.
- B. Continuous extruded aluminum retainers.
- C. Impact resistance: 18 LB/IN width.
- D. Furnish custom angled units where corners are less or greater than 90 degrees.
- E. At terminal end of walls less than 8 IN thick, use 2 IN x 2 IN corner guards with wall guard sheet of same height between corner guards.
- F. Surface-mounted Polyester Resin Corner Guards:
 - 1. G200 Series by Koroguard.
 - 2. Size: 3 IN x 3 IN
 - 3. Nose Radius: 1/4 IN.
 - 4. Color, Pattern and Texture: as noted on Drawing I101J: Interior Finish Legend.
 - 5. CG-1 Overall Height 48 IN.

2.4 SHEET WALL PROTECTION (SWP)

- A. Sheet Wall Protection (SWP) and accessories:
 - 1. Protective Wallcovering by Koroguard.
 - a. High-impact, polyester resin.
 - b. Sheet Thickness: 0.060 IN.
 - 2. Color, Pattern and Texture: As noted in Drawing I101J Interior Finish Schedule.



3. Include prefabricated trim items:
 - a. Inside and outside corners.
4. Include appropriate primers, adhesives, and sealants.
 - a. Adhesives shall have a VOC content no greater than 70 g/L.
 - b. Sealants shall have a VOC content no greater than 250 g/L.
 - c. Adhesives and sealants shall contain no carcinogen or reproductive toxicant components present at more than 1 percent of total mass of the product as defined in the California Office of Environmental Health Hazard Assessment's (OEHHA) list entitled "Chemicals Known to the State to Cause Cancer" or the Reproductive Toxicity, Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify walls are in proper condition to receive installation of protection items.
- B. Correct unsatisfactory conditions.
- C. Coordinate installation of backing required for wall protection specialties scheduled.
- D. Commencement of installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's recommendations.
- B. Install with fasteners suitable for wall substrates encountered, and provide adequate anchoring for anticipated impact loads.
- C. Install items where indicated.

3.3 INSTALLATION - CORNER GUARDS

- A. 2-piece Corner Guards (CG) – Surface-mounted type:
 1. Unless otherwise indicated: Align bottom edge of corner guards with top of wall base.
 2. Fasten retainers to corners.
 3. Mount caps so they overlap retainers.
 4. Snap covers into place.
 5. Install endcaps.

3.4 INSTALLATION –SHEET WALL PROTECTION

- A. Prepare substrates as required to receive sheet wall protection.
- B. Install in accordance with manufacturer's recommendations.
- C. Where items mounted in wall are surrounded by sheet wall protection, trim to fit behind flanges and cover plates.
- D. Where items mounted in wall are partially surrounded by sheet wall protection, trim to abut edges of flanges and cover plates.
- E. Preparation – SWP over New Gypsum Wallboard:
 1. Ensure new drywall has been taped and sanded smooth.
 2. Wipe clean to remove dust.
- F. Preparation – SWP over Painted Surfaces:
 1. Test for adhesion using 12 x 12 IN piece of SWP in an inconspicuous area.



- a. If the painted walls are drywall, test over a joint compound location if possible.
 2. After allowing the sample to set for 24 hours, remove the test piece and examine the area.
 3. If the paint has softened where the adhesive was applied:
 - a. Seal painted surfaces with Water Base Mastic Primer acceptable to manufacture of SWP material.
- G. Wainscot partial-height installations where indicated:
1. Start bottom edge at floor line and install prior to installation of Wall Base.
 - a. Install Wall Base over sheet wall protection.
 2. Install sheets horizontally to top of wainscot height and terminate with color coordinated sealant.
 3. Top of Wainscot Height:
 - a. 48 IN AFF (unless otherwise indicated).
 4. Install wall guard with matching color sealant along top edge of panels.
 5. Vertical Joints:
 - a. Install wall guard with butted joints and matching colored sealant at vertical wall joints.
 - b. Joint width: 1/16 IN.
 - c. Install 2-piece Corner Guard, CG1, at outside corners. Match wainscot height.
- H. Sealant:
1. See Section 07 92 16.
 2. Seal to adjacent finish materials including top edge, lateral edges and bottom edge.
 3. Sealants shall have a VOC content no greater than 250 g/L.
 4. Sealants shall contain no carcinogen or reproductive toxicant components present at more than 1% of total mass of the product as defined in the California Office of Environmental Health Hazard Assessment's (OEHHA) list entitled "Chemicals Known to the State to Cause Cancer" or the Reproductive Toxicity, Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65).

3.5 ADJUSTING AND CLEANING

- A. Adjust installed end caps as necessary to ensure tight seams.
- B. Remove and replace defective, misaligned or damaged units.
- C. Verify wall protection items are plumb and rigidly secured to substrate; make adjustments required.
- D. Remove protective films.
- E. Clean items adjacent areas, using materials and methods recommended by manufacturer.

3.6 PROTECTION

- A. Protect installed materials to prevent damage by other trades.

END OF SECTION





DIVISION 11

EQUIPMENT



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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 furnished items will be provided by Intermountain in schedule form and will denote items the contractor is responsible for.
 2. Owner to receive and store new equipment. Contractor to obtain such equipment from Owner's storage location, deliver to site and install.
 3. Deliver to site in manufacturer's original labeled containers.
 4. Protect exposed surfaces and edges until work is completed.
 5. Contractor to provide fasteners, supports, or other miscellaneous items necessary for complete installation, not provided by equipment manufacturer.
 6. Owner to provide Contractor with rough-in and installation Drawings of purchased equipment.
 7. Delivery place and time to be determined by Owner but not necessarily during normal working hours.
- C. Contractor Installed - Owner furnished existing equipment:
 1. Owner furnished items will be provided by Intermountain in schedule form and will denote items the contractor is responsible for.
 2. Contractor disconnect, remove, store and install such equipment in same manner as new equipment. Replace fasteners or supports as required.
 3. 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

2.1 ACCEPTABLE MANUFACTURERS

- A. Hospital equipment: As noted for individual items.
- B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 EQUIPMENT SCHEDULE

1. Owner furnished items will be provided by Intermountain in schedule form and will denote items the contractor is responsible for.

2.3 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.

2.4 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.

2.5 OWNER INSTRUCTION

- A. Perform instruction of Owner personnel.

END OF SECTION



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DIVISION 12

FURNISHINGS



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SECTION 12 32 00

ARCHITECTURAL CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Architectural Casework (AC), as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.
 - 1. Coordinate with Modular Furniture System (MFS) being provided under a separate contract with the Owner.

1.2 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Manufacturer or manufacturer's authorized representative.
- B. AWI Architectural Woodwork Standards (AWS), Current Edition.
 - 1. Grade: Premium, with exceptions indicated.
 - 2. Exposed cabinet body edges are to be fabricated flush before and after installation of edge banding.
- C. ASTM D1037 Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials.
- D. ANSI 208.1: Particleboard.
- E. ANSI 208.2: MDF for Interior Applications.
- F. Composite Panel Association listed NAUF (No Added Urea-Formaldehyde).

1.3 WALL CABINET LOAD TESTING

- A. Test is to be conducted by independent testing agency.
- B. Test Units and Set-up:
 - 1. Wall cabinet unit:
 - a. 12 IN deep x 36 IN wide x 36 IN tall with 2 intermediate shelves.
 - 2. Wall assembly:
 - a. 25 GA metal studs with 5/8 IN thick gypsum wallboard.
 - 3. Construct cabinet and wall in manner which is representative of how walls will be built for project, including specified wall backing.
 - 4. Attach test cabinets to test wall in same method proposed for project.
 - 5. Take accurate measurements of unloaded cabinet prior to beginning tests.
- C. Required Tests:
 - 1. Test 1 - Intermediate Shelves:
 - a. Uniformly load each intermediate shelf with 100 PSF.
 - b. Measure deflection when fully loaded and inspect for component failure.
 - c. Remove load and re-inspect.
 - 2. Test 2 - Bottom Shelf:
 - a. Uniformly load with 200 PSF.
 - b. Measure deflection when fully loaded and inspect for component failure.
 - c. Remove load and re-inspect.
 - 3. Test 3 – All Shelves:



- a. Uniformly load each intermediate shelves with 100 PSF.
- b. Simultaneously apply a uniform load of 200 PSF to the bottom shelf.
- c. Measure deflection when fully loaded and inspect for component failure.
- d. Remove load and re-inspect.
4. Test 4 - Lateral load test (Perpendicular to wall):
 - a. Uniformly load bottom shelf and each intermediate shelf with 100 PSF.
 - b. Apply horizontal force, perpendicular to the wall, at center line of weight distribution in an attempt to pull cabinet off wall.
 - 1) Magnitude of Horizontal load: 0.5 x total weight of loaded cabinet.
 - c. Measure movement under load and inspect for component failure.
 - d. Remove horizontal load and re-inspect.
5. Test 5 - Lateral load test (Parallel to wall):
 - a. Uniformly load bottom shelf and each intermediate shelf with 100 PSF.
 - b. Apply horizontal force, parallel to the wall, at center line of weight distribution in an attempt to shear cabinet from wall.
 - 1) Magnitude of Horizontal load: As indicated in Test 4.
 - c. Measure movement under load and inspect for component failure.
 - d. Remove horizontal load and re-inspect.
- D. Test Results and Reporting:
 1. At end of each test there shall be no permanent deformation or damage or failure of anchorage.
 2. Submit report.

1.4 SUBMITTALS

- A. Shop Drawings:
 1. Plans of casework at 1/8 IN = 1 FT or larger.
 2. Elevations of casework at 1/4 IN = 1 FT or larger.
 3. Cross reference shop drawings to Contract Documents casework elevations.
- B. Product Data:
 1. Typical details of casework construction.
 2. Reports indicating favorable outcome to Wall Cabinet Load Testing.
- C. Samples:
 1. Sealant colors for selection.
 2. Plastic laminate.
 3. Hardware.
 4. Edge banding.
- D. Project Information:
 1. The apparent successful bidder shall provide the following prior to submittal of Shop Drawings:
 - a. Sample of finished base cabinet unit, 18 IN wide minimum, with one drawer, door and shelf, complete with hardware conforming to requirements.
 - b. Catalog of standard units detailing construction and assembly of components.
 - c. If not acceptable, construct additional sample cabinets.
 - d. Sample cabinet constitutes standard of quality for actual construction.
 - e. Maintain approved sample at job office during construction, as basis for Architect's acceptance of remainder of work.
- E. Supply and install fully finished casework shown for Prototype Room.
 1. Casework shall be subject to review and final approval by Architect and Owner.
 2. Do not commence with production of balance of casework until final approval is obtained.
 3. Changes made during review period shall be incorporated in to production casework.



4. Refer to Section 01 43 41 Prototype Patient Rooms for additional information.
- F. Contract Closeout Information:
 1. Warranty.
 2. Operating and Maintenance data.
 - a. See Section 01 78 23.

1.5 WARRANTY

- A. Manufacturer five (5) year warranty against defects in materials and workmanship, such as but not limited to delamination, swelling, or warping.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Architectural Casework:
 1. Huetter Mill and Cabinet Company
 2. Granite Mill and Furniture Company
 3. Fetzer's Architectural Millwork
 4. Hurco Design and Manufacturing
 5. Johnson Brothers, Idaho
 6. Artistic Mill
- B. Plastic Laminate: See Finish Schedule on I101J.
- C. Contact Adhesive:
 1. Base:
 - a. Wilsonart.
 - b. Laminart.
- D. Wood Glue:
 1. Base:
 - a. Franklin (TiteBond).
 - b. Wilsonart (Lokweld).
- E. Low Pressure Decorative Laminate (LPDL) Panels:
 1. Base:
 - a. Casework Manufacturer.
 2. Optional:
 - a. Uniboard.
- F. Medium Density Fiberboard:
 1. Base:
 - a. Sierra Pine.
 2. Optional:
 - a. Georgia Pacific.
 - b. Uniboard.
- G. Cabinet Hardware:
 1. Base:
 - a. Accuride.
 - b. Epco.
 - c. Hafele.
 - d. Blum.
 - e. Knape & Vogt.
 - f. Grant.



- g. National Lock.
 - h. Ilco Unican Corporation.
 - i. Stanley Hardware.
 - j. Stylmark.
 - k. HEWI.
 - l. LSI America.
 - m. TMI Systems Design.
 - n. Rockford Process Control.
 - o. U.S. Futaba.
 - p. Weber Knapp Company.
 - q. CCL Security Products.
 - r. Schlage Lock.
 - s. Olympus Lock.
 - t. Sugatsune America.
 - u. Colson Caster Corporation.
 - v. AllenField.
- H. PVC Edge Banding:
- 1. Base:
 - a. Doellken-Woodtape.
 - 2. Optional:
 - a. Rehau.
 - b. Charter Industries.
 - c. Canplast.
- I. Sealant:
- 1. Base:
 - a. See Section 07 92 16.
- J. Miscellaneous items:
- 1. Products and Manufacturers as listed.
- K. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. General:
- 1. FSC certified wood components.
 - 2. No Added Urea Formaldehyde (NAUF) in materials or fabrication.
- B. Medium Density Fiberboard (MDF):
- 1. ANSI A208.2 Grade 155 MR50.
 - 2. Exterior grade.
 - 3. 48 PCF density.
 - 4. Base: Medex by Sierra Pine.
 - 5. Core material for counters, backsplash, and sidesplashes with sinks.
 - 6. Core material for p-lam faced window sills where indicated.
- C. Plastic Laminate Facings:
- 1. Standard: NEMA LD3.
 - 2. NEMA LD3, Impact rated at 43IN when adhered to MDF.
 - 3. Thickness and Grade:
 - a. Formed surfaces: Post form Grade-HGP, 0.048 IN thick.
 - b. Other exposed surfaces: Grade-VGS, 0.028 IN thick.
 - 4. Backer Sheets for laminated items.
 - a. Semi-exposed cabinet liner: Grade-CLS, 0.020 IN thick; color to match LPDL.



- b. Concealed backer sheet: Grade-CLS, 0.020 IN thick; any color.
- 5. Product as shown on sheet I-001J: Interior Finish Legend.

- D. Low Pressure Decorative Laminate:
 - 1. Resin impregnated 80 gram paper overlay, heated and fused onto substrate.
 - 2. Material: Polyester or melamine; phenolic resin may be used on concealed surfaces.
 - 3. NEMA LD3, Grade-VGL requirements.
 - 4. NEMA LD3, Impact rated at 15 IN when adhered to MDF.
 - 5. Finish: Satin.
 - 6. Color:
 - a. As selected by Architect from manufacturer's standard color line.

- E. PVC Edge-banding:
 - 1. Machine applied with waterproof hot-melt adhesive.
 - 2. Edge of case body and exposed components:
 - a. Thickness: 1mm.
 - b. Color: To match case exterior.
 - 3. Edge of shelves inside plastic laminate clad units:
 - a. Thickness: 1mm.
 - b. Color: To match shelf.
 - 4. Edges of doors and drawer fronts, exposed finished shelves and removable panels:
 - a. Thickness: 3mm.
 - b. Color: To match exterior face of panel.

- F. Contact Adhesives:
 - 1. Description:
 - a. Viscosity: 760 cps.
 - b. Density: 7.7 Lbs/gallon.
 - c. Solids content: 36 percent +/- 1 percent.
 - d. VAHP content: None.
 - 2. Contact adhesives shall have a VOC content no greater than 80g/l.
 - 3. Adhesives shall contain no carcinogen or reproductive toxicant components present at more than 1 percent of total mass of the product as defined in the California Office of Environmental Health Hazard Assessment's (OEHHA) list entitled "Chemicals Known to the State to Cause Cancer" or the Reproductive Toxicity, Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65).

- G. Wood Glue:
 - 1. Description:
 - a. Bond Strength per ASTM D905: 4,000 psi. at room temperature.
 - b. ANSI/HPVA Type I water resistant.
 - c. Application temperature: Above 47 degF.
 - d. FDA approved for indirect food contact.
 - e. Wood glue adhesives shall have a VOC content no greater than 30 g/L.
 - f. Adhesives and sealants shall contain no carcinogen or reproductive toxicant components present at more than 1 percent of total mass of the product as defined in the California Office of Environmental Health Hazard Assessment's (OEHHA) list entitled "Chemicals Known to the State to Cause Cancer" or the Reproductive Toxicity, Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65).

- H. Sealant:
 - 1. Description:
 - a. Silicone sealant in colors matching components.
 - b. See Section 07 92 16.



- c. Sealants shall have a VOC content of no greater than 250 g/L.
- d. Sealants shall contain no carcinogen or reproductive toxicant components present at more than 1% of total mass of the product as defined in the California Office of Environmental Health Hazard Assessment's (OEHHA) list entitled "Chemicals Known to the State to Cause Cancer" or the Reproductive Toxicity, Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65).
- 2. Colors:
 - a. Colors as required to match Plastic Laminate, Stone, Wood, Solid Surfacing and other materials specified for casework bodies, countertops and splashes.
 - b. Architect to select from no less than 400 standard color choices.
 - c. Number of different colors required for project shall not be limited.
- 3. Base Product:
 - a. Solid Colors: Color-Sil by Color Rite; 100% Silicone, no suspended particles.
 - b. Architect to select final colors and locations during submittals phase.

2.3 CABINET HARDWARE

- A. Concealed Hinges.
 - 1. Base Product: CLIP Top Series by Blum.
 - 2. All metal heavy-duty construction.
 - 3. Finish: Nickel plated.
 - 4. Independent 3-dimensional adjustment.
 - 5. Open Angle: 170 degrees typical. Provide 90 degree hinges at perpendicular walls and cabinets.
 - 6. Self-closing.
 - 7. Passed 200,000 cycle test.
- B. Drawer Slides:
 - 1. Nylon wheels/rollers, stainless steel or polymer ball bearings, positive closing and pull out stops, drawer removable without use of tools.
 - 2. Full extension, side-mounted.
 - 3. Capacity:
 - a. Standard Drawers (other than types listed below): 100 LBS.
 - b. File Drawers: 150 LBS.
 - c. Lateral Files:
 - 1) Less than 42 IN wide: 200 LBS.
 - 2) 42 to 48 IN wide: 400 LBS.
 - 4. Slides for use at Magnetic Resonance Imaging (MRI):
 - a. Comply with requirements above and following:
 - 1) Type 304 stainless steel construction with nylon wheels/rollers, stainless steel or polymer ball bearings, positive closing and pull out stops, drawer removable without use of tools.
 - 2) Fasteners: Type 18-8 or 316 stainless steel.
 - 5. Optional Product:
 - a. Metabox System by Blum, is acceptable where capacities (listed above) can be met.
- C. Straight Wire Pulls:
 - 1. 4 IN centers.
 - 2. Finish: Satin stainless steel.
- D. Catches:
 - 1. Magnetic or roller type, adjustable.
 - 2. Minimum 4 LB pull.
- E. Elbow Catch:



1. Provide at doors with locks.
- F. Door Bumpers:
 1. Provide on backside of doors and drawer faces.
- G. File Hanging Rails:
 1. Description: Full length metal suspension rails designed to support pendaflex hanging files.
 2. Material: Powder coated steel to match drawer interior or mill finish aluminum.
 3. Provide one pair of such rails at file drawers.
 4. Coordinate depth of drawers with file depth.

2.4 LOCKS

- A. Locks:
 1. Provide as noted on Drawings.
 2. Small-pin tumbler with heavy-duty deadbolt.
 - a. Disc-tumbler type locks will not be accepted.
 - b. Cam locks will not be accepted.
 3. Keyway: D4292, 5-pin.
 4. ANSI/BHMA Standard: E07121.
 - a. Cycle Tested per ANSI/BHMA A156.11 Grade 1.
 5. Base Products:
 - a. Door Locks: 100DR by Olympus Lock.
 - b. Drawer Locks: 200DW by Olympus Lock.
 - c. Fasteners for use at Magnetic Resonance Imaging (MRI):
 - 1) Type 18-8 or 316 stainless steel.
 6. Finish: Satin Chrome US26D (BHMA 626).
 7. Include spacers, adapters, fasteners and strikes.
 8. Barrel Length: As appropriate for conditions.
 9. Provide 2 keys for each lock.
 10. Master key and grand master key as directed.
 11. Provide 20 extra locks of each type; door locks and drawer locks to Owner at closeout.

2.5 SUPPORTS AND BRACKETS

- A. Adjustable Shelf Supports:
 1. Friction fit pins into cabinet end panels and vertical dividers.
 2. Space 1/4 IN holes on 1 1/4 IN centers.
 3. Locate support holes to avoid conflict with installation of hinges.
 4. Retain shelves on support with spring clip shelf lock or screw attachment.
 5. Material:
 - a. Injection molded clear polycarbonate.
 6. Capacity: 200 LB minimum, per support device.
- B. Concealed Wall Shelf Supports:
 1. Provide for shelves mounted to walls (not within cabinets).
 2. Bracket:
 - a. Nominal 1/2 IN dia. steel pin with 4 IN projection minimum.
 - b. Adjustable height and inclination.
 3. Coordinate locations of blocking (see Section 06 10 00).
 4. Route drywall and mount bracket directly to wood blocking or masonry.
 5. Drill hole in shelf to receive mounting pin.
- C. Surface Mounted Metal Bracket for Cantilevered Countertop:
 1. Material: 1/8 IN thick steel.
 2. Pre-drilled for attachment to wall and countertop.



3. Include fasteners suitable for conditions.
 4. Coordinate locations of blocking (see Section 09 22 16).
 5. Capacity: 550 LBS per bracket.
 6. Base Product: Hebgo287.45.477 by Hafele.
 7. Finish: Gray primer with white finish.
 8. Locations indicated on Drawings. Sizing and quantity of wall brackets shall meet manufacturer's recommendations for length, spacing, and depth of countertop shown.
- D. In-wall Concealed Metal Bracket for Cantilevered Countertop
1. Material: 1/8 IN thick steel.
 2. Pre-drilled for attachment to wall and countertop.
 3. Include fasteners suitable for conditions.
 4. Coordinate locations of blocking (see Section 09 22 16).
 5. Capacity: 550 LBS per bracket.
 6. Base Product: A&M Hardware Concealed Bracket
 7. Finish: White
 8. Locations indicated on Drawings. Sizing and quantity of wall brackets shall meet manufacturer's recommendations for length, spacing, and depth of countertop shown. Support arm max 3" shorter than countertop depth.

2.6 MISCELLANEOUS CABINET HARDWARE

- A. Continuous Hinge:
1. Base Product: 0351.04.039 by Hafele.
 2. Finish: Chrome finish.
- B. Pocket door slide system:
1. Base Product: RP-60 by Hafele.
 2. Finish: Satin chrome.
- C. Grommets:
1. Base Product: XG-3 by Doug Mockett & Company, Inc.
 2. Finish: Black or putty as selected by Architect.
 3. Size: Provide 3-1/2 IN diameter flip top grommet cap with 7/8 IN x 1-3/8 IN cord slot.
 4. Provide as directed by Owner after installation of equipment at each location such as, but not limited to, undercounter electrical or systems outlet, cord drops, and keyboard drawers.
- D. Clothes Rod:
1. Concealed locations:
 - a. Chrome plated or stainless steel tube, 1 IN diameter minimum, with supports at 36 IN maximum spacing.
 - b. Base Product: 66OSS with 764 and 766 flanges and 1195 supports by Knappe & Vogt.
 - c. For wardrobes less than 24 IN. Deep, use KV1 ANO by Knappe & Vogt.
- E. Coat Hooks:
1. Concealed locations:
 - a. Match hooks in Section 10 28 13 / Toilet Accessories; single, double or ceiling style as indicated.

2.7 FABRICATION

- A. General:
1. See A400 Series Drawings for casework quantities, configurations, finishes, countertops and casework accessories.
 2. Verify dimensions at site.
 3. Verify locations of items furnished in other sections.



4. If necessary to vary from arrangement indicated because of structural, mechanical, electrical or other considerations, make such variations only after approval of Architect.
- B. Definitions:
1. Exposed surfaces - Surfaces visible when doors and drawers are closed:
 - a. Door and drawer fronts, and their edges.
 - b. Exposed ends.
 - c. Bottom of wall case.
 - d. Countertop and backsplash and their exposed edges.
 - e. Face of cabinet body.
 - f. Interior of open cabinets, including shelving.
 2. Concealed surfaces - Surfaces not visible after installation:
 - a. Solid top panels.
 - b. Security panels.
 - c. Locking rails.
 3. Semi-exposed surfaces - Surfaces only visible when doors and drawers are opened:
 - a. Interior of cabinets with opaque doors.
 - b. Back sides of doors.
 - c. Top of wall cabinets and tall cases.
 - d. Drawer boxes.
- C. Plastic Laminate Faced Casework:
1. Factory built casework finished on exterior with high pressure laminate.
 2. Core Material:
 - a. Medium Density Fiberboard (MDF).
 - b. MR moisture resistant panels where work surfaces include a sink.
 - c. MR panels shall have 50 percent reduction in thickness swell by ANSI A208.1.
 3. Provide units complete with hardware, subbases and trim, in sizes and configurations indicated.
 4. Style:
 - a. Reveal overlay, with doors and drawer fronts overlapping case front with minimum reveal.
 - b. Edge doors and drawer fronts with 3mm PVC banding, machine applied using waterproof hot melt adhesive. Machine profile exposed edges with 1/8 IN radius.
 5. Finishes:
 - a. Exposed surfaces: Plastic Laminate.
 - b. Grain Direction, where laminate finish is directional: Vertical grain at frames, cases, door faces, drawer faces and other vertical surfaces.
 - c. Semi-exposed surfaces: LPDL.
 - d. Concealed surfaces: LPDL.
 - e. Edges of Doors and Drawer Fronts: 3mm PVC edge banding.
 - f. Edges of Case Body panels: Plastic Laminate when semi exposed and exposed.
 - g. Edges of Shelves: 1mm PVC edge banding (four sides).
- D. Casework Components:
1. Case Body:
 - a. Sides: 3/4 IN thick.
 - 1) Locate shelf support holes to avoid conflict with installation of door and drawer hardware.
 - b. Top and Bottom Panels: 3/4 IN thick.
 - c. Backs: 1/2 IN thick.
 - 1) Exception: Where back face is exposed to view: Upgrade to 3/4 IN.
 - d. Security Panels: 1/2 IN thick.
 - e. Drawer Lock Rails: 3/4 IN thick.



- f. Base: 3/4 IN thick, with intermediate reinforcing at 24 IN on center maximum.
 - 2. Shelves:
 - a. Less than 30 inches long: 3/4 IN thick.
 - b. Between 30 and 40 inches long: 1 IN thick.
 - 3. Doors:
 - a. 3/4 IN thick.
 - b. Doors not to exceed 25 IN in width.
 - 4. Drawers:
 - a. Drawer Fronts: 3/4 IN thick.
 - b. Sub-fronts, Sides and Backs: 1/2 IN thick.
 - c. Bottoms: 1/2 IN thick.
 - 1) Include intermediate reinforcing rails where drawer width exceeds 18 IN.
 - 5. Small Compartment Dividers: 1/4 IN clear acrylic panel.
 - 6. Filler Panels and Scribe Pieces: 3/4 IN thick.
 - 7. Soffits:
 - a. Material and finish to match cabinets.
 - b. 3/4 IN thick.
 - c. Abut soffit to acoustical tile ceiling without reveal or gap.
 - d. Cope tegular ceiling tile to overhang face of soffit.
 - e. Where distance between top of cabinet and ceiling is greater than 24 IN: Soffits to be sloped 30 degrees, unless noted otherwise.
- E. Case Configuration:
- 1. Plastic Laminate-Faced Units:
 - a. Provide reveal, approximately 1/8 IN, at top of doors and drawer fronts, and between doors and drawer fronts in same unit; reveal approximately 7/16 IN at sides.
 - 2. Provide reveal 1/8 IN x 1/8 IN (black) in upper edge of exposed sides of wall case when plastic laminate soffits provided.
 - 3. Toe space:
 - a. 4 IN high by approximately 3 IN deep; provide on front of each base unit unless noted on architectural drawings.
 - 4. Countertop:
 - a. Plastic laminate units:
 - 1) Overhang 3/4 IN beyond doors, drawer fronts and exposed ends.
 - 5. Hardware mounting:
 - a. Drawers:
 - 1) Center the pull in drawer front, horizontally.
 - 2) No more than 4 IN from top.
 - b. Drawers with 2 pulls:
 - 1) Set pulls at 1/4 points.
 - 2) No more than 4 IN from top.
 - c. Framed glass doors:
 - 1) Center the pull in corner of frame.
 - d. Swinging doors:
 - 1) Set door pull in swing side corner, vertically, at top of base units; at bottom of wall units.
 - 6. Adjustable shelves:
 - a. Use drilled hole supports only.
 - 1) Depth: 1/2 IN less than inside cabinet depth.
 - 2) Width: 1/8 IN, maximum, less than inside cabinet width.
 - 7. Provide doors at locations requiring access to electrical devices, as indicated on drawings.
- F. Joinery



1. Construct cabinet body of 3/4 IN thick core joined with 10mm diameter industrial grade hardwood dowels, securely glued and clamped under pressure during assembly.
2. Case body:
 - a. Sides, dividers, bottom, and top panels:
 - 1) Minimum of 6 dowels at each joint for 24 IN deep cabinets.
 - 2) Minimum of 4 dowels for 12 IN deep cabinets.
 - 3) Glue joints.
 - b. Back:
 - 1) For dadoed backs, dado into sides, bottom and top. Locate dado 3/4 IN in from back face of cabinet.
 - 2) For on-set backs, rabbet at finished ends, screw at the top and bottom, staple at the sides.
 - 3) Glue joints.
 - c. Compartment dividers and lock rails:
 - 1) Dowel and glue.
 - d. Base:
 - 1) Integral or separate.
 - 2) Construct to receive base material to match adjacent walls, unless shown otherwise.
 - 3) Blind-fasten to bottom of case body when separate.
3. Drawers:
 - a. Sub-front, sides and back: Doweled and glued corner joints.
 - b. Bottom: Dado into 4 sides and glued or screwed to the bottom with the use of bottom supporting drawer slide hardware.
 - c. Front: Secured from sub-front side with no less than four screws.
 - d. Use no blocking or fasteners in exposed or semi-exposed locations.
- G. Mechanical Fasteners:
 1. Countertop joints:
 - a. Provide joint connectors every 6 IN OC.
 2. Pre-drill and countersink screw holes before installation.
 3. Do not use mechanical fasteners or blocking in exposed locations. When fasteners are required on exposed surfaces color, materials and finish to be approved by Architect.

2.8 COUNTERTOP MATERIALS AND FABRICATIONS

- A. Solid Surface Countertops (SSF): Specified in Section 12 36 63.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify suitability of substrate to accept installation.
- B. Ensure that adequate Wall Backing has been installed.
 1. Metal Wall Backing: Specified in Section 09 22 16.
 2. Wood Backing (blocking): Specified in Section 06 10 00.
 3. Coordinate and direct installation of backing where required.
- C. Correct unsatisfactory conditions.
- D. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION

- A. Use manufacturer's printed instructions or drawings in cases where items or details are not indicated.



- B. Hardware:
 - 1. Install hinges, stops, guides and other door and drawer hardware to avoid adjustable shelf holes in case body.
- C. Construct units with sinks or lavatories to withstand an applied vertical load of not less than 250 pounds on the front edge of countertop.
- D. Provide cutouts for mechanical and electrical items.
- E. Seal sink cutouts.
- F. Install up to 10 extra door locks and 10 extra drawer locks in casework not previously shown or scheduled to have locks.
 - 1. Install extra locks where directed by Owner.
 - 2. Closeout: Turn over any extra uninstalled locks to Owner.

3.3 SEALING OF JOINTS

- A. Seal casework, countertops and splashes to walls, to seal joints.
 - 1. Sealant color to match countertop color.
- B. Seal perimeter of counter-mounted sink fixtures.
 - 1. Sealant color to match countertop or sink color.
- C. Seal window sills to walls and window frames to seal joints.
 - 1. Sealant color to match color of sill material specified.

3.4 ADJUSTMENTS AND CLEANING

- A. Test and adjust items of equipment for satisfactory operation.
- B. Adjust hinges for proper door alignment.
- C. Adjust drawer guides for proper drawer front alignment and operation.
- D. Adjust countertops to a level position and align to adjacent unit.
- E. Repair damage to casework or countertops to appear in original new condition.
- F. Repair damage to premises as a result of installation.
- G. Remove debris left by this installation.
- H. Clean casework and countertops after above items have been completed.

END OF SECTION



SECTION 12 36 63
SOLID SURFACE FABRICATIONS (SSF)

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Solid Surface Fabrications, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Applicable standards:
 - 1. International Association of Plumbing and Mechanical Officials (IAPMO)
 - a. IAPMO Z124 Plastic Plumbing Fixtures.
 - 2. ASTM International:
 - 3. National Electrical Manufacturers Association (NEMA).
 - a. NSF International.
 - 1) NSF/ANSI Standard 51 for food zone - all food types.
 - 4. Manufacturer's certification of fabricator and installer.
- B. Fabricator and Installer Qualifications:
 - 1. Firm 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.
- C. Manufacturer Certification of Fabricator and Installer:
 - 1. Certified by manufacturer.
 - 2. Submit prior to Shop Drawings.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices and other components.
 - 2. Show full-size details, edge details, thermoforming requirements, attachments, etc.
 - 3. Show locations and sizes of furring, blocking, including concealed blocking and reinforcement.
 - 4. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, waste receptacle and other items installed in surface.
 - 5. Indicate dimensions, component sizes, fabrication details, attachment provisions and coordination requirements with adjacent work.
- B. Product Data:
 - 1. Manufacturer's product data sheets, details and installation instructions for Solid Surface Fabrications, components and accessories.
- C. Samples:
 - 1. For each SSF color selected:
 - a. Minimum 6 IN x 6 IN sample.
 - b. Cut sample and seam together for representation of inconspicuous seam.
 - c. Indicate full range of color and pattern variation.
 - 2. Sealant colors for selection.



3. Approved samples will be retained as a standard for work.
- D. Project Information:
 1. Manufacturer's current certification of Fabricator and Installer prior to submittal of Shop Drawings.
- E. Contract Closeout Information:
 1. Warranty.
 2. Maintenance data.
 - a. See Section 01 78 23.

1.4 WARRANTY

- A. Provide ten (10) year manufacturer's warranty including colorfastness and material defects.
 1. Warranty shall provide material and labor to repair or replace defective materials.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Solid Surface Fabrications (SSF):
 1. Base:
 - a. Hi-Macs
 - b. Corian by DuPont.
- B. Sealant:
 1. Base:
 - a. Color Rite.
 2. Optional:
 - a. As approved by SSF manufacturer.
- C. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

- A. Solid Surface Materials:
 1. Product as shown on Interior Finish Schedule sheet I-101J.
 2. Cast, non-porous, homogeneous, acrylic polymer composition with additional fire retardant fillers and pigments.
 - a. Prime product may not coated, laminated or composite construction.
 3. Defects with depth < 0.010 IN shall be considered superficial.
 - a. Repair superficial damage by sanding and/or polishing.
 - b. Components with more severe defects shall be rejected.
 4. Physical properties:

Minimum Physical Properties		
Property	Method	Value
Tensile Strength	ASTM D638	5500 PSI
Flexural Strength	ASTM D790	10 KSI
Hardness	Rockwell M Scale ASTM D785	>85
	Barcol Impressor ASTM D2583	55
Thermal Expansion	ASTM D696	1.8 x 10-5 IN/IN/DegF



Gloss (60 –degree Gardner)	IAPMO Z124	Matte = 5; Highly Polished = 75
Light Resistance	NEMA LD 3-2000 Method 3.3	No Effect (Xenon Arc)
Wear and Cleanability	IAPMO Z124	Pass
Stain Resistance	IAPMO Z124	Pass
Fungal Resistance	ASTM G21	Does not support growth
High Temperature Resistance	NEMA LD 3-2000 Method 3.6	No change
Boiling Water Resistance	NEMA LD 3-2000 Method 3.5	No visible change
Ball Impact Resistance; 1/2 LBS Ball	NEMA LD 3-2000 Method 3.5	36 IN drop ¼ IN sheet
		144 IN drop ½ IN sheet
Water Absorption	ASTM D570	0.8% for ¼ IN sheet
		0.6% for ½ IN sheet
Flammability	ASTM E84 and NFPA 255	Class I / Class A
Flame Spread Index		< 25
Smoked Developed Index		<450

B. Backing materials (build down):

1. Finished or exposed edges: SSF material.
 - a. Profiles as indicated.
2. Concealed spaces and non-exposed edges:
 - a. Moisture-resistant formaldehyde-free medium-density fiberboard (MDF) Panels or moisture-resistant plywood.
 - 1) Base Product: Medite FR by Sierra Pine.
 - 2) Particleboard is not acceptable.
 - b. Physical Properties, Based on 3/4 IN Thickness, ASTM D1037, Part A:
 - 1) Density: 48 LBS/FT³.
 - 2) Modulus of Rupture: 4,500 PSI.
 - 3) Screw Holding: Required to pull 1 IN #10 sheet metal screw:
 - a) Face: 230 LBS.
 - b) Edge: 185 LBS.
 - 4) Water Absorption: 14 percent average, 24 hour soak.
 - 5) Thickness Swell: 6 percent average, 24 hour soak.
 - 6) Flame Spread Rating, ASTM E84: Class A (1).
 - c. Panel Thickness:
 - 1) As required for application, utilize a single thickness to achieve build down to cross sectional thickness.
3. Backer Sheets for knee spaces:
 - a. Backer sheet: Grade-BK20, 0.020 IN thick.
 - b. Apply to bottom side of backing material.
4. Backing materials adhesive:
 - a. Construction grade adhesive recommended by SSF manufacturer for backing materials with VOC content no greater than 70 g/L.
 - b. Adhesives shall contain no carcinogen or reproductive toxicant components present at more than 1% of total mass of the product as defined in the California Office of Environmental Health Hazard Assessment's (OEHHA) list entitled "Chemicals Known to the State to Cause Cancer" or the Reproductive Toxicity, Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65).



- C. Joint Adhesive:
1. Manufacturer's standard one- or two-part adhesive as required for inconspicuous, non-porous joint with VOC content no greater than 80 g/L.
 2. Adhesives shall contain no carcinogen or reproductive toxicant components present at more than 1 percent of total mass of the product as defined in the California Office of Environmental Health Hazard Assessment's (OEHHA) list entitled Chemicals Known to the State to Cause Cancer or the Reproductive Toxicity, Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65).
- D. Sealant:
1. Elastomeric.
 2. Mildew-resistant, FDA-compliant, NSF 51-compliant (food zone - any type), UL-listed silicone sealant in colors matching components.
 3. Specifically formulated for applications indicated, including wet areas.
 4. Elastomeric.
 5. Shore A Hardness: 25.
 6. Compatible with SSF specified.
 7. Compatible with gypsum wallboard, paint, laminates and other materials being sealed.
 8. Sealant VOC content shall be no greater than 250g/L.
 - a. Sealants shall contain no carcinogen or reproductive toxicant components present at more than 1 percent of total mass of the product as defined in the California Office of Environmental Health Hazard Assessment's (OEHHA) list entitled Chemicals Known to the State to Cause Cancer or the Reproductive Toxicity, Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65).
 9. Colors:
 - a. Colors to match specified SSF colors from no less than 400 standard color choices.
 - b. Number of different colors required for project shall not be limited.
 10. Base Products:
 - a. Where solid colored SSF: Color-Sil by Color Rite; 100 percent silicone, uniformly colored, no suspended accent color partials.
 - b. Where speckle-colored SSF is specified: Poly-Sil by Color Rite; 100 percent silicone with suspended accent color particles.
 - c. Architect to select final colors and locations during submittals phase.
- E. Conductive Foil Tape:
1. Manufacturer's standard aluminum foil tape, with required thickness, for use with cutouts near heat sources.
- F. Insulating Felt Tape:
1. Manufacturer's standard for use with conductive tape in insulating solid surface material from adjacent heat source.

2.3 SHOP FABRICATION - GENERAL

- A. Shop Assembly
1. Fabricate components to greatest extent practical to sizes and shapes indicated, in accordance with approved shop drawings and manufacturer's instructions.
 2. Form joints between components using color-matched Joint Adhesive in an inconspicuous manner.
 - a. Reinforce with 4 IN wide strip of SSF material.
 3. Provide factory cutouts for plumbing fittings and bath accessories as indicated.
 - a. Radius inside corners of cutouts as large as but not less than 1/4 IN.
 - b. Reinforce with SSF corner blocks to avoid stress cracking.
 - c. Sand edges and corners smooth and free of chips or nicks.



- d. Utilize heat-conductive aluminum tape around drop-in stoves and other heat sources to protect SSF from thermal stress.
 4. Rout and finish component edges with clean, sharp returns.
 - a. Rout cutouts, radii and contours to template.
 - b. Smooth edges.
 - c. Repair or reject defective and inaccurate work.
 5. Fabricate coved splashes where indicated.
 6. Reinforce inside corners, narrow pieces, cantilevered overhangs, and stress points against breakage by laminating an additional thickness of SSF on concealed face.
 7. Laminate additional thicknesses of SSF and tool edge profiles indicated.
 8. Uniformly finish completed pieces according to SSF schedule.
- B. Thermoforming:
1. Comply with manufacturer's data.
 2. Heat entire component.
 3. Material shall be uniform, between 275 to 325 Deg F during forming.
 4. Form pieces to shape prior to seaming and joining.
 5. Cut pieces to finished dimensions.
 6. Sand edges and remove nicks and scratches.

2.4 FABRICATIONS

- A. SSF Countertops:
1. Configurations as indicated in the Drawings.
 2. Composite thickness of countertop assemblies: 1-1/4 IN unless otherwise indicated.
 - a. Nominal Thickness of SSF material: Minimum 1/2 IN unless otherwise indicated.
 3. Radius exposed outside corners: Minimum 1-1/2 IN.
 4. Join multiple pieces, where required, with Joint Adhesive to create inconspicuous seam.
 5. Backer:
 - a. Configure backing material as required for application:
 - b. Ladder frame at SSF countertops supported by base cabinets:
 - 1) Form ladders from approved backing material ripped into 3- 4 IN wide strips.
 - 2) Locate main runner strips (rails) along front and back edges of countertops.
 - a) Provide clearance for shrinkage and normal expansion and contraction.
 - 3) Space front-to-back supports (stiles) to align with line where base cabinet units adjoin. Locate stiles over other wall brackets and supports.
 - 4) Where base cabinets and supports exceed in 24 IN width: Include additional intermediate stiles so that maximum spacing does not exceed 24 IN.
 - 5) Provide additional intermediate stiles at seams in SSF countertop material.
 - 6) Join the stiles to rails using screwed or glued wooden biscuit seams, serrated dowels or rabbeted seams.
 - 7) Overhangs: Configure backer material per SSF manufacturer's guidelines according to amount of overhang projects past its support.
 - c. Countertops which span between supports 30 IN and wider:
 - 1) Fabricate backer from solid backing material (not stile and rail construction).
 - 2) Extend one-piece, solid backer material, across entire span. Extend load bearing edges not less than 4 IN over edge of supporting cabinets (or similar support).
 - d. Portions of Countertops schedule to support countertop equipment:
 - 1) Provide full backing for the entire countertop cross section for the full width of the equipment.
 - 2) Extend 4 IN (min) beyond equipment width and as required for mounting.
 6. Backsplashes and Sidesplashes:
 - a. Provide where indicated.
 - b. Thickness: Minimum 1/2 IN (unless otherwise indicated).



- c. Height: As indicated.
- d. Fabricate from same material and color as top.
- e. Backsplash Style: Integrally-coved.
- f. Sidesplash Style: Applied.
- 7. Front overhang of Tops: 1-1/2 IN, unless otherwise indicated.
- 8. Edge Treatments: As indicated on the drawings.
- 9. Polish exposed faces.
- 10. SSF color as specified in drawings.
- 11. Integral SSF Sinks
 - a. Material: Cast, homogenous material composed of polyester and acrylic resins, fire-retardant filler materials, and coloring agents. Shapes complying with IAPMO Z124 standards for plastic sinks and lavatories.
 - b. Mounting: Seamed under-mount. At 2'-10" high countertop locations, locate per "Dupont Corian Sink and Lavatory Positioning for ADA Compliance" guidelines.
 - c. Mounting hardware: Manufacturer's standard bowl clips, panel inserts and fasteners for attachment of undermount sinks/lavatories.
 - d. Base Product at Toilet Rooms: Model # 815P by Corian.
 - e. Base Product at Medication, POC and Nourishment rooms: Model # 810P by Corian.
 - f. Handwashing sink at Patient Rooms: Model #816P
 - g. Patient Room Toilet Room: Model #816P
 - h. Color: as indicated on Drawings.
- B. Sinks (specified elsewhere, unless integral per above):
 - 1. Porcelain, enameled steel and/or stainless steel bowls: Specified in Section 22 40 00.
- C. Faucets and Trim: Specified in Section 22 40 00.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with fabricator present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
 - 1. Verify measurements, dimensions and drawing details before proceeding.
 - 2. Coordinate location of furring, nailers, blocking, grounds and similar supports for attached work.
 - 3. Examine conditions under which work is to be installed.
 - 4. Correct unsatisfactory conditions.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION

- A. General:
 - 1. Install components plumb, level and rigid, scribed to adjacent finishes, in accordance with approved shop drawings and product data.
 - 2. Provide product in the largest pieces available.
 - 3. Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work.
 - a. Exposed joints/seams will not be allowed.
 - 4. Reinforce field joints with SSF strips extending a minimum of 1 to 2 IN on either side of the seam with the strip being the same thickness as the top.
 - 5. Cut and finish component edges with clean, sharp returns.



6. Rout radii and contours to template.
 7. Anchor securely to base cabinets or other supports.
 8. Align adjacent countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop.
 9. Carefully dress joints smooth, remove surface scratches and clean entire surface.
 10. Install countertops with no more than 1/8 IN sag, bow or other variation from a straight line.
 11. Units with sinks or lavatories shall withstand an applied vertical load of not less than 250 LBS on front edge of countertop.
- B. Countertops:
1. Install plumb, level, true and straight.
 - a. Shim as necessary using concealed shims.
 2. Adhere tops to base cabinets with dabs of a clear silicone sealant at 10 to 12 IN apart.
 3. Attach top securely to base unit or support brackets in accordance with manufacturer's instructions.
 - a. Supply additional wood supports, spaced no more than 18 IN apart or as otherwise required for adequate strength.
 4. Attach top securely to base unit or support brackets in accordance with manufacturer's instructions.
 - a. Ensure full contact with support brackets and backing for entire support length with mechanical fastening into backing material.
 - b. Provide fasteners of appropriate length. Do not allow screws to penetrate into SSF material.
 - c. Supply additional supports or solid backing as required for adequate strength.
 5. Where tops are abutted by walls at both ends:
 - a. Include 1/8 IN expansion gaps at both ends for every of 10 FT countertop.
 - b. Seal gaps with elastomeric sealant.
- C. Backsplashes and Sidesplashes:
1. Integrally Coved Splashes:
 - a. Join coved items to countertops using color-matched Joint Adhesive.
 - b. Adhere to walls and other substrates with clear silicone sealant.
 - c. Seal to walls and adjacent cabinets with color-matched, elastomeric sealant.
 2. Applied Splashes:
 - a. Join adhered items to substrate using color-matched, elastomeric sealant.
 - b. Adhere to walls and other substrates with clear silicone sealant.
 - c. Seal to walls and adjacent cabinets with color-matched, elastomeric sealant.
- D. Integral SSF Sinks: Install SSF sink (or lavatory) bowls with overflows in locations shown on the drawings. Secure bowls to tops using Joint Adhesive and mounting hardware to maintain warranty. Drain and overflow connections: Specified in Division 22. Sinks:
1. Install sinks per Section 22 40 00.
 2. Seal to Countertop with elastomeric sealant and mounting hardware provided.
 3. Drain and overflow connections: Specified in Division 22.
- E. Faucets and Trim:
1. Install faucets and trim per Section 22 40 00.
 2. Plumbing connections: Specified in Division 22.
 3. Seal to Countertop with elastomeric sealant.

3.3 CLEANING AND PROTECTION

- A. Keep components clean during installation.
- B. Protect finished surfaces from damage.



C. Remove adhesives, sealants and other stains.

3.4 REPAIR

A. Repair damaged work.

B. Replace damaged work which cannot be repaired to Architect's satisfaction.

END OF SECTION



DIVISION 13

SPECIAL CONSTRUCTION



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SECTION 13 49 00

RADIATION PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish engineering, labor, materials, tools, equipment, and services for Radiation Protection Specialties in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Active in radiation shielding business for at least five (5) years .
 - 2. Maintain a quality assurance.
 - 3. Submit test reports to verify that material meets specification criteria.
- B. National Council on Radiation Protection and Measurements (NCRP) is the basic source of information for designing structural shielding for protection from x-rays and gamma rays.
- C. NCRP Report No. 147: Supersedes NCRP No. 49 circa 1976; It is general guide for diagnostic rad rooms.
- D. NCRP Report No. 151: Applies to Radiation Therapy rooms with accelerating voltages greater than 10 MeV.
- E. Architects may refer to these current reports for sample details on shielding of penetrations. Otherwise, these reports are intended for the Physicist (or Rad consultant) for use in determining the amount of shielding required.
- F. Applicable Standards:
 - 1. National Council on Radiation Protection and Measurements (NCRP):
 - a. NCRP Report No.147: Structural Shielding Design for Medical X-Ray Imaging Facilities.
 - b. NCRP Report No. 151: Structural Shielding Design and Evaluation for Megavoltage X- and Gamma-Ray Radiotherapy Facilities.
- G. Preinstallation Conference:
 - 1. See Section 01 31 19.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Layout of radiation-protected areas indicating lead thickness or lead equivalence of components.
 - 2. Show ducts, pipes, conduit, and other objects that penetrate radiation protection including details of penetrations.
- B. Product Data:
 - 1. Components and installation conditions.
- C. Project Information:
 - 1. Manufacturer's installation instructions and recommendations.
 - 2. Test reports: Radiation shielding test report, signed by qualified physicist licensed in the State of Utah.



PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Radiation Protection Specialties:
 - 1. Base:
 - a. A&L Shielding.
 - 2. Optional:
 - a. Mayco Industries.
 - b. NELCO
 - c. Pitts Little Corporation.
 - d. Radiation Protection Products.
 - e. Ray Bar Engineering.
 - f. Shielding Construction Solutions.
- B. Other manufacturers desiring approval comply with Section 01 61 00.
- C. Shielding Design: Few architects are qualified to design structural shielding for protection from x-rays, gamma rays, and neutrons. Owners typically provide an expert who will provide A/E with a Physicist's Report. This describes to Architect the appropriate level of protection. After the shielding is constructed, the same individual (or independent agency) must perform a radiation leakage test. Measures would then be taken to correct any deficiencies.

2.2 DESIGN CRITERIA

- A. Provide materials and workmanship, including joints and fasteners that maintain continuity of radiation protection equivalent to materials specified in thicknesses and locations indicated.
- B. Lead Equivalence:
 - 1. Thickness of lead provides the same attenuation (reduction of radiation passing through) as material in question under specified conditions.
 - 2. Lead equivalence specified for materials used in diagnostic x-ray rooms is as measured at 100 kV unless otherwise indicated.
- C. Materials, thicknesses, and configurations indicated are based on radiation protection design prepared by Owner's radiation health physicist.
 - 1. This design is available to Contractor on request.

2.3 MATERIALS

- A. Lead Sheet, Strip, and Plate:
 - 1. ASTM-B749, alloy UNS No. L51121 (chemical-copper lead).
 - 2. Federal Specification QQL-201F: Sheet Lead.
 - 3. Furnish in maximum sizes pertinent to project in thicknesses shown on the drawings or elsewhere specified.
 - 4. Variation in sheet thickness: Less than 3 %.
 - 5. Construct seams using laps, scarfs, rabbets, batten overlays, or other approved manner to prevent leakage.
 - 6. Lead sheet at wall and floor intersection shall have butt edge and be scribe cut for tight and secure fit.
 - 7. Include Lead Corner Angles required at inside corners.
 - 8. Include miscellaneous sheet lead to wrap electrical outlets, pipe and duct penetrations, and similar penetrations.
 - 9. See attached physicist report for lead requirements.

2.4 RELATED ITEMS – SPECIFIED ELSEWHERE

- A. Lead Lined Plywood: Specified in Section 06 10 00.



- B. Lead Lined Drywall: Specified in Section 09 29 00.
- C. Lead Lined Doors:
 - 1. Specified in Section 08 11 13.
 - 2. Specified in Section 08 14 16.
- D. Radiation Resistant Glazing: Specified in Section 08 81 26.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not deliver or install radiation protection until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of construction period.
- B. Examine substrates in areas to receive radiation protection, with Installer present, for compliance with requirements, installation tolerances, and other conditions affecting performance of radiation protection.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION - GENERAL

- A. General:
 - 1. Where lead is pierced or penetrated by installation of electric outlets, boxes, plumbing, trench ducts, or other built-in items: Line back, bottom, top and sides of item as required with equivalent lead thickness to maintain shielding integrity.
 - 2. Coordinate installation of radiation shielding surfaces with contractor's providing finishes over or adjacent to the shielding material.
 - 3. Protect lead from coming into contact with concrete with a coating of asphalt mastic or paint.
- B. Sheet Lead:
 - 1. Erect lead sheet laminations to prepared surfaces as per manufacturer's specifications.
 - 2. Sheets with damaged or poor fitting rabbets will not be permitted in the assembly.
 - 3. All exposed bolt heads or other fasteners shall be provided with caps or other approved devices intended for protection.

3.3 INSTALLATION OF PENETRATING ITEMS

- A. General:
 - 1. Penetrations of lead linings: Provide lead shields to maintain continuity of protection.
 - 2. Provide lead linings, sleeves, shields, and other protection in thickness not less than that required in assembly being penetrated.
 - 3. Secure shields at penetrations using adhesive or wire ties but not penetrating fasteners unless indicated on Drawings.
 - 4. Cut wall penetration covers from lead sheet of equal or greater thickness than backing on adjacent wall panels. Cut wall penetration covers to size required to cover wall penetrations with laps 1 IN minimum wide as indicated on penetration detail drawings.
 - 5. Adhesive-apply lead sheet penetration covers on penetrating boxes and raceways and return penetration covers to backside of lead-backed wall panels with 1 IN minimum laps.
 - a. Do not use penetrating fasteners unless indicated otherwise.
- B. Outlet Boxes and Conduit:
 - 1. Cover or line with lead sheet lapped over adjacent lead lining at least 1 IN.
 - 2. Wrap conduit with lead sheet for a distance of not less than 10 IN from box.



- C. Duct Openings:
 - 1. Unless otherwise indicated, line or wrap ducts with lead sheet for distance from partition/ceiling equal to three times the largest opening dimension.
 - 2. Lap lead sheet with adjacent lead lining at least 1 IN.
- D. Duct Penetrations:
 - 1. For use where lead sheet less than 1/8 IN thick or duct shielding is less than 24 IN wide.
 - 2. Wrap ducts with wall penetration covers, lapping lead joints 1 IN minimum.
 - 3. Secure lead sheet in place with 1 IN minimum width steel bands spaced not more than 12 IN on center.
 - 4. Do not cut into lead sheet with tightening steel bands.
- E. Duct Penetrations:
 - 1. For use where lead sheet greater than 1/8 IN thick or duct shielding is greater than 24 IN wide.
 - 2. Laminate wall penetration covers to fire-retardant treated plywood or other similar structural panels conforming to shape of duct, lapping lead joints 1 IN minimum.
 - 3. Secure lead laminated panels to ducts with mechanical fasteners located at duct seams and corners.
 - 4. Where necessary to prevent lead laminated panels from overloading duct supports, independently suspend panels from hangers secured to overhead building structure.
 - 5. Cover fastener heads with lead sheet matching thickness of adjacent lead.
- F. Piping:
 - 1. Unless otherwise indicated, wrap piping with lead sheet for a distance of not less than 10 IN from point of penetration.

3.4 FIELD QUALITY CONTROL

- A. Radiation Shielding Testing:
 - 1. Radiation shielding will be tested by Owner's registered radiation physicist.
 - 2. Notify Owner's radiation physicist when shielding installation is complete to perform a visual inspection.
 - 3. Upon completion of radiology equipment installation, perform tests and radiation survey
 - a. Conduct leakage tests under direction of Owner's radiation physicist.
 - b. Test elements forming radiation shielding.
- B. Testing Results:
 - 1. Exposure levels shall not exceed those specified in Radiation Shielding Report.
- C. Perform corrective work that inspection reports indicate does not comply with specified requirements.
- D. Re-test locations where system is found to be deficient following repair.
- E. Submit certified reports to Owner.

3.5 PROTECTION

- A. Lock radiation-protected rooms once doors and locks are installed and limit access to only those persons performing work in the rooms.

END OF SECTION





DIVISION 21

FIRE SUPPRESSION



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SECTION 21 10 00
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. Semiautomatic wet-type, Class I standpipe systems.
 2. Wet-pipe sprinkler systems.
 3. Preaction sprinkler systems single interlock.
 4. Description: New patient tower will have a independent wet system with standpipes and a preaction system protecting the I.S MAIN T.E.C room. Part of the existing building will be remodeled, all existing sprinklers will be removed and replaced to fit new floor plan.
- B. Related Sections include the following:
1. Division 10 Section "Fire Extinguisher Cabinets" and "Fire Extinguishers" for cabinets and fire extinguishers.
 2. Division 22 Section "Facility Water Distribution Piping" for piping outside the building.
 3. Division 28 Section "Fire Detection and Alarm" for alarm devices not specified in this 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
FM Global	No
Calculations	Required, use reduced flow data



Alarm Device	Horn/Strobe
FDC	Flush Polished Brass 3-inlet Caps: Knox required purchased by contractor, coordinate installation with local Fire Department
Special Items	
Seismic	
Coordination	All sprinkler piping exposed to view shall be coordinated with the architect prior to final design acceptance.

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.
- C. Preaction Single Interlock Sprinkler System: Automatic sprinklers are attached to piping containing air. Actuation of fire-detection system in same area as sprinklers opens deluge valve, permitting water to flow into piping and to discharge from sprinklers that have opened.

1.5 PERFORMANCE REQUIREMENTS

- A. Standard Piping System Component Working Pressure: Listed for at least 175 psig.
- B. High-Pressure Piping System Component Working Pressure: Listed for 250 psig minimum 300 psig.
- C. Fire-suppression standpipe system design shall be approved by authorities having jurisdiction.
 - 1. Minimum residual pressure at each hose-connection outlet is the following:
 - a. NPS 1-1/2 Hose Connections: 65 psig.



- b. NPS 2-1/2 Hose Connections: 100 psig.
- 2. Unless otherwise indicated, the following is maximum residual pressure at required flow at each hose-connection outlet:
 - a. NPS 1-1/2 Hose Connections: 100 psig.
 - b. NPS 2-1/2 Hose Connections: 175 psig.
- D. 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:

Flow data available at 500 E 1400 N in Logan.

Static – 115 psi

Residual – 81 psi @ 2,599 gpm flowing

Date of Test – 08/14/2019 by VBFA, Inc.
 - 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. Automobile Parking Areas: Ordinary Hazard, Group 1.
 - b. Building Service Areas: Ordinary Hazard, Group 1.
 - c. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
 - d. General Storage Areas: Ordinary Hazard, Group 1.
 - e. Laundries: Ordinary Hazard, Group 1.
 - f. Libraries, Except Stack Areas: Light Hazard.
 - g. Library Stack Areas: Ordinary Hazard, Group 2.
 - h. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
 - i. Office and Public Areas: Light Hazard.
 - j. Residential Living Areas: Light Hazard.
 - k. Restaurant Service Areas: Ordinary Hazard, Group 1.
 - 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.
- 7. Maximum Protection Area per Sprinkler:
 - a. Office Spaces: 225 sq. ft..
 - b. Storage Areas: 130 sq. ft..
 - c. Mechanical Equipment Rooms: 130 sq. ft..
 - d. Electrical Equipment Rooms: 130 sq. ft..
 - e. Other Areas: According to NFPA 13 recommendations, unless otherwise indicated.
- 8. Total Combined Hose-Stream Demand Requirement: According to NFPA 13, unless otherwise indicated:
 - a. Light-Hazard Occupancies: 100 gpm for 30 minutes.
 - b. Ordinary-Hazard Occupancies: 250 gpm for 60 to 90 minutes.
 - c. Extra-Hazard Occupancies: 500 gpm for 90 to 120 minutes.
- 9. Sprinklers are to be installed throughout the premises, as required by NFPA 13.
- E. 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. Air compressors, including electrical data.
 - 5. Sprinklers, escutcheons, and guards. Include sprinkler flow characteristics, mounting, finish, and other pertinent data.
 - 6. Hose connections, including size, type, and finish.
 - 7. Fire department connections, including type; number, size, and arrangement of inlets; caps and chains; size and direction of outlet; escutcheon and marking; and finish.
 - 8. Alarm devices, including electrical data.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Fire-hydrant flow test report.
- D. Seismic Calculations.
- E. 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.



- F. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13 and NFPA 14. Include "Contractor's Material and Test Certificate for Aboveground Piping" and "Contractor's Material and Test Certificate for Underground Piping."
- G. Welding certificates.
- H. Field quality-control test reports.
- I. 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. The following are the approved contractors for this project:

a. PRE-APPROVED CONTRACTORS LIST

- 1) A&D Fire
- 2) Alta Fire
- 3) Certified Fire
- 4) Chaparral Fire (A-1 National)
- 5) Delta Fire
- 6) Kimco Fire
- 7) Preferred Fire Protection
- 8) Quality Fire Protection
- 9) FireTrol
- 10) FireFly Fire Protection
- 11) Simplex-Grinnell
- 12) State Fire DC Specialties
- 13) The Safety Team
- 14) Western Automatic
- 15) Or prior approved equal

- b. A contractor not listed in the "PRE-APPROVED CONTRACTORS LIST" must receive prior approval from the engineer to bid this project.

- 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."
 - 2. NFPA 14, "Installation of Standpipe, Private Hydrant, and Hose Systems."
 - 3. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."
- E. International Conference of Building Code Officials codes and standards complying with the following:
 - 1. IBC-2018, "International Building Code."
 - 2. IFC-2018, "International Fire Code."
- F. Utah Amendments
 - 1. Title 15A

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.

1.10 GENERAL ENGINEERING QUALITY

- A. Unless noted otherwise the following applies:
 - 1. The maximum water velocity shall not exceed 32-fps.
 - 2. Submit the calculations using the reduced flow data.
 - 3. When calculating flexible drops, the contractor shall use the maximum number of bends for the associated length. The value is to be taken from the UL tests (unless the material is only FM approved).
 - 4. In the event of multiple (3) submittal rejections (including revise and resubmit) a meeting shall be held at the engineer's office at the engineer time of choosing and the designer, fire sprinkler contractor, and general contractor shall be physically in attendance to discuss the required modifications to the design.

1.11 CONTRACT COMPLETION

- A. Incomplete and Unacceptable work:



1. 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.

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 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell end and plain end.

1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, Class 53, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron gland, rubber gasket, and steel bolts and nuts.

B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell end and plain end.

1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
2. Gaskets: AWWA C111, rubber.

2.3 C-900 TUBE AND FITTINGS

A. PVC, AWWA Pipe: AWWA C900, Class 150, with bell end with gasket and spigot end.

1. Comply with UL 1285 for fire-service mains if indicated.
2. PVC Fabricated Fittings: AWWA C900, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
3. PVC Molded Fittings: AWWA C907, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
4. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - a. Gaskets: AWWA C111, rubber.
5. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.



2.4 STAINLESS STEEL IN BUILDING RISER

- A. Continuous from the factory, no field formed fittings in the stainless steel riser. Field modifications are not allowed. Restrain with thrust block, per NFPA 24, rods as required by manufacture.
 - 1. Inlet: AWWA C900/DIP
 - 2. Outlet: AWWA 606

2.5 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.

2.6 CPVC TUBE AND FITTINGS

- A. CPVC pipe is produced to the specifications of ASTM F442; Complete system in accordance with its listing limitations, including installation instructions. CPVC is not allowed on this project.

2.7 COPPER TUBE AND FITTINGS

- A. Soft Copper Tube: ASTM B 88, Type L, water tube, annealed temper; with plain ends.
 - 1. Copper fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.
 - 2. Brazing Filler Metals: AWS A5.8, BCuP-3 or BCuP-4.
- B. Plain-End, Hard Copper Tube: ASTM B 88, Type K or ASTM B 88, Type L, water tube, drawn temper.
 - 1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.
 - 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match tubing system.
 - 3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body with ball-and-socket metal-to-metal seating surfaces, and solder-joint or threaded ends.
 - 4. Copper, Mechanically Formed Tee Option: For forming T-branch on copper water tube not allowed.
 - 5. Brazing Filler Metals: AWS A5.8, BCuP-3 or BCuP-4.
- C. Grooved-End, Hard Copper Tube: ASTM B 88, Type K or ASTM B 88, Type L, water tube, drawn temper; with factory- or field-formed, roll-grooved ends.
 - 1. Copper, Mechanically Formed Tee Option: For forming T-branch on copper water tube not allowed.
 - 2. Grooved-Joint Systems:
 - a. Manufacturers:
 - 1) Anvil International, Inc.
 - 2) Victaulic Co. of America.
 - b. Grooved-End Copper Fittings: ASTM B 75, copper tube or ASTM B 584, bronze casting. Fittings may have ends factory or field expanded to steel-pipe OD if required for copper tube systems using grooved-end-pipe couplings.
 - c. Grooved-End-Tube Couplings: UL 213, rigid pattern, unless otherwise indicated; gasketed fitting equivalent to AWWA C606, but made to match copper-tube 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. Use grooved-end-pipe couplings for tube and fitting that have expanded ends.

2.8 DIELECTRIC FITTINGS

- A. Assembly shall be copper alloy, ferrous, and insulating materials with ends matching piping system.
- B. Dielectric Unions: Factory-fabricated assembly, designed for 250-psig minimum working pressure at 180 deg F. Include insulating material that isolates dissimilar materials and ends with inside threads according to ASME B1.20.1.
 - 1. Manufacturers:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Epco Sales, Inc.
 - d. Hart Industries International, Inc.
 - e. Watts Industries, Inc.; Water Products Div.
 - f. Zurn Industries, Inc.; Wilkins Div.
- C. Dielectric Flanges: Factory-fabricated companion-flange assembly, for 175-psig minimum working-pressure rating as required for piping system.
 - 1. Manufacturers:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Epco Sales, Inc.
 - d. Watts Industries, Inc.; Water Products Div.
- D. Dielectric Flange Insulation Kits: Components for field assembly shall include CR or phenolic gasket, PE or phenolic bolt sleeves, phenolic washers, and steel backing washers.
 - 1. Manufacturers:
 - a. Advance Products and Systems, Inc.
 - b. Calpico, Inc.
 - c. Central Plastics Company.
 - d. Pipeline Seal and Insulator, Inc.
 - e. Insert manufacturer's name.
- E. Dielectric Couplings: Galvanized steel with inert and noncorrosive thermoplastic lining and threaded ends and 300-psig working-pressure rating at 225 deg F.
 - 1. Manufacturers:
 - a. Calpico, Inc.
 - b. Lochinvar Corp.
- F. Dielectric Nipples: Electroplated steel with inert and noncorrosive thermoplastic lining, with combination of plain, threaded, or grooved ends and 300-psig working-pressure rating at 225 deg F.



1. Manufacturers:
 - a. Perfection Corporation.
 - b. Precision Plumbing Products, Inc.
 - c. Victaulic Co. of America.

2.9 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.

2.10 FLEXIBLE PIPE CONNECTORS (SEISMIC)

- 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 2 and Smaller: Threaded.
 2. NPS 2-1/2 and Larger: Flanged.
 3. Option for NPS 2-1/2 and Larger: Grooved for use with grooved-end-pipe couplings.
- B. Manufacturers:
 1. Flexicraft Industries.
 2. Flex-Pression, Ltd.
 3. Metraflex, Inc.
- C. Bronze-Hose, Flexible Connectors: Corrugated, bronze, inner tubing covered with bronze wire braid. Include copper-tube ends or bronze flanged ends, braze welded to hose.
- D. 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.
- E. 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.



2.11 CORROSION-PROTECTIVE ENCASEMENT FOR PIPING

- A. Encasement for Underground Metal Piping: ASTM A 674 or AWWA C105, PE film, 0.008-inch minimum thickness, tube or sheet.

2.12 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. Sprinkler Branch-Line Test Fittings: Brass body with threaded inlet, capped drain outlet, and threaded outlet for sprinkler.
- D. Sprinkler Inspector's Test Fitting: Cast- or ductile-iron housing with threaded inlet and drain outlet and sight glass.
- E. Drop-Nipple Fittings: UL 1474, adjustable with threaded inlet and outlet, and seals.
- F. Dry-Pipe-System Fittings: UL listed for dry-pipe service.

2.13 LISTED FIRE-PROTECTION VALVES

- A. Valves shall be FMG approved, with 175-psig minimum pressure rating. Valves shall have 250-psig minimum pressure rating if valves are components of high-pressure piping system.
- B. Gate Valves with Wall Indicator Posts:
 - 1. Gate Valves: UL 262, cast-iron body, bronze mounted, with solid disc, nonrising stem, operating nut, and flanged ends.
 - 2. Indicator Posts: UL 789, horizontal-wall type, cast-iron body, with hand wheel, extension rod, locking device, and cast-iron barrel.
 - 3. Manufacturers:
 - a. Grinnell Fire Protection.
 - b. McWane, Inc.; Kennedy Valve Div.
 - c. NIBCO.
 - d. Stockham.



C. 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.

D. 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.
2. NPS 2-1/2 and Larger: Bronze, cast-iron, or ductile-iron body; wafer type or with flanged or grooved ends.
 - a. Manufacturers:
 - 1) Central Sprinkler Corp.
 - 2) McWane, Inc.; Kennedy Valve Div.
 - 3) Mueller Company.
 - 4) NIBCO.
 - 5) Victaulic Co. of America.

E. Check Valves NPS 2 and Larger: UL 312, swing type, cast-iron body with flanged or grooved ends.

1. Manufacturers:
 - a. American Cast Iron Pipe Co.; Waterous Co.
 - b. Central Sprinkler Corp.
 - c. Clow Valve Co.
 - d. Crane Co.; Crane Valve Group; Crane Valves.
 - e. Crane Co.; Crane Valve Group; Jenkins Valves.
 - f. Fivalco
 - g. Globe Fire Sprinkler Corporation.
 - h. Grinnell Fire Protection.
 - i. Hammond Valve.
 - j. McWane, Inc.; Kennedy Valve Div.
 - k. Mueller Company.
 - l. NIBCO.
 - m. Potter-Roemer; Fire Protection Div.
 - n. Reliable Automatic Sprinkler Co., Inc.
 - o. Star Sprinkler Inc.
 - p. Stockham.
 - q. United Brass Works, Inc.



- r. Victaulic Co. of America.
- s. Watts Industries, Inc.; Water Products Div.

F. Gate Valves: UL 262, OS&Y type.

1. NPS 2 and Smaller: Bronze body with threaded ends.

a. Manufacturers:

- 1) Crane Co.; Crane Valve Group; Crane Valves.
- 2) Fivalco.
- 3) Hammond Valve.
- 4) NIBCO.
- 5) United Brass Works, Inc.

2. NPS 2-1/2 and Larger: Cast-iron body with flanged ends.

a. Manufacturers:

- 1) Clow Valve Co.
- 2) Crane Co.; Crane Valve Group; Crane Valves.
- 3) Crane Co.; Crane Valve Group; Jenkins Valves.
- 4) Fivalco
- 5) Hammond Valve.
- 6) Milwaukee Valve Company.
- 7) Mueller Company.
- 8) NIBCO.
- 9) United Brass Works, Inc.

G. 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.



H. Supervised Normally Closed Valve

1. Indicator: Electrical, 115-V ac, prewired, single-circuit, supervisory switch and visual to send signal on partial close.
 - a. Manufactures:
 - 1) NIBCO.
 - 2) Victaulic Co. of America.

2.14 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.

2.15 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.
 2. Dry-Pipe Valves: UL 260, differential type; with bronze seat with O-ring seals, single-hinge pin, and latch design. Include UL 1486, quick-opening devices, trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
 - a. Air-Pressure Maintenance Device: UL 260, automatic device to maintain correct air pressure in piping. Include shutoff valves to permit servicing without shutting down sprinkler piping, bypass valve for quick filling, pressure regulator or switch to maintain pressure, strainer, pressure ratings with 14- to 60-psig adjustable range, and 175-psig maximum inlet pressure.
 - 1) Manufacturers:



- a) AFAC Inc.
- b) Central Sprinkler Corp.
- c) General Air Products, Inc.
- d) Globe Fire Sprinkler Corporation.
- e) Reliable Automatic Sprinkler Co., Inc.
- f) Viking Corp.

b. Air Compressor: UL 753, fractional horsepower, 120-V ac, 60 Hz, single phase.

1) Manufacturers:

- a) AFAC Inc.
- b) Gast Manufacturing, Inc.
- c) General Air Products, Inc.
- d) Grinnell Fire Protection.
- e) Reliable Automatic Sprinkler Co., Inc.
- f) Viking Corp.

3. Deluge Valves: UL 260, cast-iron body, hydraulically operated, differential-pressure type. Include bronze seat with O-ring seals, trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, drip cup assembly piped without valves and separate from main drain line, fill-line attachment with strainer, and push-rod chamber supply connection.

- a. Dry, Pilot-Line Trim Set: Include dry, pilot-line actuator; air- and water-pressure gages; low-air-pressure warning switch; air relief valve; and actuation device. Dry, pilot-line actuator includes cast-iron, operated, diaphragm-type valve with resilient facing plate, resilient diaphragm, and replaceable bronze seat. Valve includes threaded water and air inlets and water outlet. Loss of air pressure on dry, pilot-line side allows pilot-line actuator to open and causes deluge valve to open immediately.

B. Automatic Drain Valves: UL 1726, NPS 3/4, ball-check device with threaded ends.

1. Manufacturers:

- a. Grinnell Fire Protection.

2.16 MANUAL CONTROL STATIONS (Pre-action)

A. Manual Control Stations: FMG approved, hydraulic operation, with union, NPS 1/2 pipe nipple, and bronze ball valve. Include metal enclosure labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut to prevent accidental opening.

2.17 CONTROL PANELS (Pre-action)

A. Description: Single-area, two-area, or single-area cross-zoned type control panel as indicated, including NEMA ICS 6, Type 1 enclosure, detector, alarm, and solenoid-valve circuitry for operation of deluge valves. Panels contain power supply; battery charger; standby batteries; field-wiring terminal strip; electrically supervised solenoid valves and polarized fire alarm bell; lamp test facility; single-pole, double-throw auxiliary alarm contacts; and rectifier.



1. Panels: FMG approved when used with thermal detectors and Class A detector circuit wiring. Electrical characteristics are 120-V ac, 60 Hz, with 24-V dc rechargeable batteries.
2. Manual Control Stations: Electric operation, metal enclosure, labeled "MANUAL CONTROL STATION" with operating instructions and a cover held closed by breakable strut.

2.18 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. Sprinklers shall have 250-psig minimum 300-psig pressure rating if sprinklers are components of high-pressure piping system.
- C. Manufacturers:
 1. Globe Fire Sprinkler Corporation.
 2. Reliable Automatic Sprinkler Co., Inc.
 3. Victaulic Co. of America.
 4. Viking Corp.
 5. Tyco Fire
- D. Automatic Sprinklers: With heat-responsive element complying with the following:
 1. UL 199, for nonresidential applications.
 2. UL 1626, for residential applications.
- E. Sprinkler Types and Categories: Nominal 1/2-inch orifice for "Ordinary" temperature classification rating, unless otherwise indicated or required by application.
 1. Open Sprinklers: UL 199, without heat-responsive element.
 - a. Orifice: 1/2 inch, with discharge coefficient K between 5.3 and 5.8.
 - b. Orifice: 17/32 inch, with discharge coefficient K between 7.4 and 8.2.
- F. 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.
- G. Sprinkler Finishes: Chrome plated, bronze, and painted. Finishes as approved by FM Global.



- H. Special Coatings: Wax, lead, and corrosion-resistant paint.
- I. 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: Flat plate concealed, white.
- J. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler.

2.19 HOSE CONNECTIONS

- A. Manufacturers:
 - 1. Central Sprinkler Corp.
 - 2. Elkhart Brass Mfg. Co., Inc.
 - 3. Fire-End and Croker Corp.
 - 4. Fivalco
 - 5. Grinnell Fire Protection.
 - 6. Guardian Fire Equipment Incorporated.
 - 7. McWane, Inc.; Kennedy Valve Div.
 - 8. Mueller Company.
 - 9. Potter-Roemer; Fire-Protection Div.
 - 10. United Brass Works, Inc.
- B. Description: UL 668, brass or bronze, 300-psig minimum pressure rating, hose valve for connecting fire hose. Include angle or gate pattern design; female NPS inlet and male hose outlet; and lugged cap, gasket, and chain. Include NPS 1-1/2 or NPS 2-1/2, and hose valve threads according to NFPA 1963 and matching local fire department threads.
 - 1. Valve Operation: Nonadjustable type, unless pressure-regulating type is indicated.
 - 2. Finish: Rough metal.

2.20 FIRE DEPARTMENT CONNECTIONS

- A. Manufacturers:
 - 1. Central Sprinkler Corp.
 - 2. Elkhart Brass Mfg. Co., Inc.
 - 3. Fire-End and Croker Corp.
 - 4. Fire Protection Products, Inc.
 - 5. Guardian Fire Equipment Incorporated.
 - 6. Potter-Roemer; Fire-Protection Div.
 - 7. Reliable Automatic Sprinkler Co., Inc.
 - 8. United Brass Works, Inc.
- B. Wall-Type, Fire Department Connection: UL 405, 175-psig minimum pressure rating; with corrosion-resistant-metal body with brass inlets, brass wall escutcheon plate, brass lugged caps with gaskets and brass chains, and brass lugged swivel connections. Include inlets with threads according to



NFPA 1963 and matching local fire department sizes and threads, outlet with pipe threads, extension pipe nipples, check devices or clappers for inlets, and escutcheon plate with marking similar to "AUTO SPKR & STANDPIPE."

1. Type: Flush, with three inlets and square or rectangular escutcheon plate.
2. Finish: Polished brass.

2.21 ALARM DEVICES

- A. Alarm-device types shall match piping and equipment connections.
- B. Electrically Operated Alarm: Horn/Strobe, NEMA 3R minimum suitable for outdoor use.
 1. Manufacturers:
 - a. Potter Electric Signal Company.
 - b. System Sensor.
- C. Water-Flow Indicator: UL 346, electrical-supervision, paddle-operated-type, water-flow detector with 250-psig pressure rating and designed for horizontal or vertical installation. Include two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
 1. Manufacturers:
 - a. ADT Security Services, Inc.
 - b. Grinnell Fire Protection.
 - c. ITT McDonnell & Miller.
 - d. Potter Electric Signal Company.
 - e. System Sensor.
 - f. Viking Corp.
 - g. Watts Industries, Inc.; Water Products Div.
- D. Pressure Switch: UL 753, electrical-supervision-type, water-flow switch with retard feature. Include single-pole, double-throw, normally closed contacts and design that operates on rising pressure and signals water flow.
 1. Manufacturers:
 - a. Grinnell Fire Protection.
 - b. Potter Electric Signal Company.
 - c. System Sensor.
 - d. Viking Corp.
- E. 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.
- F. Indicator-Post Supervisory Switch: UL 753, electrical, single-pole, double-throw switch with normally closed contacts. Include design that signals controlled indicator-post valve is in other than fully open position.
 - 1. Manufacturers:
 - a. Potter Electric Signal Company.
 - b. System Sensor.

2.22 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.

2.23 DOUBLE CHECK VALVE ASSEMBLIES

- A. Manufacturers
 - 1. Ames
 - 2. Backflow Direct
 - 3. Febco
 - 4. Wilkins
 - 5. Watts
- B. Description; Resilient seated, spring loaded with testable outlets provided, as required by Authorities Having Jurisdiction.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Obtain Engineer's Water Analysis or fire-hydrant flow test. Use results for system design calculations required in "Quality Assurance" Article in Part 1 of this Section.
- B. Engineer's Water Analysis. See Flow Analysis provided by Van Boerum & Frank Associates.



3.2 EARTHWORK

- A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.3 EXAMINATION

- A. Examine roughing-in for hose connections and stations to verify actual locations of piping connections before installation.
- B. Examine walls and partitions for suitable thicknesses, fire- and smoke-rated construction, framing for hose-station cabinets, and other conditions where hose connections and stations are to be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.4 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. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
- E. Underground Service-Entrance Piping: Ductile-iron, push-on or mechanical-joint pipe and fittings and restrained joints. Include corrosion-protective encasement.
- F. 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.
- G. Branch line piping: Use the following:
 - 1. NPS 1-1/4 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
- H. Standpipes and mains: Use the following:
 - 1. NPS 4 to NPS 6: Schedule 40 steel pipe with grooved ends & Welded outlets.
 - 2. NPS 3 and Smaller: Schedule 40 steel pipe with threaded ends, or grooved ends. No plain ends allowed.



3.5 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.

3.6 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.

3.7 WATER-SUPPLY CONNECTION

- A. Install shutoff Backflow preventions assemblies, valve, pressure gage's, drain, and other accessories at connection to water service.

3.8 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 underground service-entrance piping according to NFPA 24 and with restrained joints.
- D. Make connections between underground and above-ground piping using bolted flange.
- E. Install mechanical sleeve seal at pipe penetrations in basement and foundation walls. Refer to Division 23 Section "Common Work Result for HVAC."



- F. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- G. 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.
- H. Install flanges or flange adapters on valves, apparatus, and equipment having NPS 2-1/2 and larger connections.
- I. Install "Inspector's Test Connections" in sprinkler piping, complete with shutoff valve, sized and located according to NFPA 13.
- J. Install sprinkler piping with drains for complete system drainage.
- K. Install sprinkler zone control valves, check valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
- L. Install drain valves on standpipes.
- M. Install ball drip valves to drain piping between fire department connections and check valves. Drain to floor drain or outside building.
- N. Install alarm devices in piping systems.
- O. Hangers and Supports: Comply with NFPA 13 for hanger materials. Install according to NFPA 13 for sprinkler piping and to NFPA 14 for standpipes.
 - 1. No powder driven studs allowed.
 - 2. Wrap-around braces are to be provided at end of branch lines.
- P. 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.
- Q. 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.
- R. 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.
- S. 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.

3.9 SPECIALTY SPRINKLER FITTING INSTALLATION

- A. Install specialty sprinkler fittings according to manufacturer's written instructions.



3.10 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.
- C. Double Check Valve Assemblies: Install valves in vertical up or horizontal position, per listings and for proper direction of flow.

3.11 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 unless indicated otherwise.
 - 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.
 - c. Semi-Recessed Sprinklers: White, with FMG approved white escutcheon.
- B. Sprinklers: Use the following:
 - 1. All sprinklers shall be listed, quick response type.
 - 2. Sprinkler in future finish spaces (shelled) 10' x 10' spacing shall be pendants/uprights installed with 1 x 1/2" bushing, to accommodate future finishes.
 - 3. Finish ceiling spaces shall have semi-recessed type escutcheon.

3.12 SPRINKLER INSTALLATION

- A. Every effort shall be required to ensure that the heads form a symmetrical pattern in the ceiling with the ceiling grid if included, as well as lights, diffusers and grilles. Offsets shall be made in piping to



accommodate ductwork in the ceiling. Heads shall be symmetrical in all ceilings and all piping run parallel or perpendicular to building lines. Heads shall be linearly aligned in corridors.

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. Install sprinklers with 1" x 1/2" bushings, and space heads at a maximum spacing of 100 sq. ft. per head. Occupancy shall be Ordinary-Hazard Group 1 Design.
- F. Concealed type sprinkler shall be installed in the following areas:
1. All areas.

3.13 HOSE-CONNECTION INSTALLATION

- A. Install hose connections adjacent to standpipes, unless otherwise indicated.
- B. Install freestanding hose connections for access and minimum passage restriction.
- C. Install NPS 2-1/2 hose connections with quick-disconnect NPS 2-1/2 by NPS 1-1/2 reducer adapter, cap and chain.

3.14 FIRE DEPARTMENT CONNECTION INSTALLATION

- A. When installing the Fire Department Connection, the contractor is to ensure that there are no permanent obstruction(s) as to the fire department access. If an obstruction is present immediately notify the designer and the design team before proceeding with the installation.
- B. Coordinate the exact location with the Architect and the Authority Having Jurisdiction.
- C. Install ball drip valves at each check valve for fire department connection. Drain to floor drain or outside building.



3.15 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.

3.16 LABELING AND IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13 and NFPA 14 and in Division 23 Section "Common Work Result for HVAC."

3.17 FIELD QUALITY CONTROL

- A. Flush, test, and inspect sprinkler piping according to NFPA 13, "System Acceptance" Chapter.
- B. Flush, test, and inspect standpipes according to NFPA 14, "Tests and Inspection" Chapter.
- C. Replace piping system components that do not pass test procedures and retest to demonstrate compliance. Repeat procedure until satisfactory results are obtained.
- D. When making a mechanical tee connection the coupon shall be attached at the mechanical tee.
- E. Report test results promptly and in writing to Architect and authorities having jurisdiction.
- F. Whether the underground serving the sprinkler system is done by this contractor or another, this contractor will be responsible to assure and have in his possession a certificate that the underground has been flushed and tested by the contractor who installed it in accordance with NFPA-24 prior to connection of the underground piping to the overhead sprinkler system.

3.18 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Remove and replace sprinklers having paint other than factory finish.

3.19 PROTECTION

- A. Protect sprinklers from damage until Substantial Completion.

3.20 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. Verify that hose connections and fire department connections have threads compatible with local fire department equipment.
- F. Fill wet-pipe sprinkler piping with water.
- G. Fill standpipes with water.
- H. Verify that hose connections are correct type and size.
- I. Coordinate with fire alarm tests. Operate as required.

3.21 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 Utah 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.

3.22 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.

3.23 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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DIVISION 22

PLUMBING



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SECTION 22 05 00

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. Grout.
 - 8. Equipment installation requirements common to equipment sections.
 - 9. Painting and finishing.
 - 10. Concrete bases.
 - 11. Supports and anchorages.
 - 12. Link Seal
 - 13. 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 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

2.10 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.

2.11 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 22 05 48 "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. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Install steel pipe for sleeves smaller than 6 inches in diameter.
 - 2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.

3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- R. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- S. 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.
- T. Verify final equipment locations for roughing-in.
- U. 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.
- I. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 - 1. Plain-End Pipe and Fittings: Use butt fusion.
 - 2. Plain-End Pipe and Socket Fittings: Use socket fusion.
- J. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

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 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
 - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
 - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.10 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.11 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

3.12 GROUTING

- A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.

- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION

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SECTION 22 05 17

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, concrete roof slabs, 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. Exterior Concrete Walls above Grade:
 - a. Piping Smaller Than **NPS 6: Cast-iron wall sleeves.**
 - b. Piping **NPS 6** and Larger: **Cast-iron wall sleeves.**
 - 2. Exterior Concrete Walls below 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.



3. Concrete Slabs above Grade:
 - a. Piping Smaller Than **NPS 6**: **Galvanized-steel-pipe sleeves** .
 - b. Piping **NPS 6** and Larger: **Galvanized-steel-pipe sleeves**.
4. 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



SECTION 22 05 23
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 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
2. 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. Norriseal; 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. Norriseal; 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. Norriseal; 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 LOW-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 PSIG OR LESS)

- A. Pipe NPS 2 and Smaller:
 1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
 2. Ball Valves: One, Two, or Three piece, full, regular or reduced port, with brass, bronze or stainless-steel trim.
 3. Bronze Lift Check Valves: Class 125, bronze disc.
 4. Bronze Swing Check Valves: Class 125, 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: 200 CWP, NBR seat, aluminum-bronze, ductile-iron or stainless-steel disc.
 3. Iron Swing Check Valves: Class 125, metal seats.

3.6 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



SECTION 22 05 29
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 stands.
7. Pipe positioning systems.
8. Equipment supports.

- B. Related Sections include the following:

1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Division 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 22 05 48 "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 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.10 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 22 05 48 "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 Stand Installation:
1. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
 2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. Refer to Division 07 Section "Roof Accessories" for curbs.
- H. 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.
- I. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- J. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- K. 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.
- L. Install lateral bracing with pipe hangers and supports to prevent swaying.
- M. 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.
- N. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.



- O. 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.
- P. 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 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make smooth bearing surface.
- C. Provide lateral bracing, to prevent swaying, for equipment supports. For applications where seismic bracing is required, 'Cracked Concrete' expansion anchors or concrete screws tested per A.C. 193 must be provided for seismic bracing anchorage where post-installed anchors are required.

3.4 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.



- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches .

3.6 PAINTING

- A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. 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 22 05 48
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 23 05 48 "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 22 05 53
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 22 07 00
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:
 - a. Flexible elastomeric.
 - b. Mineral fiber.
 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. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.
- 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 I. 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.; Duct Wrap.
 - b. Johns Manville; Microlite.
 - c. Knauf Insulation; Duct Wrap.
 - d. Manson Insulation Inc.; Alley Wrap.
 - e. Owens Corning; 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 equipment 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; Fiberglass 700 Series.

I. 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.

J. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied 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.

1. 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.

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 Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.



- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
1. Comply with requirements in Division 07 Section "Penetration Firestopping" and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
1. Pipe: Install insulation continuously through floor penetrations.
 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 EQUIPMENT, TANK, AND VESSEL INSULATION INSTALLATION

- A. Mineral Fiber, Pipe and Tank Insulation Installation for Tanks and Vessels: Secure insulation with adhesive and anchor pins and speed washers.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of tank and vessel surfaces.
 2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
 3. Protect exposed corners with secured corner angles.
 4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:
 - a. Do not weld anchor pins to ASME-labeled pressure vessels.
 - b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
 - c. On tanks and vessels, maximum anchor-pin spacing is 3 inches from insulation end joints, and 16 inches o.c. in both directions.
 - d. Do not overcompress insulation during installation.
 - e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
 - f. Impale insulation over anchor pins and attach speed washers.



- g. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
- 5. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
- 6. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches from each end. Install wire or cable between two circumferential girdles 12 inches o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches o.c. Use this network for securing insulation with tie wire or bands.
- 7. Stagger joints between insulation layers at least 3 inches.
- 8. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
- 9. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
- 10. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

B. Insulation Installation on Pumps:

- 1. Fabricate metal boxes lined with insulation. Fit boxes around pumps and coincide box joints with splits in pump casings. Fabricate joints with outward bolted flanges. Bolt flanges on 6-inch centers, starting at corners. Install 3/8-inch- diameter fasteners with wing nuts. Alternatively, secure the box sections together using a latching mechanism.
- 2. Fabricate boxes from aluminum or stainless steel, at least 0.040 inch thick.
- 3. For below ambient services, install a vapor barrier at seams, joints, and penetrations. Seal between flanges with replaceable gasket material to form a vapor barrier.

3.6 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.

3.7 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
 1. Install pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
 1. Install mitered sections of pipe insulation.
 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
 1. Install preformed valve covers manufactured of same material as pipe insulation when available.
 2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 3. Install insulation to flanges as specified for flange insulation application.
 4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.8 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.

3.9 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.

3.10 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.



3.11 Insulation shall have a k value that meets the minimum requirements of the latest International Energy Conservation Code (IECC).

3.12 EQUIPMENT INSULATION SCHEDULE

- A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.
- B. Insulate indoor and outdoor equipment in paragraphs below that is not factory insulated.
- C. Steam-to-hot-water converter insulation shall be one of the following:
 - 1. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.
 - 2. Mineral-Fiber Pipe and Tank: 2 inches thick.
- D. Unfired Hot Water Storage Tanks
 - 1. Mineral-Fiber Board: 3.5 inches thick and 2-lb/cu. ft. nominal density.
 - 2. Mineral-Fiber Pipe and Tank: 3.5 inches thick.
- E. Domestic water pump insulation shall be the following:
 - 1. Mineral-Fiber Board: 1 inch thick and 2-lb/cu. ft. nominal density.
- F. Domestic hot-water pump insulation shall be the following:
 - 1. Mineral-Fiber Board: 1 inch thick and 2-lb/cu. ft. nominal density.
- G. Domestic water, domestic chilled-water (potable), and domestic hot-water hydropneumatic tank insulation shall be one of the following:
 - 1. Mineral-Fiber Board: 1 inch thick and 2-lb/cu. ft. nominal density.
 - 2. Mineral-Fiber Pipe and Tank: 1 inch thick.

3.13 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.

3.14 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.
- C. Domestic Chilled Water (Potable):
1. All Pipe Sizes: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch.
- D. Stormwater and Overflow:
1. All Pipe Sizes: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch.
- E. Roof Drain and Overflow Drain Bodies:
1. All Pipe Sizes: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch.
- F. Condensate and Equipment Drain Water below 60 Deg F:
1. All Pipe Sizes: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch.

3.15 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. Equipment, Concealed:



- 1. None.
- D. Equipment, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches.
 - 1. Aluminum, Stucco Embossed: 0.016 inch thick.
- E. Equipment, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches:
 - 1. Aluminum, Stucco Embossed with 1-1/4-Inch- Deep Corrugations: 0.032 inch thick.
- F. Piping, Concealed:
 - 1. None.
- G. Piping, Exposed:
 - 1. PVC: 20 mils thick.
 - a. Jacket Color: (Mechanical Rooms and where exposed)
 - 1) Domestic Water (Hot & Cold & Hot Return): **Green**
 - 2) Industrial Water (Hot & Cold & Hot Return): **Brown**
 - 3) All Other Piping: **White**

3.16 OUTDOOR, 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: 20 mils thick.

END OF SECTION

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SECTION 22 11 16

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 DUCTILE-IRON PIPE AND FITTINGS

- A. Mechanical-Joint, Ductile-Iron Pipe:
 1. AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.



- 2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- B. Standard-Pattern, Mechanical-Joint Fittings:
 - 1. AWWA C110/A21.10, ductile or gray iron.
 - 2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- C. Compact-Pattern, Mechanical-Joint Fittings:
 - 1. AWWA C153/A21.53, ductile iron.
 - 2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- D. Plain-End, Ductile-Iron Pipe: AWWA C151/A21.51.

2.4 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.
- F. PP Pipe and Fittings: Manufacturer's recommended fusion-weld system.

2.5 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.
- D. Plastic-to-Metal Transition Fittings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following
 - a. Charlotte Pipe and Foundry Company.
 - b. Harvel Plastics, Inc.
 - c. Spears Manufacturing Company.
 - 2. Description:
 - a. CPVC or PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions.
 - b. One end with threaded brass insert and one solvent-cement-socket or threaded end.
- E. Plastic-to-Metal Transition Unions:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Colonial Engineering, Inc.
 - b. NIBCO Inc.
 - c. Spears Manufacturing Company.
 - 2. Description:
 - a. **CPVC** four-part union.
 - b. **Brass** threaded end.
 - c. **Solvent-cement-joint** plastic end.
 - d. Rubber O-ring.
 - e. Union nut.

2.6 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric 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. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
- D. Install underground **copper tube** in PE encasement according to ASTM A 674 or AWWA C105/A21.5.
- E. 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."
- F. Install shutoff valve immediately upstream of each dielectric fitting.
- G. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Division 22 Section "Domestic Water Piping Specialties."
- H. Install domestic water piping level **with 0.25 percent slope downward toward drain** and plumb.
 - 1. Piping will be drained seasonally for freeze protection.



- I. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- J. 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."
- K. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- L. 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.
- M. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- N. Install piping to permit valve servicing.
- O. 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.
- P. Install piping free of sags and bends.
- Q. Install fittings for changes in direction and branch connections.
- R. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- S. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gages in Division 22 Section "Meters and Gages for Plumbing Piping."
- T. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Division 22 Section "Domestic Water Pumps."
- U. Install thermometers on **inlet** piping from each water heater. Comply with requirements for thermometers in Division 22 Section "Meters and Gages for Plumbing Piping."
- V. 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."
- W. 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."
- X. 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," "Brazed 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. Joint Construction for Grooved-End, Ductile-Iron Piping: Make joints according to AWWA C606. Cut round-bottom grooves in ends of pipe at gasket-seat dimension required for specified (flexible or rigid) joint. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.
- G. Joint Construction for Grooved-End Steel Piping: Make joints according to AWWA C606. Roll groove ends of pipe as specified. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.
- H. 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.
- I. 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**.
- D. Dielectric Fittings for NPS 5 and Larger: 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 copper tubing every 10 feet.
- G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4 and Smaller: 84 inches with 3/8-inch rod.
 - 2. NPS 1-1/2: 108 inches with 3/8-inch rod.



3. NPS 2: 10 feet with 3/8-inch rod.
 4. NPS 2-1/2: 11 feet with 1/2-inch rod.
 5. NPS 3 and NPS 3-1/2: 12 feet with 1/2-inch rod.
 6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
 7. NPS 6: 12 feet with 3/4-inch rod.
 8. NPS 8 to NPS 12: 12 feet with 7/8-inch rod.
- H. Install supports for vertical steel piping every 15 feet.
- I. 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.
- J. 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. Under-building-slab, domestic water, building-service piping, NPS 3 and smaller, shall be the following:
 - 1. Soft copper tube, **ASTM B 88, Type K; wrought-copper, solder-joint fittings;** and brazed joints.
- F. Under-building-slab, domestic water, building-service piping, NPS 4 to NPS 8 and larger, shall be the following:
 - 1. Soft copper tube, **ASTM B 88, Type K;** wrought-copper, solder-joint fittings; and brazed joints.
- G. Under-building-slab, combined domestic water, building-service, and fire-service-main piping, NPS 6 to NPS 12, shall be the following:
 - 1. Mechanical-joint, ductile-iron pipe; **standard-**, mechanical-joint fittings; and mechanical joints.
- H. Under-building-slab, domestic water piping, **NPS 2 and smaller**, shall be the following:
 - 1. **Hard** copper tube; **ASTM B 88, Type K; wrought-copper, solder-joint fittings;** and brazed joints.
- I. 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.
- J. 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.
- K. Aboveground domestic water piping, **NPS 5 and larger**, 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. Hot-Water Circulation Piping, Balancing Duty: **Calibrated** balancing valves.
 4. 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

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SECTION 22 11 19
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. Balancing valves.
 5. Temperature-actuated water mixing valves.
 6. Strainers.
 7. Outlet boxes.
 8. Hose bibbs.
 9. Wall hydrants.
 10. Drain valves.
 11. 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 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.

E. Carbonated-Beverage-Dispenser, Dual-Check-Valve Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cash Acme.
 - b. Lancer Corporation.
 - c. Watts Industries, Inc.; Water Products Div.
2. Standard: ASSE 1032.
3. Operation: Continuous-pressure applications.
4. Size: NPS 1/4 or NPS 3/8.
5. Body: Stainless steel.
6. End Connections: Threaded.

2.3 WATER PRESSURE-REDUCING VALVES

A. Water Regulators: (Direct Type)

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. Watts Industries, Inc.; Water Products Div.
 - e. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1003.
 3. Pressure Rating: Initial working pressure of 150 psig.
 4. Body: Bronze, provide chrome-plated finish if connected to chrome plated or stainless steel piping 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 NPS 3.
 5. Valves for Booster Heater Water Supply: Include integral bypass.
 6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and NPS 3.

B. Water Control Valves: (Pilot type)

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CLA-VAL Automatic Control Valves.
 - b. Mifab Corp; Beeco.
 - c. Watts Industries, Inc.; Ames Fluid Control Systems.
 - d. Watts Industries, Inc.; Watts ACV.
 - e. Zurn Plumbing Products Group; Wilkins Div.
2. Description: Pilot-operation, diaphragm-type, single-seated main water control valve.
3. Pressure Rating: Initial working pressure of 150 psig minimum with AWWA C550 or FDA-approved, interior epoxy coating. Include small pilot-control valve, restrictor device, specialty fittings, and sensor piping.
4. Main Valve Body: Cast- or ductile-iron body with AWWA C550 or FDA-approved, interior epoxy coating; or stainless-steel body.
5. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.

2.4 BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong International, Inc.
 - b. Flo Fab Inc.
 - c. ITT Industries; Bell & Gossett Div.
 - d. NIBCO INC.
 - e. TAC Americas.
 - f. Taco, Inc.
 - g. Victaulic
 - h. Watts Industries, Inc.; Water Products Div.
2. Type: Ball or Y-pattern globe valve with two readout ports and memory setting indicator.
3. Body: bronze,
4. Size: Same as connected piping, but not larger than NPS 2.
5. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.



B. Cast-Iron Calibrated Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong International, Inc.
 - b. Flo Fab Inc.
 - c. ITT Industries; Bell & Gossett Div.
 - d. NIBCO INC.
 - e. TAC Americas.
 - f. Watts Industries, Inc.; Water Products Div.
2. Type: Adjustable with Y-pattern globe valve, two readout ports, and memory-setting indicator.
3. Size: Same as connected piping, but not smaller than NPS 2-1/2.

C. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

2.5 TEMPERATURE-ACTUATED WATER MIXING VALVES

A. Water-Temperature Limiting Devices:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong International, Inc.
 - b. Cash Acme.
 - c. Conbraco Industries, Inc.
 - d. Honeywell Water Controls.
 - e. Leonard Valve Company.
 - f. Powers; a Watts Industries Co.
 - g. Symmons Industries, Inc.
 - h. Taco, Inc.
 - i. Watts Industries, Inc.; Water Products Div.
 - j. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig.
4. Type: Thermostatically controlled water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded union inlets and outlet.
7. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Valve Finish: Rough bronze.

B. 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.

C. 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.

2.6 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.

2.7 OUTLET BOXES

A. Icemaker Outlet Boxes:

1. Basis of Design: See plumbing fixture schedule.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Acorn Engineering Company.
 - b. Guy Gray Manufacturing Co., Inc.
 - c. IPS Corporation.
 - d. LSP Products Group, Inc.
 - e. Oatey.
 - f. Plastic Oddities; a division of Diverse Corporate Technologies.
 - g. Symmons Industries, Inc.
 - h. Watts Industries, Inc.; Water Products Div.
 - i. Whitehall Manufacturing; a div. of Acorn Engineering Company.
 - j. Zurn Plumbing Products Group; Light Commercial Operation.
3. Mounting: Recessed.
4. Material and Finish: Enameled-steel or epoxy-painted-steel or plastic box and faceplate.
5. Faucet: Combination, valved fitting or separate hot- and cold-water, valved fittings complying with ASME A112.18.1. Include garden-hose thread complying with ASME B1.20.7 on outlets.
6. Supply Shutoff Fittings: NPS 1/2 gate, globe, or ball valves and NPS 1/2 copper, water tubing.
7. Drain: NPS 2 standpipe and P-trap for direct waste connection to drainage piping.
8. Inlet Hoses: Two 60-inch- long, rubber household clothes washer inlet hoses with female, garden-hose-thread couplings. Include rubber washers.
9. Drain Hose: One 48-inch- long, rubber household clothes washer drain hose with hooked end.
10. Operating Keys: Two with each wall hydrant.

2.8 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.



2.9 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.

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. Carbonated-beverage-machine backflow preventers.
 - 5. Dual-check-valve backflow preventers.
 - 6. Water pressure-reducing valves.
 - 7. Calibrated balancing valves.
 - 8. Primary, thermostatic, water mixing valves.
 - 9. Primary water tempering valves.
 - 10. Outlet boxes.
- 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 22 13 16

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 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. PVC: Polyvinyl chloride plastic.

1.4 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.
- B. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of earthquake motions determined according to SEI/ASCE 7 and with the requirements specified in Section 23 05 48 "Vibration and Seismic Controls for HVAC."
 - 1. For piping 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."
 - 2. For piping 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."

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:



1. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.
2. Laboratory Test Reports for Credit IEQ 4: For solvent cements and adhesive primers, documentation indicating that products 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."

1.6 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. LEED Submittals:
 1. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.
- C. Field quality-control reports.

1.7 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.

1.8 PROJECT CONDITIONS

- A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 1. Notify Construction Manager no fewer than two days in advance of proposed interruption of sanitary waste 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.

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).
- 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).

2.4 DOUBLE-CONTAINMENT PIPE AND FITTINGS

- A. Piping Materials:
 - 1. PVC Double-Containment Pipe and Fittings:
 - a. PVC Carrier Pipe: ASTM D1785, Schedule 40 with ASTM D2466 fittings.
 - 1) Piping Color: White.
 - b. PVC Containment Pipe: ASTM D1785, Schedule 40 with ASTM D2466 fittings.
 - 1) Piping Color: Clear.
 - c. Supports: Molded supports or disks as supplied by the double containment piping system manufacturer for the size and piping type specified.

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 at indicated slopes.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Install piping to allow application of insulation.
- I. 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."
- J. 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.
- K. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert.
- L. 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.
- M. 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.
- N. Install underground PVC piping according to ASTM D 2321.
- O. Install PVC Double-Containment as required by the manufacturer:
 - 1. All installers should be trained by manufacturer or manufacturer's rep to ensure that proper installation techniques and considerations are followed.
- P. 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.
- Q. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- R. 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."
- S. 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."
- T. 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. Install hangers for double-containment PVC piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS: 48 inches with 3/8-inch rod.
 - 2. NPS 3: 48 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
 - 4. NPS 6 and NPS 8: 48 inches with 3/4-inch rod.
 - 5. NPS 10 and NPS 12: 48 inches with 7/8-inch rod.
- I. Install supports for vertical double-containment PVC piping every 48 inches.
- J. 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. Comply with requirements for cleanouts and drains specified in Division 22 Section "Sanitary Waste Piping Specialties."
 6. 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.
 2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- 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.
 2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- 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.
 2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- 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. Aboveground Grease, soil, waste and vent piping shall be any of the following:
 - 1. Hubless, cast-iron soil pipe and fittings heavy-duty hubless-piping couplings; and coupled joints.
 - 2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- G. Aboveground, soil and waste piping installed above operating rooms, delivery rooms, trauma rooms, nurseries, central kitchens, sterile processing and Class 1 and 2 imaging rooms shall be the following:
 - 1. Double-Containment piping with solvent cement joints.
 - 2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- H. Underground Grease, soil, waste and vent piping 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. Rated for High Temperatures.
- I. Underground, soil, waste, and vent piping NPS 3 and smaller shall be the following:
 - 1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints. All underground waste piping in boiler room shall be rated for high temperatures.
 - 2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- J. Underground, soil and waste piping NPS 4 and larger shall be the following:
 - 1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints. All underground waste piping in boiler room shall be rated for high temperatures.
 - 2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- K. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

END OF SECTION



SECTION 22 13 19
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. Channel drainage systems.
 4. Roof flashing assemblies.
 5. Through-penetration firestop assemblies.
 6. Miscellaneous sanitary drainage piping specialties.
 7. 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 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment."



1.4 DEFINITIONS

- A. FOG: Fats, oils, and greases.
- B. FRP: Fiberglass-reinforced plastic.
- C. HDPE: High-density polyethylene plastic.
- D. PE: Polyethylene plastic.
- E. PP: Polypropylene plastic.
- F. 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 calk.
 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: Barrier type trap seal. Trap Guard or equivalent.

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.
- 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. Floor-Drain, Trap-Seal:



1. Description: Barrier type trap seal. Trap Guard or equivalent.
- C. 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.
- D. 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.
- E. 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.
- F. 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.



2.6 MOTORS

- A. General requirements for motors are specified in Division 22 Section "Common Motor Requirements for Plumbing Equipment."
 - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - 2. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 26 Sections.

PART 3 - EXECUTION

3.1 CONCRETE BASES

- A. Anchor grease removal devices to concrete bases.
 - 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 19-inch centers around full perimeter of base.
 - 2. For installed equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be imbedded.
 - 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 5. Concrete base construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."
 - 6. Cast-in-place concrete materials and placement requirements are specified in Division 03.

3.2 INSTALLATION

- A. Comply with requirements for seismic-restraint devices in Section 22 05 48 "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 backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.
- D. 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.



- E. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- F. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- G. 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.
- H. 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.
- I. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- J. Install floor-drain, trap-seal device in inlet to floor drains that require trap-seal protection.
 - 1. Size: Same as floor drain inlet.
- K. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- L. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- M. Install vent cap filters on each vent pipe passing through roof.
- N. Install wood-blocking reinforcement for wall-mounting-type specialties.
- O. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.
- P. 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.



3.3 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. 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 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.

3.5 LABELING AND IDENTIFYING

- A. 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."



3.6 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.

3.7 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.

3.8 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 22 40 00
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 showers and sinks.
 2. Flushometers.
 3. Toilet seats.
 4. Protective shielding guards.
 5. Fixture supports.
 6. Water closets.
 7. Lavatories.
 8. Service sinks.
- B. Related Sections include the following:
1. Division 10 Section "Toilet, Bath, and Laundry Accessories."
 2. Division 22 Section "Domestic Water Piping Specialties" for backflow preventers, floor drains, and specialty fixtures not included in this Section.
 3. Division 22 Section "Emergency Plumbing Fixtures."
 4. Division 22 Section "Drinking Fountains and Water Coolers."

1.3 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.

1.4 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.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.
 - 1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.
- B. 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.
 8. Whirlpool Bathtub Fittings: ASME A112.19.8M.
- 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 shower faucets:
1. Backflow Protection Devices for Hand-Held Showers: ASME A112.18.3M.
 2. Combination, Pressure-Equalizing and Thermostatic-Control Antiscald Faucets: ASSE 1016.
 3. Deck-Mounted Bath/Shower Transfer Valves: ASME 18.7.
 4. Faucets: ASME A112.18.1.
 5. Hand-Held Showers: ASSE 1014.
 6. High-Temperature-Limit Controls for Thermal-Shock-Preventing Devices: ASTM F 445.
 7. Hose-Coupling Threads: ASME B1.20.7.
 8. Manual-Control Antiscald Faucets: ASTM F 444.
 9. Pipe Threads: ASME B1.20.1.
 10. Pressure-Equalizing-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
 11. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
 12. Thermostatic-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
- J. 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.
- K. Comply with the following applicable standards and other requirements specified for miscellaneous components:
1. Disposers: ASSE 1008 and UL 430.
 2. Dishwasher Air-Gap Fittings: ASSE 1021.
 3. Flexible Water Connectors: ASME A112.18.6.
 4. Floor Drains: ASME A112.6.3.
 5. Grab Bars: ASTM F 446.
 6. Hose-Coupling Threads: ASME B1.20.7.
 7. Off-Floor Fixture Supports: ASME A112.6.1M.
 8. Pipe Threads: ASME B1.20.1.
 9. Plastic Toilet Seats: ANSI Z124.5.
 10. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 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. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
 2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.
 3. Flushometer Valve, Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than 12 of each type.
 4. Provide hinged-top wood or metal box, or individual metal boxes, with separate compartments for each type and size of extra materials listed above.
 5. Toilet Seats: Equal to 5 percent of amount of each type installed.

PART 2 - PRODUCTS

2.1 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.

2.2 SHOWER FAUCETS

- A. Shower Faucets:



1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Symmons
 - b. Chicago Faucets.
 - c. Leonard Valve Company.
 - d. T & S Brass and Bronze Works, 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. Zurn Plumbing Products Group; Commercial Brass Operation.

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.

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. Briggs Plumbing Products, Inc.
 - b. Crane Plumbing, L.L.C./Fiat Products.
 - c. Eljer.
 - d. Kohler Co.

2.10 SERVICE SINKS

A. Service Sinks:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard Companies, Inc.
 - b. Commercial Enameling Company.
 - c. Eljer.
 - d. Kohler Co.
 - e. Crane Plumbing, L.L.C./Fiat Products.

2.11 KITCHEN EQUIPMENT

A. Kitchen Equipment (as noted on Kitchen Equipment Schedule):

1. Rough-in and connect to Kitchen equipment as per the Kitchen Equipment Rough-in drawings. Provide all "P" traps required, chrome-plated cast brass. Tail pieces and trap arms shall be chrome-plated 17 ga. brass tubing.
2. Provide Precision Plumbing Products water hammer arrestors upstream of all quick-closing valves, such as on disposers and dishwasher.
3. Gas and water services to portable and countertop appliances shall be connected to equipment with flexible tubing and quick-disconnect fittings. Gas fittings and hoses shall be A.G.A. approved for commercial kitchen equipment.



4. All exposed piping and fittings shall be chrome-plated or stainless steel. Furnish and install stops on all hot and cold water lines at equipment.
5. Provide shut-off valves and unions in all gas, steam and condensate lines at each connection to equipment.
6. All piping penetrations through walls shall be a minimum of 6" above the floor.
7. Provide 3/4" Watts model U5BLP pressure reducing valve on supply line to dishwasher.
8. Provide check valves on supplies to hose sprays.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.
- B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.
 1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
 2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
 3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
- C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.
- D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
- E. Install wall-mounting fixtures with tubular waste piping attached to supports.
- F. Install counter-mounting fixtures in and attached to casework.
- G. Install fixtures level and plumb according to roughing-in drawings.
- H. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
 1. Exception: Use ball, 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."



- I. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- J. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
- K. Install 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.
- L. Install toilet seats on water closets.
- M. 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.
- N. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.
- O. 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.
- P. Install shower flow-control fittings with specified maximum flow rates in shower arms.
- 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. 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 22 62 13

VACUUM PIPING FOR LABORATORY AND HEALTHCARE FACILITIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Medical-surgical vacuum piping, designated "medical vacuum."
 - 2. Waste anesthetic gas disposal piping, designated "WAGD."
- B. Related Requirements:
 - 1. Section 22 62 19 "Vacuum Equipment for Laboratory and Healthcare Facilities" for vacuum producers and accessories.
 - 2. Section 22 64 00 "Medical Gas Alarms" for vacuum piping alarms.

1.03 DEFINITIONS

- A. WAGD: Waste anesthetic gas disposal.
- B. Medical vacuum piping systems include medical vacuum, WAGD, dental vacuum, HVE, and medical laboratory vacuum piping systems.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and testing agency.
- B. Review reports for testing agency's review of construction documents.
- C. Material Certificates: Signed by Installer certifying that medical vacuum piping materials comply with requirements in NFPA 99.
- D. Brazing certificates.



- E. Field quality-control reports.

1.06 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For vacuum piping specialties to include in emergency, operation, and maintenance manuals.

1.07 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. Quick-Coupler Service Connections: Furnish complete noninterchangeable medical vacuum suction inlets.
 - a. Medical Vacuum: Equal to 10 percent of amount installed, but no fewer than 10 units.
 - b. WAGD: Equal to 10 percent of amount installed, but no fewer than 10 units.
 - 2. D.I.S.S. Service Connections: Furnish complete medical vacuum suction inlets complying with CGA V-5.
 - a. Medical Vacuum D.I.S.S. No. 1220: Equal to 10 percent of amount installed, but no fewer than 10 units.
 - b. WAGD D.I.S.S. No. 2220: Equal to 10 percent of amount installed, but no fewer than 10 units.

1.08 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Medical Vacuum Piping Systems for Healthcare Facilities: According to ASSE Standard #6010 for medical-gas-system installers.
 - 2. Shape-Memory-Metal Coupling Joints: An authorized representative who is trained and approved by manufacturer.
- B. Testing Agency Qualifications: An independent testing agency, with the experience and capability to conduct the vacuum piping testing indicated, that is a member of the Medical Gas Professional Healthcare Organization or is an NRTL, and that is acceptable to authorities having jurisdiction.
 - 1. Qualify testing personnel according to ASSE Standard #6020 for medical-gas-system inspectors and ASSE Standard #6030 for medical-gas-system verifiers.
- C. Brazing: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code, Section IX, "Welding and Brazing Qualifications"; or AWS B2.2, "Standard for Brazing Procedure and Performance Qualification."



PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION

- A. Medical vacuum operating at 15 in. Hg.
- B. WAGD operating at 15 in. Hg.

2.02 PIPES, TUBES, AND FITTINGS

- A. Comply with NFPA 99 for medical vacuum piping materials.
- B. Copper Medical Gas Tube: ASTM B 819, Type L, seamless, drawn temper that has been manufacturer cleaned, purged, and sealed for medical gas service or according to CGA G-4.1 for oxygen service. Include standard color marking "OXY," "MED," "OXY/MED," "OXY/ACR," or "ACR/MED" in blue.
- C. Wrought-Copper Fittings: ASME B16.22, solder-joint pressure type that has been manufacturer cleaned, purged, and sealed for medical gas service or according to CGA G-4.1 for oxygen service.
- D. Copper Unions: ASME B16.22 or MSS SP-123, wrought-copper or cast-copper alloy.
- E. Cast-Copper-Alloy Flanges: ASME B16.24, Class 150.
 - 1. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness, full-face type.
 - 2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel.
- F. Shape-Memory-Metal Couplings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:
 - a. Aerofit, Inc.
 - b. Smart Tap, Inc.
 - 3. Description: Cryogenic compression fitting made of nickel-titanium, shape-memory alloy, and that has been manufacturer cleaned, purged, and sealed for oxygen service according to CGA G-4.1.
- G. Flexible Pipe Connectors:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 2. Basis-of-Design Product: Subject to compliance with requirements, product by one of the following:



- a. Flex-Hose Co., Inc.
 - b. Flexicraft Industries.
 - c. Hyspan Precision Products, Inc.
 - d. Mercer Gasket & Shim, Inc.
 - e. Metraflex Company (The).
 - f. Proco Products, Inc.
 - g. Unaflex.
 - h. Universal Metal Hose; a Hyspan Co.
3. Description: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
- a. Working-Pressure Rating: 200 psig minimum.
 - b. End Connections: Plain-end copper tube.

2.03 JOINING MATERIALS

- A. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- B. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys.
- C. Threaded-Joint Tape: PTFE.

2.04 VALVES

- A. General Requirements for Valves: Manufacturer cleaned, purged, and bagged according to CGA G-4.1 for oxygen service.
 - 1. Exception: Factory cleaning and bagging are not required for valves for WAGD service.
- B. Zone-Valve Box Assemblies: Box with medical gas valves, tube extensions, and gages.
 - 1. Zone-Valve Boxes:
 - a. Steel Box with Aluminum Cover:
 - 1) Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 2) Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:
 - a) Allied Healthcare Products Inc.
 - b) Amico Corporation.
 - c) Ohio Medical Corporation.
 - d) BeaconMedaes
 - e) Patton's Medical
 - b. Description: Formed steel box with cover, anchors for recessed mounting, holes with grommets in box sides for tubing extension protection, and of size for single



or multiple valves with pressure gages and in sizes required to permit manual operation of valves. Medical air and medical vacuum tubing, valves, and gages may be incorporated in zone valve boxes for medical gases.

- 1) Interior Finish: Factory-applied white enamel.
- 2) Cover Plate: Aluminum with frangible or removable windows.
- 3) Valve-Box Windows: Clear or tinted transparent plastic with labeling that includes rooms served, according to NFPA 99.

C. Copper-Alloy Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:
 - a. Allied Healthcare Products Inc.; Chemetron Division.
 - b. Amico Corporation.
 - c. BeaconMedaes.
 - d. Conbraco Industries, Inc.
 - e. Marwin Valve; a division of Richards Industries.
 - f. NIBCO INC.
 - g. Ohio Medical Corporation.
 - h. Patton's Medical
3. Standard: MSS SP-110.
4. Description: Three-piece body, brass or bronze.
5. Pressure Rating: 300 psig minimum.
6. Ball: Full-port, chrome-plated brass.
7. Seats: PTFE or TFE.
8. Handle: Lever type with locking device.
9. Stem: Blowout proof with PTFE or TFE seal.
10. Ends: manufacturer-installed ASTM B 819, copper-tube extensions with pressure gage on one copper-tube extension.

D. Check Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:
 - a. Allied Healthcare Products Inc.; Chemetron Division.
 - b. Amico Corporation.
 - c. BeaconMedaes.
 - d. Conbraco Industries, Inc.
 - e. Ohio Medical Corporation.
 - f. Patton's Medical
3. Description: In-line pattern, bronze.
4. Pressure Rating: 300 psig minimum.
5. Operation: Spring loaded.



6. Ends: Manufacturer-installed ASTM B 819, copper-tube extensions.

2.05 MEDICAL VACUUM SERVICE CONNECTIONS

- A. Manufacturers: The contractor shall match the existing system exactly and shall include a bid breakdown form showing breakout pricing for each of the listed manufacturers. Subject to compliance with requirements, provide products by one of the following:
 1. Beacon Medaes (Basis of Design)
 2. Allied Healthcare Products Inc.; Chemetron Division.
 3. Amico Corporation.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide Chemetron compatible product by one of the following:
 1. Beacon Medaes (Basis of Design)
 2. Allied Healthcare Products Inc.; Chemetron Division.
 3. Amico Corporation.
- C. General Requirements for Medical Vacuum Service Connections:
 1. Suitable for specific medical vacuum service listed.
 2. Include roughing-in assemblies, finishing assemblies, and cover plates.
 3. Individual cover plates are not required if service connection is in multiple unit or assembly with cover plate.
 4. Recessed-type units made for concealed piping unless otherwise indicated.
- D. Roughing-in Assembly:
 1. Steel outlet box for recessed mounting and concealed piping.
 2. Brass-body inlet block.
 3. Seals that will prevent vacuum leakage.
 4. ASTM B 819, NPS 3/8 copper outlet tube brazed to valve with service marking and tube-end dust cap.
- E. Finishing Assembly:
 1. Brass housing with primary check valve.
 2. Seals that will prevent vacuum leakage.
 3. Cover plate with gas-service label.
- F. Quick-Coupler Suction Service Connections:
 1. Inlets for medical vacuum and WAGD with noninterchangeable keyed indexing to prevent interchange between services.
 2. Constructed to permit one-handed connection and removal of equipment.
 3. With positive-locking ring that retains equipment stem in valve during use.
- G. D.I.S.S. Suction Service Connections:
 1. Inlets complying with CGA V-5.
 2. Threaded indexing to prevent interchange between services.
 3. Constructed to permit one-handed connection and removal of equipment.
 4. Medical Vacuum: CGA V-5, D.I.S.S. No. 1220.
 5. WAGD: CGA V-5, D.I.S.S. No. 2220.



- H. Vacuum Bottle Brackets: One piece, with pattern and finish matching corresponding service cover plate.
- I. Cover Plates:
 - 1. One piece.
 - 2. Aluminum or stainless steel.
 - 3. Permanent, color-coded, identifying label matching corresponding service.

2.06 NITROGEN

- A. Comply with USP 32 - NF 27 for oil-free dry nitrogen.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Cleaning of Medical Gas Tubing: If manufacturer-cleaned and -capped fittings or tubing is not available or if precleaned fittings or tubing must be recleaned because of exposure, have supplier or separate agency acceptable to authorities having jurisdiction perform the following procedures:
 - 1. Clean medical gas tube and fittings, valves, gages, and other components of oil, grease, and other readily oxidizable materials as required for oxygen service according to CGA G-4.1.
 - 2. Wash medical gas tubing and components in hot, alkaline-cleaner-water solution of sodium carbonate or trisodium phosphate in proportion of 1 lb of chemical to 3 gal. of water.
 - a. Scrub to ensure complete cleaning.
 - b. Rinse with clean, hot water to remove cleaning solution.

3.02 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of vacuum piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, vacuum producer sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Comply with NFPA 99 for installation of vacuum piping.
- C. Install piping concealed from view and protected from physical contact by building occupants 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 and coordinate with other services occupying that space.
- F. Install piping adjacent to equipment and specialties to allow service and maintenance.
- G. Install vacuum piping with 1 percent slope downward in direction of flow.
- H. Install nipples, unions, special fittings, and valves with pressure ratings same as or higher than piping pressure rating used in applications specified in "Piping Schedule" Article unless otherwise indicated.
- I. Install eccentric reducers, if available, where vacuum piping is reduced in direction of flow, with bottoms of both pipes and reducer fitting flush.
- J. Provide drain leg and drain trap at end of each main and branch and at low points.
- K. Install thermometer and vacuum gage on inlet piping to each vacuum producer and on each receiver and separator. Comply with requirements in Section 22 05 19 "Meters and Gages for Plumbing Piping."
- L. Install piping to permit valve servicing.
- M. Install piping free of sags and bends.
- N. Install fittings for changes in direction and for branch connections. Extruded-tee branch outlets in copper tubing may be made where specified.
- O. Install medical vacuum piping from medical vacuum service connections specified in this Section, to equipment specified in Section 22 62 19 "Vacuum Equipment for Laboratory and Healthcare Facilities," and to equipment specified in other Sections requiring medical vacuum service.
- P. Piping Restraint Installation: Install seismic restraints on vacuum piping. Seismic-restraint devices are specified in Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- Q. Install medical vacuum service connections recessed in walls. Attach roughing-in assembly to substrate; attach finishing assembly to roughing-in assembly.
- R. Install medical vacuum bottle bracket adjacent to each wall-mounted medical vacuum service connection suction inlet.
- S. Connect vacuum piping to vacuum producers and to equipment requiring vacuum service.
- T. Install unions in copper vacuum tubing adjacent to each valve and at final connection to each machine, specialty, and piece of equipment.
- U. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."



- V. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 22 05 00 "Common Work Results for Plumbing."

3.03 VALVE INSTALLATION

- A. Install shutoff valve at each connection to and from vacuum equipment and specialties.
- B. Install check valves to maintain correct direction of vacuum flow to vacuum-producing equipment.
- C. Install valve boxes recessed in wall and anchored to substrate. Single boxes may be used for multiple valves that serve same area or function.
- D. Install zone valves and gages in valve boxes. Rotate valves to angle that prevents closure of cover when valve is in closed position.
- E. Install flexible pipe connectors in suction inlet piping to each vacuum producer.

3.04 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from outside of cleaned tubing and fittings before assembly.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Threaded Joints: Apply appropriate tape to external pipe threads.
- E. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" chapter. Do not use flux. Continuously purge joint with oil-free dry nitrogen during brazing.
- F. Flanged Joints:
 - 1. Copper Tubing: Install flange on copper tubes. Use pipe-flange gasket between flanges. Join flanges with gasket and bolts according to ASME B31.9 for bolting procedure.
 - 2. PVC Piping: Install PVC flange on PVC pipes. Use pipe-flange gasket between flanges. Join flanges with gasket and bolts according to ASME B31.9 for bolting procedure.
- G. Shape-Memory-Metal Coupling Joints: Join new copper tube to existing tube according to procedures developed by fitting manufacturer for installation of shape-memory-metal coupling joints.

3.05 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements in Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.



- B. Comply with requirements in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices.
- C. Vertical Piping: MSS Type 8 or Type 42, clamps.
- D. Individual, Straight, Horizontal Piping Runs:
 - 1. 100 Feet and Less: MSS Type 1, adjustable, steel, clevis hangers.
 - 2. Longer Than 100 Feet: MSS Type 43, adjustable, roller hangers.
- E. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze. Comply with requirements in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment" for trapeze hangers.
- F. Base of Vertical Piping: MSS Type 52, spring hangers.
- G. Support horizontal piping within 12 inches of each fitting and coupling.
- H. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch- minimum rods.
- I. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1/4: 60 inches with 3/8-inch rod.
 - 2. NPS 3/8 and NPS 1/2: 72 inches with 3/8-inch rod.
 - 3. NPS 3/4: 84 inches with 3/8-inch rod.
 - 4. NPS 1: 96 inches with 3/8-inch rod.
 - 5. NPS 1-1/4: 108 inches with 3/8-inch rod.
 - 6. NPS 1-1/2: 10 feet with 3/8-inch rod.
 - 7. NPS 2: 11 feet with 3/8-inch rod.
 - 8. NPS 2-1/2: 13 feet with 1/2-inch rod.
 - 9. NPS 3: 14 feet with 1/2-inch rod.
 - 10. NPS 3-1/2: 15 feet with 1/2-inch rod.
 - 11. NPS 4: 16 feet with 1/2-inch rod.
 - 12. NPS 6: 20 feet with 5/8-inch rod.
- J. Install supports for vertical copper tubing every 10 feet.

3.06 IDENTIFICATION

- A. Install identifying labels and devices for laboratory vacuum piping, valves, and specialties. Comply with requirements in Section 22 05 53 "Identification for Plumbing Piping and Equipment."
- B. Install identifying labels and devices for medical vacuum piping systems according to NFPA 99. Use the following or similar captions and color-coding for piping products where required by NFPA 99:
 - 1. Medical Vacuum: Black letters on white background.
 - 2. WAGD: White letters on violet background.



3.07 FIELD QUALITY CONTROL FOR HEALTHCARE FACILITY MEDICAL VACUUM PIPING

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections of medical vacuum piping systems in healthcare facilities and to prepare test and inspection reports.
- B. Review of Construction Documents: Testing Agency shall review the construction documents and note any variation from code requirements and provide a written report of their review and recommendations prior to any installation of vacuum piping or components.
- C. Tests and Inspections:
 - 1. Medical Vacuum Testing Coordination: Perform tests, inspections, verifications, and certification of medical vacuum piping systems concurrently with tests, inspections, and certification of medical compressed-air piping and medical gas piping systems.
 - 2. Preparation: Perform the following Installer tests according to requirements in NFPA 99 and ASSE Standard #6010:
 - a. Initial blowdown.
 - b. Initial pressure test.
 - c. Cross-connection test.
 - d. Piping purge test.
 - e. Standing pressure test for vacuum systems.
 - f. Repair leaks and retest until no leaks exist.
 - 3. System Verification: Perform the following tests and inspections according to NFPA 99, ASSE Standard #6020, and ASSE Standard #6030:
 - a. Standing pressure test.
 - b. Individual-pressurization or pressure-differential cross-connection test.
 - c. Valve test.
 - d. Master and area alarm tests.
 - e. Piping purge test.
 - f. Final tie-in test.
 - g. Operational vacuum test.
 - h. Verify correct labeling of equipment and components.
 - 4. Testing Certification: Certify that specified tests, inspections, and procedures have been performed and certify report results. Include the following:
 - a. Inspections performed.
 - b. Procedures, materials, and gases used.
 - c. Test methods used.
 - d. Results of tests.
- D. Remove and replace components that do not pass tests and inspections and retest as specified above.



3.08 FIELD QUALITY CONTROL FOR LABORATORY FACILITY NONMEDICAL VACUUM PIPING

- A. Testing Agency: Engage qualified testing agency to perform field tests and inspections of vacuum piping in nonmedical laboratory facilities and to prepare test and inspection reports.
- B. Tests and Inspections:
 - 1. Piping Leak Tests for Vacuum Piping: Test new and modified parts of existing piping. Cap and fill vacuum piping with oil-free, dry nitrogen. Isolate test source and let stand for four hours to equalize temperature. Refill system, if required, to test pressure; hold for two hours with no drop in pressure.
 - a. Test Pressure for Copper Tubing: 100 psig.
 - 2. Repair leaks and retest until no leaks exist.
 - 3. Inspect filters for proper operation.
- C. Remove and replace components that do not pass tests and inspections and retest as specified above.

3.09 PROTECTION

- A. Protect tubing from damage.
- B. Retain sealing plugs in tubing, fittings, and specialties until installation.
- C. Clean tubing not properly sealed, and where sealing is damaged, according to "Preparation" Article.

3.10 PIPING SCHEDULE

- A. Connect new copper tubing to existing copper tubing with memory-metal couplings.
- B. Flanges may be used where connection to flanged equipment is required.
- C. Medical Vacuum Piping: Use copper medical gas tube, wrought-copper fittings, and brazed joints.
- D. WAGD Piping: Use copper medical gas tube, wrought-copper fittings, and brazed joints.

3.11 VALVE SCHEDULE

- A. Shutoff Valves:
 - 1. Copper Tubing: Copper-alloy ball valve with manufacturer-installed ASTM B 819, copper-tube extensions.



- B. Zone Valves: Copper-alloy ball valve with manufacturer-installed ASTM B 819, copper-tube extensions with pressure gage on one copper-tube extension.

END OF SECTION



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SECTION 22 63 13

GAS PIPING FOR LABORATORY AND HEALTHCARE FACILITIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Carbon dioxide piping, designated "medical carbon dioxide."
 - 2. Nitrogen piping, designated "medical nitrogen."
 - 3. Nitrous oxide piping, designated "medical nitrous oxide."
 - 4. Oxygen piping, designated "medical oxygen."
- B. Owner-Furnished Material:
 - 1. Medical gas manifolds.
- C. Related Requirements:
 - 1. Section 22 64 00 "Medical Gas Alarms" for combined medical air, vacuum, and gas alarms.

1.03 DEFINITIONS

- A. CR: Chlorosulfonated polyethylene synthetic rubber.
- B. Medical gas piping systems include medical carbon dioxide, medical nitrogen, medical nitrous oxide, and medical oxygen for healthcare facility patient care.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and testing agency.



- B. Review reports for testing agency's review of construction documents.
- C. Seismic Qualification Certificates: For gas manifolds and bulk gas storage tanks, 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.
- D. Material Certificates: Signed by Installer certifying that medical gas piping materials comply with requirements in NFPA 99 for positive-pressure medical gas systems.
- E. Brazing certificates.
- F. Certificates of Shop Inspection and Data Report for Bulk Gas Storage Tanks: As required by ASME Boiler and Pressure Vessel Code.
- G. Field quality-control reports.

1.06 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For medical and specialty gas piping specialties to include in emergency, operation, and maintenance manuals.

1.07 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. Quick-Coupler Service Connections: Furnish complete noninterchangeable medical gas pressure outlets and suction inlets.
 - a. Medical Carbon Dioxide: Equal to 10 percent of quantity installed, but no fewer than 10 units.
 - b. Medical Nitrous Oxide: Equal to 10 percent of quantity installed, but no fewer than 10 units.
 - c. Medical Oxygen: Equal to 10 percent of quantity installed, but no fewer than 10 units.
 - d. Medical Air: Equal to 10 percent of quantity installed, but no fewer than 10 units.
 - e. Instrument Air: Equal to 10 percent of quantity installed, but no fewer than 10 units.
 - f. Medical Vacuum: Equal to 10 percent of quantity installed, but no fewer than 10 units.
 - g. WAGD: Equal to 10 percent of quantity installed, but no fewer than 10 units.
 - 2. D.I.S.S. Service Connections: Furnish complete medical gas pressure outlets and suction inlets complying with CGA V-5.



- a. Medical Carbon Dioxide D.I.S.S. No. 1080: Equal to 10 percent of quantity installed, but no fewer than 10 units.
- b. Medical Nitrogen D.I.S.S. No. 1120: Equal to 10 percent of quantity installed, but no fewer than 10 units.
- c. Medical Nitrous Oxide D.I.S.S. No. 1040: Equal to 10 percent of quantity installed, but no fewer than 10 units.
- d. Medical Oxygen D.I.S.S. No. 1240: Equal to 10 percent of quantity installed, but no fewer than 10 units.
- e. Medical Air D.I.S.S. No. 1160: Equal to 10 percent of quantity installed, but no fewer than 10 units.
- f. Instrument Air D.I.S.S. No. 1160: Equal to 10 percent of quantity installed, but no fewer than 10 units.
- g. Medical Vacuum D.I.S.S. No. 1220: Equal to 10 percent of quantity installed, but no fewer than 10 units.
- h. WAGD D.I.S.S. No. 2220: Equal to 10 percent of quantity installed, but no fewer than 10 units.

1.08 QUALITY ASSURANCE

A. Installer Qualifications:

- 1. Medical Gas Piping Systems for Healthcare Facilities: According to ASSE Standard #6010 for medical-gas-system installers.
- 2. Bulk Medical Gas Systems for Healthcare Facilities: According to ASSE Standard #6015 for bulk-medical-gas-system installers.
- 3. Shape-Memory-Metal Coupling Joints: An authorized representative who is trained and approved by manufacturer.

B. Testing Agency Qualifications: An independent testing agency, with the experience and capability to conduct the medical gas piping testing indicated, that is a member of the Medical Gas Professional Healthcare Organization or is an NRTL, and that is acceptable to authorities having jurisdiction.

- 1. Qualify testing personnel according to ASSE Standard #6020 for medical-gas-system inspectors and ASSE Standard #6030 for medical-gas-system verifiers.

C. Brazing: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code, Section IX, "Welding and Brazing Qualifications"; or AWS B2.2, "Standard for Brazing Procedure and Performance Qualification."

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION

- A. Medical carbon dioxide operating at 50 to 55 psig.
- B. Medical helium operating at 50 to 55 psig.
- C. Medical nitrogen operating at 160 to 185 psig.



- D. Medical nitrous oxide operating at 50 to 55 psig.
- E. Medical oxygen operating at 50 to 55 psig.

2.02 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Medical gas manifolds shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the medical gas manifolds will remain in place without separation of any parts when subjected to the seismic forces specified and the manifolds and tanks will be fully operational after the seismic event."
 - 2. Component Importance Factor is 1.5.

2.03 PIPES, TUBES, AND FITTINGS

- A. Comply with NFPA 99 for medical gas piping materials.
- B. Copper Medical Gas Tube: ASTM B 819, Type K and Type L, seamless, drawn temper that has been manufacturer cleaned, purged, and sealed for medical gas service; or according to CGA G-4.1 for oxygen service. Include standard color marking "OXY," "MED," "OXY/MED," "OXY/ACR," or "ACR/MED" in green for Type K tube and blue for Type L tube.
- C. Wrought-Copper Fittings: ASME B16.22, solder-joint pressure type that has been manufacturer cleaned, purged, and bagged for oxygen service according to CGA G-4.1.
- D. Copper Unions: ASME B16.22 or MSS SP-123, wrought-copper or cast-copper alloy.
- E. Cast-Copper-Alloy Flanges: ASME B16.24, Class 150.
 - 1. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch - maximum thickness, full-face type.
 - 2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel.
- F. Shape-Memory-Metal Couplings:
 - 1. Manufacturers: Subject to compliance with requirements provide products by one of the following:
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:
 - a. AeroFit, Inc.
 - b. Smart Tap, Inc.
 - 3. Description: Cryogenic compression fitting made of nickel-titanium, shape-memory alloy, and that has been manufacturer cleaned, purged, and sealed for oxygen service according to CGA G-4.1.



2.04 JOINING MATERIALS

- A. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys.
- B. Threaded-Joint Tape: PTFE.
- C. Solvent Cement for Joining PVC Piping: ASTM D 2564. Include primer complying with ASTM F 656.

2.05 VALVES

- A. General Requirements for Valves: Manufacturer cleaned, purged, and bagged according to CGA G-4.1 for oxygen service.
- B. Zone-Valve Box Assemblies: Box with medical gas valves, tube extensions, and gages.

1. Zone-Valve Boxes:

a. Steel Box with Aluminum Cover:

- 1) Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 2) Basis-of-Design Product: The contractor shall match the existing system exactly and shall include a bid breakdown form showing breakout pricing for each of the listed manufacturers. Subject to compliance with requirements, provide product by one of the following:
 - a) Beacon Medaes (Basis of Design)
 - b) Allied Healthcare Products Inc.
 - c) Amico Corporation.
 - d) Ohio Medical Corporation.
 - e) Patton's Medical

- b. Description: Formed steel box with cover, anchors for recessed mounting, holes with grommets in box sides for tubing extension protection, and of size for single or multiple valves with pressure gages and in sizes required to permit manual operation of valves. Medical air and medical vacuum tubing, valves, and gages may be incorporated in zone valve boxes for medical gases.

- 1) Interior Finish: Factory-applied white enamel.
- 2) Cover Plate: Aluminum with frangible or removable windows.
- 3) Valve-Box Windows: Clear or tinted transparent plastic with labeling that includes rooms served, according to NFPA 99.

C. Ball Valves:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 2. Basis-of-Design Product: The contractor shall match the existing system exactly and shall include a bid breakdown form showing breakout pricing for each of the listed



manufacturers. Subject to compliance with requirements, provide product by one of the following:

- a. Allied Healthcare Products Inc.; Chemetron Division.
 - b. Amico Corporation.
 - c. BeaconMedaes.
 - d. Conbraco Industries, Inc.
 - e. Marwin Valve; a division of Richards Industries.
 - f. NIBCO INC.
 - g. Ohio Medical Corporation.
 - h. Patton's Medical
3. Standard: MSS SP-110.
 4. Description: Three-piece body, brass or bronze.
 5. Pressure Rating: 300 psig minimum.
 6. Ball: Full-port, chrome-plated brass.
 7. Seats: PTFE or TFE.
 8. Handle: Lever type with locking device.
 9. Stem: Blowout proof with PTFE or TFE seal.
 10. Ends: Manufacturer-installed ASTM B 819, copper-tube extensions.

D. Check Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: The contractor shall match the existing system exactly and shall include a bid breakdown form showing breakout pricing for each of the listed manufacturers. Subject to compliance with requirements, provide product by one of the following:
 - a. Allied Healthcare Products Inc.; Chemetron Division.
 - b. Amico Corporation.
 - c. BeaconMedaes. (Basis of Design)
 - d. Conbraco Industries, Inc.
 - e. Ohio Medical Corporation.
 - f. Patton's Medical
3. Description: In-line pattern, bronze.
4. Pressure Rating: 300 psig minimum.
5. Operation: Spring loaded.
6. Ends: Manufacturer-installed ASTM B 819, copper-tube extensions.

E. Emergency Oxygen Connections: Low-pressure oxygen inlet assembly for connection to building oxygen piping systems.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: The contractor shall match the existing system exactly and shall include a bid breakdown form showing breakout pricing for each of the listed manufacturers. Subject to compliance with requirements, provide product by one of the following:



- a. BeaconMedaes (Basis of Design)
 - b. Allied Healthcare Products Inc.; Chemetron Division.
 - c. Amico Corporation.
 - d. Ohio Medical Corporation.
 - e. Patton's Medical
3. Enclosure: Weatherproof hinged locking cover with caption similar to "Emergency Low-Pressure Gaseous Oxygen Inlet."
 4. Inlet: Manufacturer-installed, NPS 1 or NPS 1-1/4, ASTM B 819, copper tubing with NPS 1 minimum ball valve.
 5. Safety Valve: Bronze-body pressure relief valve set at 75 or 80 psig.
 6. Instrumentation: Pressure gage.
- F. Safety Valves:
1. Bronze body.
 2. ASME-construction, poppet, pressure-relief type.
 3. Settings to match system requirements.
- G. Pressure Regulators:
1. Bronze body and trim.
 2. Spring-loaded, diaphragm-operated, relieving type.
 3. Manual pressure-setting adjustment.
 4. Rated for 250-psig minimum inlet pressure.
 5. Capable of controlling delivered gas pressure within 0.5 psig for each 10-psig inlet pressure.

2.06 MEDICAL GAS SERVICE CONNECTIONS

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
- B. Basis-of-Design Product: The contractor shall match the existing system exactly and shall include a bid breakdown form showing breakout pricing for each of the listed manufacturers. Subject to compliance with requirements, provide Chemetron Compatible product by one of the following:
1. Beacon Medaes.
 2. Amico Corporation.
- C. General Requirements for Medical Gas Service Connections:
1. Suitable for specific medical gas pressure and suction service listed.
 2. Include roughing-in assemblies, finishing assemblies, and cover plates.
 3. Individual cover plates are not required if service connection is in multiple unit or assembly with cover plate.
 4. Recessed-type units made for concealed piping unless otherwise indicated.
- D. Roughing-in Assembly:
1. Steel outlet box for recessed mounting and concealed piping.



2. Brass-body outlet block with secondary check valve that will prevent gas flow when primary valve is removed. Suction inlets to be without secondary valve.
 3. Double seals that will prevent gas leakage.
 4. ASTM B 819, NPS 3/8 copper outlet tube brazed to valve with service marking and tube-end dust cap.
- E. Finishing Assembly:
1. Brass housing with primary check valve.
 2. Double seals that will prevent gas leakage.
 3. Cover plate with gas-service label.
- F. Quick-Coupler Pressure Service Connections: Outlets for carbon dioxide nitrous oxide and oxygen with noninterchangeable keyed indexing to prevent interchange between services, constructed to permit one-handed connection and removal of equipment, and with positive-locking ring that retains equipment stem in valve during use.
- G. Quick-Coupler Pressure Service Connections: Outlets for instrument air with noninterchangeable keyed indexing to prevent interchange between services, constructed to permit one-handed connection and removal of equipment, and with positive-locking ring that retains equipment stem in valve during use.
- H. Quick-Coupler Suction Service Connections: Inlets for medical vacuum with noninterchangeable keyed indexing to prevent interchange between services, constructed to permit one-handed connection and removal of equipment, and with positive-locking ring that retains equipment stem in valve during use.
- I. D.I.S.S. Pressure Service Connections: Outlets, complying with CGA V-5, with threaded indexing to prevent interchange between services, constructed to permit one-handed connection and removal of equipment.
1. Medical Carbon Dioxide: D.I.S.S. No. 1080.
 2. Medical Nitrogen: D.I.S.S. No. 1120.
 3. Medical Nitrous Oxide: D.I.S.S. No. 1040.
 4. Medical Oxygen: D.I.S.S. No. 1240.
- J. D.I.S.S. Pressure Service Connections: Outlets, complying with CGA V-5, with threaded indexing to prevent interchange between services, constructed to permit one-handed connection and removal of equipment.
1. Medical Air: D.I.S.S. No. 1160.
 2. Instrument Air: D.I.S.S. No. 1160.
- K. D.I.S.S. Suction Service Connections: Inlets, complying with CGA V-5, with threaded indexing to prevent interchange between services, constructed to permit one-handed connection and removal of equipment.
1. Medical Vacuum: D.I.S.S. No. 1220.
 2. WAGD: D.I.S.S. No. 2220.
- L. Cover Plates: One piece, aluminum or stainless steel and permanent, color-coded, identifying label matching corresponding service.



2.07 MEDICAL NITROGEN PRESSURE CONTROL PANELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Basis-of-Design Product: The contractor shall match the existing system exactly and shall include a bid breakdown form showing breakout pricing for each of the listed manufacturers. Subject to compliance with requirements, provide product by one of the following:
 - 1. Allied Healthcare Products Inc.; Chemetron Division.
 - 2. Amico Corporation.
 - 3. BeaconMedaes. (Basis of Design)
 - 4. Ohio Medical Corporation.
 - 5. Patton's Medical
- C. Description:
 - 1. Steel box and support brackets for recessed roughing-in with stainless-steel or anodized-aluminum cover plate with printed operating instructions.
 - 2. Manifold assembly consisting of inlet supply valve, inlet supply pressure gage, line-pressure control regulator, outlet supply pressure gage, D.I.S.S. service connection, and piping outlet for remote service connection.
 - 3. Minimum Working Pressure: 200 psig.
 - 4. Line-Pressure Control Regulator: Self-relieving diaphragm type with precision manual adjustment.
 - 5. Pressure Gages: 0 to 300 psig.
 - 6. Service Connection: CGA V-5, D.I.S.S. No. 1120, nitrogen outlet.
 - 7. Before final assembly, provide temporary dust shield and U-tube for testing.
 - 8. Label cover plate "Nitrogen Pressure Control."

2.08 MEDICAL GAS MANIFOLDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Basis-of-Design Product: The contractor shall match the existing system exactly and shall include a bid breakdown form showing breakout pricing for each of the listed manufacturers. Subject to compliance with requirements, provide product by one of the following:
 - 1. BeaconMedaes (Basis of Design)
 - 2. Acme Cryogenics.
 - 3. Allied Healthcare Products Inc.; Chemetron Division.
 - 4. Amico Corporation.
 - 5. Ohio Medical Corporation.
 - 6. Patton's Medical
- C. Comply with NFPA 99 for high-pressure medical gas cylinders.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.



- E. Central Control-Panel Unit:
 - 1. Supply and delivery pressure gages.
 - 2. Electrical alarm-system connections and transformer.
 - 3. Indicator lights or devices.
 - 4. Manifold connection.
 - 5. Pressure changeover switch.
 - 6. Line-pressure regulator.
 - 7. Shutoff valves.
 - 8. Safety valve.
- F. Manifold and Headers:
 - 1. Duplex, nonferrous-metal header for number of cylinders indicated, divided into two equal banks.
 - 2. Designed for 2000-psig minimum inlet pressure except nitrous oxide manifolds may be designed for 800 psig and carbon dioxide manifolds may be designed for 1500 psig.
 - 3. Cylinder-bank headers with inlet (pigtail) connections complying with CGA V-1.
 - 4. Individual inlet check valves, shutoff valve, pressure regulator, check valve, and pressure gage.
- G. Operation: Automatic, pressure-switch-activated changeover from one cylinder bank to the other when first bank becomes exhausted, without line-pressure fluctuation or resetting of regulators and without supply interruption by shutoff of either cylinder-bank header.
- H. Mounting: Wall with mounting brackets for manifold control cabinet and headers.
- I. Label manifold control unit with permanent label identifying medical gas type and system operating pressure.

2.09 GAS CYLINDER STORAGE RACKS

- A. Wall Storage Racks: Fabricate racks with chain restraints for upright cylinders as indicated or provide equivalent manufactured wall racks.
- B. Freestanding Storage Racks: Fabricate racks as indicated or provide equivalent manufactured storage racks.

2.10 NITROGEN

- A. Comply with USP 32 - NF 27 for oil-free dry nitrogen.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Cleaning of Medical Gas Tubing: If manufacturer-cleaned and -capped fittings or tubing is not available or if precleaned fittings or tubing must be recleaned because of exposure, have supplier



or separate agency acceptable to authorities having jurisdiction perform the following procedures:

1. Clean medical gas tube and fittings, valves, gages, and other components of oil, grease, and other readily oxidizable materials as required for oxygen service according to CGA G-4.1.
2. Wash medical gas tubing and components in hot, alkaline-cleaner-water solution of sodium carbonate or trisodium phosphate in proportion of 1 lb of chemical to 3 gal. of water.
 - a. Scrub to ensure complete cleaning.
 - b. Rinse with clean, hot water to remove cleaning solution.

3.02 EARTHWORK

- A. Comply with requirements in Section 31 20 00 "Earth Moving" for excavating, trenching, and backfilling and for underground warning tapes.

3.03 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of gas piping. Indicated locations and arrangements were 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. Comply with NFPA 99 for installation of medical gas piping.
- C. Install piping concealed from view and protected from physical contact by building occupants 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 and coordinate with other services occupying that space.
- F. Install piping adjacent to equipment and specialties to allow service and maintenance.
- G. Install nipples, unions, special fittings, and valves with pressure ratings same as or higher than system pressure rating used in applications specified in "Piping Schedule" Article unless otherwise indicated.
- H. Install piping to permit valve servicing.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and for branch connections.



- K. Install medical gas piping to medical gas service connections specified in this Section, to medical gas service connections in equipment specified in this Section, and to equipment specified in other Sections requiring medical gas service.
- L. Install exterior, buried medical gas piping in protective conduit fabricated with PVC pipe and fittings. Do not extend conduit through foundation wall.
- M. Piping Restraint Installation: Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- N. Install medical gas service connections recessed in walls. Attach roughing-in assembly to substrate; attach finishing assembly to roughing-in assembly.
- O. Connect gas piping to gas sources and to gas outlets and equipment requiring gas service.
- P. Install unions in copper tubing adjacent to each valve and at final connection to each specialty and piece of equipment.
- Q. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."
- R. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."
- S. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 22 05 00 "Common Work Results for Plumbing."

3.04 VALVE INSTALLATION

- A. Install shutoff valve at each connection to gas laboratory and healthcare equipment and specialties.
- B. Install check valves to maintain correct direction of gas flow from laboratory and healthcare gas supplies.
- C. Install valve boxes recessed in wall and anchored to substrate. Single boxes may be used for multiple valves that serve same area or function.
- D. Install zone valves and gages in valve boxes. Arrange valves so largest valve is lowest. Rotate valves to angle that prevents closure of cover when valve is in closed position.
- E. Install pressure regulators on gas piping where reduced pressure is required.
- F. Install emergency oxygen connection with pressure relief valve and full-size discharge piping to outside, with check valve downstream from pressure relief valve, and with ball valve and check valve in supply main from bulk oxygen storage tank.



3.05 JOINT CONSTRUCTION

- A. Remove scale, slag, dirt, and debris from outside of cleaned tubing and fittings before assembly.
- B. Threaded Joints: Apply appropriate tape to external pipe threads.
- C. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" chapter. Continuously purge joint with oil-free, dry nitrogen during brazing.
- D. Shape-Memory-Metal Coupling Joints: Join new copper tube to existing tube according to procedures developed by fitting manufacturer for installation of shape-memory-metal coupling joints.

3.06 GAS SERVICE COMPONENT INSTALLATION

- A. Assemble patient-service console with service connections. Install with supplies concealed in walls. Attach console box or mounting bracket to substrate.
- B. Install nitrogen pressure-control panels in walls. Attach to substrate.
- C. Install gas manifolds anchored to substrate.
- D. Install gas cylinders and connect to manifold piping.
- E. Install gas manifolds with seismic restraints.

3.07 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements in Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.
- B. Comply with requirements in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices.
- C. Vertical Piping: MSS Type 8 or Type 42, clamps.
- D. Individual, Straight, Horizontal Piping Runs:
 - 1. 100 Feet and Less: MSS Type 1, adjustable, steel, clevis hangers.
 - 2. Longer Than 100 Feet: MSS Type 43, adjustable, roller hangers.
- E. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze. Comply with requirements in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment" for trapeze hangers.
- F. Base of Vertical Piping: MSS Type 52, spring hangers.
- G. Support horizontal piping within 12 inches of each fitting and coupling.
- H. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch- minimum rods.



- I. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1/4: 60 inches with 3/8-inch rod.
 - 2. NPS 3/8 and NPS 1/2: 72 inches with 3/8-inch rod.
 - 3. NPS 3/4: 84 inches with 3/8-inch rod.
 - 4. NPS 1: 96 inches with 3/8-inch rod.
 - 5. NPS 1-1/4: 108 inches with 3/8-inch rod.
 - 6. NPS 1-1/2: 10 feet with 3/8-inch rod.
 - 7. NPS 2: 11 feet with 3/8-inch rod.
 - 8. NPS 2-1/2: 13 feet with 1/2-inch rod.
 - 9. NPS 3: 14 feet with 1/2-inch rod.
 - 10. NPS 3-1/2: 15 feet with 1/2-inch rod.
 - 11. NPS 4: 16 feet with 1/2-inch rod.
 - 12. NPS 6: 20 feet with 5/8-inch rod.
- J. Install supports for vertical copper tubing every 10 feet.

3.08 IDENTIFICATION

- A. Install identifying labels and devices for specialty gas piping, valves, and specialties. Comply with requirements in Section 22 05 53 "Identification for Plumbing Piping and Equipment."
- B. Install identifying labels and devices for healthcare medical gas piping systems according to NFPA 99. Use the following or similar captions and color-coding for piping products where required by NFPA 99:
 - 1. Carbon Dioxide: Black or white letters on gray background.
 - 2. Nitrogen: White letters on black background.
 - 3. Nitrous Oxide: White letters on blue background.
 - 4. Oxygen: White letters on green background or green letters on white background.

3.09 FIELD QUALITY CONTROL FOR HEALTHCARE FACILITY MEDICAL GAS

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Review of Construction Documents: Testing Agency shall review the construction documents and note any variation from code requirements and provide a written report of their review and recommendations prior to any installation of piping or components.
- C. Tests and Inspections:
 - 1. Medical Gas Piping Testing Coordination: Perform tests, inspections, verifications, and certification of medical gas piping systems concurrently with tests, inspections, and certification of medical compressed-air piping and medical vacuum piping systems.
 - 2. Preparation: Perform the following Installer tests according to requirements in NFPA 99 and ASSE Standard #6010:
 - a. Initial blowdown.
 - b. Initial pressure test.



- c. Cross-connection test.
 - d. Piping purge test.
 - e. Standing pressure test for positive-pressure medical gas piping.
 - f. Standing pressure test for vacuum systems.
 - g. Repair leaks and retest until no leaks exist.
3. System Verification: Perform the following tests and inspections according to NFPA 99, ASSE Standard #6020, and ASSE Standard #6030:
- a. Standing pressure test.
 - b. Individual-pressurization or pressure-differential cross-connection test.
 - c. Valve test.
 - d. Master and area alarm tests.
 - e. Piping purge test.
 - f. Piping particulate test.
 - g. Piping purity test.
 - h. Final tie-in test.
 - i. Operational pressure test.
 - j. Medical gas concentration test.
 - k. Medical air purity test.
 - l. Verify correct labeling of equipment and components.
 - m. Verify medical gas supply sources.
4. Testing Certification: Certify that specified tests, inspections, and procedures have been performed and certify report results. Include the following:
- a. Inspections performed.
 - b. Procedures, materials, and gases used.
 - c. Test methods used.
 - d. Results of tests.
- D. Remove and replace components that do not pass tests and inspections and retest as specified above.
- E. Prepare test and inspection reports.

3.10 FIELD QUALITY CONTROL FOR LABORATORY FACILITY SPECIALTY GAS

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Tests and Inspections:
 - 1. Piping Leak Tests for Specialty Gas Piping: Test new and modified parts of existing piping. Cap and fill specialty gas piping with oil-free, dry nitrogen to pressure of 50 psig above system operating pressure, but not less than 150 psig. Isolate test source and let stand for four hours to equalize temperature. Refill system, if required, to test pressure; hold for two hours with no drop in pressure.
 - 2. Repair leaks and retest until no leaks exist.
 - 3. Inspect specialty gas regulators for proper operation.



- C. Remove and replace components that do not pass tests and inspections and retest as specified above.
- D. Prepare test and inspection reports.

3.11 PROTECTION

- A. Protect tubing from damage.
- B. Retain sealing plugs in tubing, fittings, and specialties until installation.
- C. Clean tubing not properly sealed, and where sealing is damaged, according to "Preparation" Article.

3.12 DEMONSTRATION

- A. Engage factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain bulk gas storage tanks.

3.13 PIPING SCHEDULE

- A. Connect new tubing to existing tubing with memory-metal couplings.

3.14 VALVE SCHEDULE

- A. Shutoff Valves: Ball valve with manufacturer-installed ASTM B 819, copper-tube extensions.
- B. Zone Valves: Ball valve with manufacturer-installed ASTM B 819, copper-tube extensions with pressure gage on one copper-tube extension.

END OF SECTION



SECTION 22 64 00

MEDICAL GAS ALARMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Master alarm panels.
 - 2. Anesthetizing-area alarm panels.
 - 3. Area alarm panels.
 - 4. Local alarm panels.
 - 5. Computer-interface cabinet.

1.03 DEFINITIONS

- A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and testing agency.
- B. Review reports for testing agency's review of construction documents.
- C. Product Test Reports: For each alarm panel, for tests performed by a qualified testing agency.
- D. Field quality-control reports.

1.06 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For alarm panels and computer-interface cabinet to include in emergency, operation, and maintenance manuals.



1.07 QUALITY ASSURANCE

- A. Installer Qualifications: Qualify Installers for air, vacuum, and gas piping systems for healthcare facilities according to ASSE Standard #6010 for medical-gas-system installers.
- B. Testing Agency Qualifications: An independent testing agency, with the experience and capability to conduct the air, vacuum, and gas piping testing indicated, that is a member of the Medical Gas Professional Healthcare Organization or is an NRTL, and that is acceptable to authorities having jurisdiction.
 - 1. Qualify testing personnel for air, vacuum, and gas piping systems for healthcare facilities according to ASSE Standard #6020 for medical-gas-system inspectors and ASSE Standard #6030 for medical-gas-system verifiers.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION

- A. Gas and Vacuum Systems Monitored:
 - 1. Carbon dioxide, designated "medical carbon dioxide."
 - 2. Gas-powered-tool compressed air, designated "instrument air."
 - 3. Medical compressed air, designated "medical air."
 - 4. Medical-surgical vacuum, designated "medical vacuum."
 - 5. Nitrogen, designated "medical nitrogen."
 - 6. Nitrous oxide, designated "medical nitrous oxide."
 - 7. Oxygen, designated "medical oxygen."
 - 8. Waste anesthetic gas disposal, designated "WAGD."

2.02 MANUFACTURERS

- A. Manufacturers: The contractor shall match the existing system exactly and shall include a bid breakdown form showing breakout pricing for each of the listed manufacturers. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:
 - 1. Allied Healthcare Products, Inc.; Chemetron Division.
 - 2. Amico Corporation.
 - 3. BeaconMedaes. (Basis of Design)
 - 4. Ohio Medical Corporation.
 - 5. Patton's Medical
- C. Source Limitations: Obtain medical alarm systems and components from single manufacturer.

2.03 GENERAL REQUIREMENTS FOR ALARM PANELS

- A. Description: Factory wired with audible and color-coded visible signals to indicate specified functions.



1. Mounting: Recessed installation.
 2. Enclosures: Fabricated from minimum 0.047-inch- thick steel or minimum 0.05-inch- thick aluminum, with knockouts for electrical and piping connections.
- B. Components: Designed for continuous service and to operate on power supplied from 120 -V ac power source to alarm panels and with connections for low-voltage wiring to remote sensing devices. Include step-down transformers if required.
- C. Dew Point Monitors: Continuous line monitoring, having panel with gage or digital display, pipeline sensing element, electrical connections for alarm system, factory- or field-installed valved bypass, and visual and cancelable audio signal for dryer site and master alarm panels. Alarm signals when pressure dew point rises above 39 deg F at 55 psig.
1. Operation: Chilled-mirror method or hygrometer moisture analyzer with sensor probe.
- D. Pressure Switches or Transducer Sensors: Continuous line monitoring with electrical connections for alarm system.
1. Low-Pressure Operating Range: 0 to 100 psig.
 2. High-Pressure Operating Range: Up to 250 psig.
- E. Wiring for alarm panels to be installed under automatic temperature control specification.
- F. Carbon-Monoxide Monitors: Panel with gage or digital display, pipeline sensing element, electrical connections for alarm system, and factory- or field-installed valved bypass. Alarm signals when carbon-monoxide level rises above 10 ppm.
- G. Vacuum Switches or Pressure Transducer Sensors: Continuous line monitoring with electrical connections for alarm system.
1. Vacuum Operating Range: 0 to 30 in. Hg.
- H. Building Management Connections: The medical gas alarm panels are not to tie directly into the BMS. The contractor is to provide relays in order to communicate with the BMS.

2.04 MASTER ALARM PANELS

- A. Master Alarm Panels: Separate trouble alarm signals and indicators for each system.
1. Standards: Comply with NFPA 99 and UL 544.
 2. 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.
 3. Include alarm signals when the following conditions exist:
 - a. Medical Air: Pressure drops below 40 psig or rises above 60 psig, backup air compressor is in operation, pressure drop across filter assembly increases more than 2 psig, dew point rises above 39 deg F at 55 psig, carbon-monoxide level rises above 10 ppm, and high water level is reached in receiver for liquid-ring, medical air compressor systems.
 - b. Instrument Air: Pressure drops below 125 psig or rises above 145 psig.
 - c. Medical Vacuum: Vacuum drops below 12 in. Hg and backup vacuum pump is in operation.
 - d. Medical Carbon Dioxide: Pressure drops below 40 psig or rises above 60 psig and changeover is made to alternate bank.



- e. Medical Nitrogen: Pressure drops below 145 psig or rises above 200 psig and changeover is made to alternate bank.
- f. Medical Nitrous Oxide: Liquid level is low, pressure downstream from main shutoff valve drops below 40 psig or rises above 60 psig, changeover is made to reserve, reserve is in use, and reserve level is low.
- g. Medical Oxygen: Liquid level is low, pressure downstream from main shutoff valve drops below 40 psig or rises above 60 psig, changeover is made to reserve, reserve is in use, reserve level is low, and reserve pressure is low.

2.05 ANESTHETIZING-AREA ALARM PANELS

- A. Anesthetizing-Area Alarm Panels: Separate trouble alarm signals and indicators for each system.
 - 1. Standards: Comply with NFPA 99 and UL 544.
 - 2. 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.
 - 3. Include alarm signals when the following conditions exist:
 - a. Medical Air: Pressure drops below 40 psig or rises above 60 psig.
 - b. Instrument Air: Pressure drops below 125 psig or rises above 145 psig.
 - c. Medical Vacuum: Vacuum drops below 12 in. Hg.
 - d. Medical Carbon Dioxide: Pressure drops below 40 psig or rises above 60 psig.
 - e. Medical Nitrogen: Pressure drops below 145 psig or rises above 200 psig.
 - f. Medical Nitrous Oxide: Pressure drops below 40 psig or rises above 60 psig.
 - g. Medical Oxygen: Pressure drops below 40 psig or rises above 60 psig.

2.06 AREA ALARM PANELS

- A. Area Alarm Panels: Separate trouble alarm signals and indicators for each system.
 - 1. Standards: Comply with NFPA 99 and UL 544.
 - 2. 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.
 - 3. Include alarm signals when the following condition exists:
 - a. Medical Air: Pressure drops below 40 psig or rises above 60 psig.
 - b. Medical Vacuum: Vacuum drops below 12 in. Hg.
 - c. Medical Oxygen: Pressure drops below 40 psig or rises above 60 psig.

2.07 LOCAL ALARM PANELS

- A. Local Alarm Panels: Separate trouble alarm signals and indicators for each system.
 - 1. Standards: Comply with NFPA 99 and UL 544.
 - 2. 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.
 - 3. Include alarm signals when the following conditions exist:
 - a. Medical Air: Pressure drops below 40 psig or rises above 60 psig backup air compressor is in operation, pressure drop across filter assembly increases more than 2 psig, dew point



risers above 39 deg F at 55 psig, carbon-monoxide level rises above 10 ppm, and the following:

- 1) Oilless Air Compressor: High discharge-air temperature and high water level in receiver.
 - 2) Liquid-Ring Air Compressor: High water level in receiver and high water level in separator.
- b. Instrument Air: Pressure drops below 125 psig or rises above 145 psig, backup air compressor is in operation, pressure drop across filter assembly increases more than 2 psig, dew point rises above 39 deg F at 55 psig, and high water level is in receiver.
- c. Medical Vacuum: Vacuum drops below 12 in. Hg, backup vacuum producer is in operation, and high water level is in receiver.

2.08 COMPUTER-INTERFACE CABINET

A. Description:

1. Wall-mounted, welded-steel, control cabinet with gasketed door.
2. Mounting brackets.
3. Grounding device.
4. White-enamel finish.
5. Factory-installed signal circuit boards.
6. Power transformer.
7. Circuit breaker.
8. Wiring terminal board, and internal wiring capable of interfacing 40 alarm signals.

PART 3 - EXECUTION

3.01 ALARM-PANEL INSTALLATION

- A. Install alarm panels in locations required by and according to NFPA 99.
- B. Install computer-interface cabinet with connection to alarm panels and facility computer.
- C. Coordinate wiring installation with Automatic Temperature Control section.

3.02 CONNECTIONS

- A. Comply with requirements for piping specified in Section 22 61 13 "Compressed-Air Piping for Laboratory and Healthcare Facilities," Section 22 62 13 "Vacuum Piping for Laboratory and Healthcare Facilities," and Section 22 63 13 "Gas Piping for Laboratory and Healthcare Facilities." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to alarm panels, allow space for service and maintenance.

3.03 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment" and according to NFPA 99.



3.04 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Review of Construction Documents: Testing Agency shall review the construction documents and note any variation from code requirements and provide a written report of their review and recommendations prior to any installation of medical gas alarms or wiring.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- D. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Perform each visual and mechanical inspection.
 - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning panels and equipment.
- E. Alarm panels will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports.

3.05 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.

3.06 ADJUSTING

- A. Adjust initial alarm panel pressure and vacuum set points.

3.07 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain alarm panels and computer-interface cabinet.

END OF SECTION





DIVISION 23

HEATING, VENTILATING, AND AIR
CONDITIONING (HVAC)



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SECTION 23 01 00

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. Comply with one of the following requirements:
 - a. After Construction ends, prior to occupancy and with all interior finishes installed, perform a building flush-out by supplying a total volume of 14000 cu. Ft. of outdoor air per sq. ft. of floor area while maintaining an internal temperature of at least 60 deg F and a relative humidity no higher than 60 percent.
 - b. If occupancy is desired prior to flush-out completion, the space may be occupied following delivery of a minimum of 3500 cu. ft. of outdoor air per sq. ft. of floor area to the space. Once a space is occupied, it shall be ventilated at a minimum rate of 0.30 cfm per sq. ft. of outside air or the design minimum outside air rate determined in EQ Prerequisite 1, whichever is greater. During each day of the flush-out period, ventilation shall begin a minimum of three hours prior to occupancy and continue during occupancy. These conditions shall be maintained until a total of 14000 cu. ft./sq. ft. of outside air has been delivered to the space.

1.2 SCOPE OF WORK

- A. The project described herein is the INTERMOUNTAIN HEALTHCARE LOGAN REGIONAL HOSPITAL PET/CT. 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-2020 Edition
 2. International Building code- 2021 Edition
 3. International Mechanical Code- 2021 Edition
 4. International Plumbing Code- 2021 Edition
 5. International Fire Code- 2021 Edition
 6. International Energy Code- 2021 Edition
 7. International Fuel Gas Code- 2021 Edition
 8. National Electrical Code- 2020 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 CONCRETE BASES AND INSERTS

- A. Bases: The concrete bases shall be provided and installed as work by this division. This Division shall be responsible for the proper size and location of bases and shall furnish all required anchor bolts and sleeves with templates to be installed as work of Division 3, Concrete.
- B. All floor-mounted mechanical equipment shall be set on 6-inch high concrete bases, unless otherwise noted or shown on drawings. Such bases shall extend 6 inches beyond equipment or mounting rails on all sides or as shown on the drawings and shall have a 1-inch beveled edge all around.



- C. Inserts: Where slotted or other types of inserts required for this work are to be cast into concrete, they shall be furnished as work of this Division
- D. Concrete inserts and pipe support systems shall be equal to Unistrut P3200 series for all piping where more than one pipe is suspended at a common location. Spacing of the inserts shall match the size and type of pipe and of ductwork being supported. The Unistrut insert and pipe support system shall include all inserts, vertical supports, horizontal support members, clamps, hangers, rollers, bolts, nuts, and any other accessory items for a complete pipe-supporting system.

1.27 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.

1.28 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 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.

1.29 CURBS

- A. Unless otherwise noted in these specifications or on the documents all roof curbs for all equipment are to be provided by Division 22 and 23.

1.30 TEST RUN

- A. The Mechanical Contractor shall operate the mechanical system for a minimum of 30 days to prove the operation of the system.

1.31 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.

1.32 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 23 01 50
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



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SECTION 23 05 00

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. Mechanical sleeve seals.
 - 5. Sleeves.
 - 6. Escutcheons.
 - 7. Grout.
 - 8. Equipment installation requirements common to equipment sections.
 - 9. Painting and finishing.
 - 10. Concrete bases.
 - 11. Supports and anchorages.
 - 12. Link-Seal

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, BAgl, 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 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 PVC: Permanent, with nailing flange for attaching to wooden forms.
- F. PVC Pipe: ASTM D 1785, Schedule 40.

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, 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.

2.9 GROUT

- A. Description: ASTM C 1107, Grade B, non-shrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: **5000-psi**, 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

2.10 LINK-SEAL MODULAR SEAL PRESSURE PLATES

- A. Link-Seal® modular seal pressure plates shall be molded of glass reinforced Nylon Polymer with the following properties:
 - 1. Izod Impact - Notched = **2.05ft-lb/in.** per ASTM D-256
 - 2. Flexural Strength @ Yield = **30,750 psi** per ASTM D-790
 - 3. Flexural Modulus = **1,124,000 psi** per ASTM D-790
 - 4. Elongation Break = 11.07% per ASTM D-638
 - 5. Specific Gravity = 1.38 per ASTM D-792
- B. 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.
- C. For fire service, pressure plates shall be steel with 2-part Zinc Dichromate Coating.
- D. 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:
 - 1. 316 Stainless Steel per ASTM F593-95, with a **85,000 psi** average tensile strength.

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. 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. PVC 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.
- O. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Install steel pipe for sleeves smaller than **6 inches** in diameter.
 2. Install cast-iron "wall pipes" for sleeves **6 inches** and larger in diameter.
 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- P. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for **1-inch** annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- 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.

3.2 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 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
 - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on **18-inch** centers around the full perimeter of the base.
 - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 - 7. Use **3000-psi**, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Miscellaneous Cast-in-Place Concrete."

3.7 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.

3.8 GROUTING

- A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.



- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

3.9 LINK SEAL

- A. Provide Link Seal at all piping penetrations from the outside.

END OF SECTION

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SECTION 23 05 17

SLEEVES AND SLEEVE SEALS 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. 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. Metraflex Company (The).
4. Pipeline Seal and Insulator, Inc.
5. 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: Stainless steel.
 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.3 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

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, concrete roof slabs, 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 Section 07 92 16 "Interior Joint Sealants."
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 07 84 00 "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. Exterior Concrete Walls above Grade:
 - a. Piping Smaller Than NPS 6: Cast-iron wall sleeves.
 - b. Piping NPS 6 and Larger: Cast-iron wall sleeves.
 - c.
 2. Exterior Concrete Walls below 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.
 3. Concrete Slabs-on-Grade:
 - a. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - b. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 4. Concrete Slabs above Grade:
 - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
 - b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves.
 5. 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 23 05 29

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 23 05 16 "Expansion Fittings and Loops for HVAC Piping" for pipe guides and anchors.
 - 3. Section 23 05 48 "Vibration and Seismic Controls for HVAC" for vibration isolation devices.
 - 4. Section 23 31 13 "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 Cold Piping:



1. **Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig** minimum compressive strength.
- C. Insulation-Insert Material for Hot Piping:
 1. **Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig** minimum compressive strength.
- D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- F. 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 23 05 48 "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. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.



- F. 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.
- G. Install lateral bracing with pipe hangers and supports to prevent swaying.
- H. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, **NPS 2-1/2** and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- I. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- J. 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.
- K. Insulated Piping:
 - 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 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. 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 allow 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 allow 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 allow 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.
- N. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- O. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- P. Use **powder-actuated fasteners** instead of building attachments where required in concrete construction.

END OF SECTION



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SECTION 23 05 48

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

B. Related Requirements:

1. Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for devices for plumbing equipment and systems.

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-2018)

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, 2012.
- 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. Flood-Restraint Loading: Per the structural drawings and specifications.
- B. 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 7-10 Chapter 13, IBC 2018 chapter 1908 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 RESTRAINED VIBRATION ISOLATION ROOF-CURB RAILS

- 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. Restrained Vibration Isolation Roof-Curb Rails: **RC1**:
- C. Description: Factory-assembled, fully enclosed, insulated, air- and watertight curb rail designed to resiliently support equipment and to withstand seismic and wind forces.
- D. Upper Frame: The upper frame shall provide continuous support for equipment and shall be captive to resiliently resist **seismic** forces.
- E. Lower Support Assembly: The lower support assembly shall be a formed sheet-metal section containing adjustable and removable steel springs that support upper frame. Lower support assembly shall have a means for attaching to building structure and a wood nailer for attaching roof materials, and shall be insulated with a minimum of 2 inches of rigid, glass-fiber insulation on inside of assembly.
- F. Spring Isolators: Adjustable, restrained spring isolators shall be mounted on 1/4-inch-thick, elastomeric vibration isolation pads and shall have access ports, for level adjustment, with removable waterproof covers at all isolator locations. Isolators shall be located so they are accessible for adjustment at any time during the life of the installation without interfering with the integrity of the roof.
1. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic and wind restraint.
 - a. Housing: Steel with resilient vertical-limit stops and adjustable equipment mounting and leveling bolt.
 - 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.
- G. Snubber Bushings: All-directional, elastomeric snubber bushings at least 1/4 inch-thick.
- H. Water Seal: Galvanized sheet metal with EPDM seals at corners, attached to upper support frame, extending down past wood nailer of lower support assembly, and counterflashed over roof materials.
- I. All roof curbs shall be at least 8-inches (MIN) above the roof membrane.

2.3 VIBRATION ISOLATION EQUIPMENT BASES

- 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. Steel Bases and Rails **SB1**: Factory-fabricated, welded, structural-steel bases and rails.

1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.
 - a. Include supports for suction and discharge elbows for pumps.
2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

C. Inertia Base **IB1**: Factory-fabricated, welded, structural-steel bases and rails ready for placement of cast-in-place concrete.

1. Design Requirements: Lowest possible mounting height with not less than **2-inch** clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.
 - a. Include supports for suction and discharge elbows for pumps.
2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
4. Fabrication: Fabricate steel templates to hold equipment anchor-bolt sleeves and anchors in place during placement of concrete. Obtain anchor-bolt templates from supported equipment manufacturer.

2.4 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.

2.5 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 COORDINATION

- A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in **Divison 03 Section "Cast-in-Place Concrete."**
- B. Coordinate size, shape, reinforcement and attachment of all housekeeping pads supporting vibration/seismically rated equipment. Concrete shall have a minimum compressive strength of 4,000 psi or as specified by the project engineer. Coordinate size, thickness, doweling, and reinforcing of concrete equipment housekeeping pads and piers with vibration isolation and seismic restraint device manufacturer to ensure adequate space, embedment and prevent edge breakout failures. Pads and piers must be adequately doweled in to structural slab.
- C. Housekeeping pads shall have adequate space to mount equipment and seismic restraint devices.
- D. Housekeeping Pads must be adequately reinforced and adequately sized for proper installation of equipment anchors and shall also be large enough and thick enough to ensure adequate edge distance and embedment depth for restraint anchor bolts to avoid housekeeping pad breakout failure. Refer seismic restraint manufacturer's written instructions.
- E. Coordinate with vibration/seismic restraint manufacturer and the structural engineer of record to locate and size structural supports underneath vibration/seismically restrained equipment (e.g. roof curbs, cooling towers and other similar equipment). Installation of all seismic restraint materials specified in this



section shall be accomplished as per the manufacturer's written instructions. Adjust isolators and restraints after piping systems have been filled and equipment is at its operating weight, following the manufacturer's written instructions.

3.3 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.

3.4 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. Isolated equipment, duct and piping located on roofs must be attached to the structure. Supports (e.g., sleepers) that are not attached to the structure will not be acceptable.
- O. 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.
- P. All floor mounted isolated equipment shall be protected with specification M1, M2, S1, S2 or S3 isolator.
- Q. 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".
- R. Install full line size flexible pipe connectors at the inlet and outlet of each pump, cooling tower, condenser, chiller, coiling connections and where shown on the drawings. All connectors shall be suitable for use at the temperature, pressure, and service encountered at the point of installation and operation. End fitting connectors shall conform to the pipefitting schedule. Control rods or protective braid must be used to limit elongation to 3/8". Flexible connectors shall not be required for suspended in-line pumps.
- S. All plumbing pumped water, piping size 1-1/4" and larger within mechanical rooms shall be isolated the same as HVAC piping above. Isolators are not required for any plumbing pumped water, pumped condensate, and steam piping outside of mechanical rooms unless listed in the isolation schedule.
- T. Pipe Riser Isolation: The operating weight of all variable temperature vertical pipe risers 1-1/4" and larger, requiring isolation where specifically shown and detailed on riser drawings shall be fully supported by specification M1, M2 or R1 supports. S1, S2, S3, H2 or H3 steel spring deflection isolators with minimum 3/4-inch minimum shall be in those locations where added deflection is required due to pipe expansion and contraction. Spring deflection shall be a minimum of 4 times the anticipated deflection change. Springs shall be selected to keep the riser in tension. Height saving brackets used with isolators having 2.5" deflection or greater shall be of the precompression type to limit exposed bolt length. Specification R1 riser supports shall be installed near the center point of the riser to anchor the



riser when spring isolation is used. Specification R2 riser guides may be used in conjunction with spring isolators per design calculations. Pipe risers up through 16" shall be supported at intervals of every third floor of the building. Pipe risers 18" and over, every second floor. Wall sleeves for take-offs from riser shall be sized for insulation O.D. plus two times the anticipated movement to prevent binding. Horizontal take-offs and at upper and lower elbows shall be supported with spring isolators as required to accommodate anticipated movement. In addition to submittal data requirements previously outlined, riser diagrams and calculations shall be submitted for approval. Calculations must show anticipated expansion and contraction at each support point, initial and final loads on the building structure, and spring deflection changes. Submittal data shall include certification that the riser system has been examined for excessive stresses and that none will exist if installed per design proposed.

- U. Where riser pipes pass through cored holes, core diameters shall be a maximum of 2" larger than pipe O.D. including insulation. Cored holes must be packed with resilient material or firestop as provided by other sections of this specification or local codes. Where seismic restraint is required specification isolator S3 shall support risers and provide longitudinal restraint at floors where thermal expansion is minimal and will not bind isolator restraints.
- V. 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.

3.5 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 ASCE 7-10 Chapter 13.
 - 2. Branch lines may not be used to brace main lines.
 - 3. All piping requires restraint unless it meets any of the exemptions listed below.
 - 4. Exemptions:
 - a. All high deformability pipe 3" or less in diameter suspended by individual hanger rods where $I_p = 1.0$.
 - b. High deformability pipe or conduit in Seismic Design Category C, 2" or less in diameter suspended by individual hanger rods where $I_p = 1.5$.
 - c. High deformability pipe in Seismic Design Category D, E or F, 1" or less in diameter suspended by individual hanger rods where $I_p = 1.5$.
 - 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 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 33” 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 Longitudinal	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.

3.6 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.

3.7 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.

3.8 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.

EQUIPMENT ISOLATION SCHEDULE									
LOCATION EQUIPMENT (1)	A' CRITICAL (35'-50' SPAN)			B' UPPER STORY (20'-35' SPAN)			C' GRADE		
	ISOLA TOR TYPE	MINIM UM DEFLEC TION (IN)	BASE TYPE	ISOLA TOR TYPE	MINIM UM DEFLEC TION (IN)	BASE TYPE	ISOLA TOR TYPE	MINIM UM DEFLEC TION (IN)	BASE TYPE
AIR HANDLING UNITS FLOOR MOUNTED UP TO 15 HP	S3	1.5		S3	0.75		S3	0.75	
20 HP & OVER	S3	2.5	SB1	S3	1.5		S3	0.75	
SUSPENDED UP TO 15 HP	H3	1.75		H3	1		H3	1	
20 HP & OVER	H3	2.5	SB1	H3	1.75		H3	1	
HIGH PRESSURE FAN SECTIONS UP TO 30 HP	S1	2.5	IB1	S3	1.5	IB1	S3	0.75	IB1
40 HP & OVER	S1	3.5	IB1	S3	2.5	IB1	S3	1.5	IB1
CENTRIFUGAL FANS CL. I & II UP TO 54-112" W.D. UPT015HP	S3	1.5	SB1	S3	0.75	SB1	S3	0.75	SB1
20-50 HP	S1	2.5	IB1	S3	1.5	IB1	S3	0.75	SB1
60 HP & OVER	S1	3.5	IB1	S1	2.5	IB1	S3	1.5	SB1
CL. I & II 60" W.D. & OVER ALL CL. III FANS UPT015HP	S1	2.5	IB1	S3	1.5	IB1	S3	0.75	IB1
20-50 H P	S1	2.5	IB1	S1	2.5	IB1	S3	1.5	IB1
60 HP & OVER	S1	3.5	IB1	S1	2.5	IB1	S3	1.5	IB1
CABINET FANS, FANS SECTIONS FLOOR MTD. UP TO 15 HP	S3	1.5		S3	0.75		S3	0.75	
20 HP & OVER	S1	2.5	IB1	S3	1.5		S3	0.75	
SUSPENDED UP TO 15 HP	H3	1.75		H3	1		H3	0.75	
20 HP & OVER	H3	2.5	SB1	H3	1.75		H3	1.75	
PUMPS FLOOR MTD. UP TO 15 HP	S3	0.75	IB1	S3	0.75	IB1	SRVD	0.4	IB1
7-112 HP & OVER	S3	1.5	IB1	S3	1.5	IB1	S3	0.75	IB1
SUSPENDED INLINE	H3	1.75		H3	1.75		H3	1	
REFRIGERATION UNITS RECIPROCATING COMPRESSORS	S1	2.5	IB1	S3	1.5	IB1	S3	0.75	IB1
RECIPROCATING COND.	S1	2.5	IB1	S3	1.5		S3	0.75	



UNITS & CHILLERS									
HERMETIC CENTRIFUGALS	S3	2.5		S3	1.5		P1	0.15	
OPEN CENTRIFUGALS	S1	2.5	IB1	S3	1.5	IB1	P1	0.15	
ABSORPTION MACHINES	S3	1.5		S3	0.75		P1	0.15	
AIR COOLED CONDENSERS									
UP TO 50 TONS	S3	1.5		S3	0.75		P1	0.15	
OVER 50 TONS	S3	2.5		S3	1.5		P1	0.15	

NOTES:

1) Thrust restraints required on all high-pressure fan section, suspended axial-flow fans and on floor-mounted axial fans operating at 3.0" S.P. or greater.

END OF SECTION



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SECTION 23 05 50

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 23 05 93.
 - 2. Training and Instructions to Owner's Representative is specified in section 23 01 00.

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 23 01 00. 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 23 05 53

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. Specialty Gas.
 - 11. 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 SPECIALTY GAS

- A. All piping for specialty gases shall be identified and marked consistent with the discipline and industry governing the same and ANSI standards.

2.11 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.
- D. Provide identification for control devices and low voltage power sources (ATC Controls) 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)
 1. Piping Background Color shall be applied to all exposed piping (either over bare pipe or the insulation) in mechanical rooms. Identifying lettering and arrows shall then be added as indicated above, and as necessary to be visible from anywhere in the room.
 2. For duct in mechanical rooms, chases and other exposed areas, as well as piping routed in other exposed areas such as chases, background color shall be applied in a two foot (2'0") wide band with identifying lettering and a flow direction arrow.
 3. Background and lettering shall be semi-gloss enamel paint by DeVoe (Mirrolac), Pratt and Lambert, Glidden, Rust-Oleum, Sherwin Williams or approved equal. The colors specified herein shall not be varied.

Color	Sherwin Williams	Pratt & Lambert	Rust-Oleum
Red	SW4081 Safety Red	1007 Vibrant Red	964 Federal Safety Red
Orange	SW4083 Safety Orange	S4507 Safety Orange	956 Federal Safety Orange
Yellow	SW4084 Safety Yellow	1732 Spectrum Yellow	944 Federal Safety Yellow
Green	SW4085 Safety Green	Safety Green	933 Federal Safety Green
Blue	SW4086 Safety Blue	1228 Anchors Aweigh	925 Federal Safety Blue
Purple	SW4080 Plum	Bright Medium	Bright Medium



Silver (Aluminum)	B59S11 Silver Brite	--	--
Black	Black	Effecto Black	634 Black
White	White	Effecto White	2766 White
Brown	SW4001 Bolt Brown	2278 Char Brown	--

- a. Identifying lettering shall be painted or stenciled on duct or pipe over the background color. Self-adhesive or glue-one type labels are acceptable. Letters shall be 2" high for duct and larger piping 3" or more, 1" high for 1-14" to 2-1/2" pipe, and 1/2" high for 1" pipe and smaller.
- b. Arrows to indicate direction of flow shall be painted over the background color in the same color as the lettering. The arrow shall point away from the lettering. On large piping 3" or more in diameter, the "shaft" of the arrow shall be 2" long and 1" wide. Smaller piping, 2-1/2" or less, shall have arrows with a shaft 1/2" wide and 2" long. Use a double-headed arrow if the flow can be in either direction.
- c. Piping shall be identified as follows:

Medium in Pipe		Background Color	Identifying Lettering	Lettering Color
Refrigerant:				
	Freon	Black	Freon	White
Steam:				
	Low Pressure (0-15psig)	Orange <i>(Note: No bands for Low Pressure)</i>	Low-Press. Steam	Black
	High Pressure (over 15 psig)	Orange <i>(Note: Two Black bands for High Pressure)</i>	High-Press. Steam	White
Water:				
	Boiler Blow-Off	Yellow	Blow-Off Water	Black
	Chilled Water Supply	Blue	Chilled Water Supply	White
	Chilled Water Return	Blue	Chilled Water Return	White
	Condenser Water Supply	Light Blue	Condenser Water Supply	White
	Condenser Water Return	Light Blue	Condenser Water Return	Black
	Condensate Return	Orange <i>(Note: One white band required for Steam Condensate Return)</i>	Condensate Return	Black



	Heating Water Supply	Red	Heating Water Supply	White
	Heating Water Return	Red	Heating Water Return	White
	Glycol Heating Water Supply	Yellow	Glycol HW Supply	White
	Glycol Heating Water Return	Yellow	Glycol HW Return	White
	Industrial Water (Hot and/or Cold)	Brown	Industrial Water	White

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



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SECTION 23 05 93

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. Constant-flow hydronic systems.
 - b. Variable-flow hydronic systems.
 - c. Primary-secondary hydronic systems.
 - 3. Balancing Steam Systems.
 - 4. Various HVAC Equipment.
 - a. Heat Exchangers.
 - b. Motors.
 - c. Chillers.
 - d. Cooling Towers.
 - e. Condensing Units.
 - f. Boilers.
 - g. Heat Transfer Coils.
 - 5. Domestic Heater Systems.
- B. **Central Plant: The central plant systems will be rebalanced in their entirety at the conclusion of the project including all new and existing chillers, cooling towers, heat exchanger, boilers, pumps, fuel systems, etc.**
- C. **Existing Building Pressurization: The building addition will alter the pressure relationships between the existing Women's Center and D&T. This division will coordinate with the ATC contractor during startup and shall modify the existing airflow balancing and building**



pressurization sequences for the D&T and Women Center to maintain neutral pressure relationships with the new patient tower.

- D. Room Pressurization Test:** Spaces with air pressurization requirements shall undergo a room pressure test to measure capability of the room to maintain air pressure. Rooms shall be pressurized to the differential noted (0.03" w.g. unless otherwise noted) using a blower apparatus and the air leakage rate shall be measured. The maximum leakage rate is specified on sheet M-091.A, M-092.A, M-093.A. If the space exceeds the leakage rate the room shall be sealed and retested. The contractor shall schedule this testing with the architect, engineer, and owner a minimum of 7-days in advance. Submit a report to the Architect/Engineer including at a minimum: Date of testing, individual performing test, witnesses to test, test pressure, leakage rate measured.

1. The following spaces shall be tested:

- a. Injection Room 1606
- b. Injection Room 1608
- c. Hot Lab 1614
- d. Nuclear Med 1617
- e. Endoscopy 2102
- f. Scope Storage 2104
- g. Scope Cleaning 2105
- h. ICU- Pat Rm – A.I.I. 2202
- i. ICU- Pat Rm – A.I.I. 2204
- j. ICU- Pat Rm – ISO 2206
- k. ICU- Pat Rm – ISO 2208
- l. TCU- Pat Rm – A.I.I. 2328
- m. TCU- Pat Rm – A.I.I. 2330
- n. Peds – Pat Rm – ADA/A.I.I. 3105
- o. Peds – Pat Rm – ADA/A.I.I. 3107
- p. Peds – Pat Rm – A.I.I. 3109
- q. Peds – Pat Rm – A.I.I. 3113
- r. Med/Surg – Pat Rm – A.I.I. 3317
- s. Med/Surg – Pat Rm – A.I.I. 3319
- t. Med/Surg – Pat Rm – A.I.I. 3321
- u. Med/Surg – Pat Rm – A.I.I. 3323
- v. POS Med/Surg – Pat Room - A.I.I. 3325

2. Refer to mechanical zoning plan for leakage rates and test pressure.

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 ACTION SUBMITTALS

A. LEED Submittals:

1. Air-Balance Report for Prerequisite IEQ 1: Documentation of work performed for ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
2. TAB Report for Prerequisite EA 2: Documentation of work performed for ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.5 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.

1.6 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."
- E. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."



- F. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.7 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.

1.8 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 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. BTC Service.
 - 2. Certified Test & Balance.
 - 3. RS Analysis.
 - 4. 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 23 31 13 "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"
 2. Comply with requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
- 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 23 07 13 "Duct Insulation," Section 23 07 16 "HVAC Equipment Insulation," and Section 23 07 19 "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 23 31 13 "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 23 21 23 "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 PRIMARY-SECONDARY HYDRONIC SYSTEMS

- A. Balance the primary circuit flow first and then balance the secondary circuits.

3.12 PROCEDURES FOR STEAM SYSTEMS

- A. Measure and record upstream and downstream pressure of each piece of equipment.
- B. Measure and record upstream and downstream steam pressure of pressure-reducing valves.



- C. Check settings and operation of automatic temperature-control valves, self-contained control valves, and pressure-reducing valves. Record final settings.
- D. Check settings and operation of each safety valve. Record settings.
- E. Verify the operation of each steam trap.

3.13 PROCEDURES FOR HEAT EXCHANGERS

- A. Measure water flow through all circuits.
- B. Adjust water flow to within specified tolerances.
- C. Measure inlet and outlet water temperatures.
- D. Measure inlet steam pressure.
- E. Check settings and operation of safety and relief valves. Record settings.

3.14 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.

3.15 PROCEDURES FOR CHILLERS

- A. Balance water flow through each evaporator and condenser to within specified tolerances of indicated flow with all pumps operating. With only one chiller operating in a multiple chiller installation, do not exceed the flow for the maximum tube velocity recommended by the chiller manufacturer. Measure and record the following data with each chiller operating at design conditions:
 - 1. Evaporator-water entering and leaving temperatures, pressure drop, and water flow.
 - 2. For water-cooled chillers, condenser-water entering and leaving temperatures, pressure drop, and water flow.
 - 3. Evaporator and condenser refrigerant temperatures and pressures, using instruments furnished by chiller manufacturer.
 - 4. Power factor if factory-installed instrumentation is furnished for measuring kilowatts.



5. Kilowatt input if factory-installed instrumentation is furnished for measuring kilowatts.
6. Capacity: Calculate in tons of cooling.
7. For air-cooled chillers, verify condenser-fan rotation and record fan and motor data including number of fans and entering- and leaving-air temperatures.

3.16 PROCEDURES FOR COOLING TOWERS

- A. Shut off makeup water for the duration of the test, and verify that makeup and blowdown systems are fully operational after tests and before leaving the equipment. Perform the following tests and record the results:
 1. Measure condenser-water flow to each cell of the cooling tower.
 2. Measure entering- and leaving-water temperatures.
 3. Measure wet- and dry-bulb temperatures of entering air.
 4. Measure wet- and dry-bulb temperatures of leaving air.
 5. Measure condenser-water flow rate recirculating through the cooling tower.
 6. Measure cooling-tower spray pump discharge pressure.
 7. Adjust water level and feed rate of makeup water system.
 8. Measure flow through bypass.

3.17 PROCEDURES FOR CONDENSING UNITS

- A. Verify proper rotation of fans.
- B. Measure entering- and leaving-air temperatures.
- C. Record compressor data.

3.18 PROCEDURES FOR HEAT-TRANSFER COILS

- A. Measure, adjust, and record the following data for each water coil:
 1. Entering- and leaving-water temperature.
 2. Water flow rate.
 3. Water pressure drop.
 4. Dry-bulb temperature of entering and leaving air.
 5. Wet-bulb temperature of entering and leaving air for cooling coils.
 6. Airflow.
 7. Air pressure drop.
- B. Measure, adjust, and record the following data for each electric heating coil:
 1. Nameplate data.
 2. Airflow.
 3. Entering- and leaving-air temperature at full load.
 4. Voltage and amperage input of each phase at full load and at each incremental stage.
 5. Calculated kilowatt at full load.
 6. Fuse or circuit-breaker rating for overload protection.
- C. Measure, adjust, and record the following data for each steam coil:



1. Dry-bulb temperature of entering and leaving air.
 2. Airflow.
 3. Air pressure drop.
 4. Inlet steam pressure.
- D. Measure, adjust, and record the following data for each refrigerant coil:
1. Dry-bulb temperature of entering and leaving air.
 2. Wet-bulb temperature of entering and leaving air.
 3. Airflow.
 4. Air pressure drop.
 5. Refrigerant suction pressure and temperature.

3.19 DOMESTIC HEATER SYSTEMS

- A. Test domestic heater system per Engineer's instructions.

3.20 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.

3.21 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.

3.22 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. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:



1. Unit Data:

- a. Unit identification.
- b. Location.
- c. Make and type.
- d. Model number and unit size.
- e. Manufacturer's serial number.
- f. Unit arrangement and class.
- g. Discharge arrangement.
- h. Sheave make, size in inches, and bore.
- i. Center-to-center dimensions of sheave, and amount of adjustments in inches.
- j. Number, make, and size of belts.
- k. Number, type, and size of filters.

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.

3. Test Data (Indicated and Actual Values):

- a. Total air flow rate in cfm.
- b. Total system static pressure in inches wg.
- c. Fan rpm.
- d. Discharge static pressure in inches wg.
- e. Filter static-pressure differential in inches wg.
- f. Preheat-coil static-pressure differential in inches wg.
- g. Cooling-coil static-pressure differential in inches wg.
- h. Heating-coil static-pressure differential in inches wg.
- i. Outdoor airflow in cfm.
- j. Return airflow in cfm.
- k. Outdoor-air damper position.
- l. Return-air damper position.
- m. Vortex damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:

- a. System identification.
- b. Location.
- c. Coil type.
- d. Number of rows.
- e. Fin spacing in fins per inch o.c.
- f. Make and model number.
- g. Face area in sq. ft..
- h. Tube size in NPS.
- i. Tube and fin materials.



j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

- a. Air flow rate in cfm.
- b. Average face velocity in fpm.
- c. Air pressure drop in inches wg.
- d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
- e. Return-air, wet- and dry-bulb temperatures in deg F.
- f. Entering-air, wet- and dry-bulb temperatures in deg F.
- g. Leaving-air, wet- and dry-bulb temperatures in deg F.
- h. Water flow rate in gpm.
- i. Water pressure differential in feet of head or psig.
- j. Entering-water temperature in deg F.
- k. Leaving-water temperature in deg F.
- l. Refrigerant expansion valve and refrigerant types.
- m. Refrigerant suction pressure in psig.
- n. Refrigerant suction temperature in deg F.
- o. Inlet steam pressure in psig.

G. Gas- and Oil-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:

1. Unit Data:

- a. System identification.
- b. Location.
- c. Make and type.
- d. Model number and unit size.
- e. Manufacturer's serial number.
- f. Fuel type in input data.
- g. Output capacity in Btu/h.
- h. Ignition type.
- i. Burner-control types.
- j. Motor horsepower and rpm.
- k. Motor volts, phase, and hertz.
- l. Motor full-load amperage and service factor.
- m. Sheave make, size in inches, and bore.
- n. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Test Data (Indicated and Actual Values):

- a. Total air flow rate in cfm.
- b. Entering-air temperature in deg F.
- c. Leaving-air temperature in deg F.
- d. Air temperature differential in deg F.
- e. Entering-air static pressure in inches wg.
- f. Leaving-air static pressure in inches wg.
- g. Air static-pressure differential in inches wg.
- h. Low-fire fuel input in Btu/h.
- i. High-fire fuel input in Btu/h.
- j. Manifold pressure in psig.



- k. High-temperature-limit setting in deg F.
- l. Operating set point in Btu/h.
- m. Motor voltage at each connection.
- n. Motor amperage for each phase.
- o. Heating value of fuel in Btu/h.

H. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

- a. System identification.
- b. Location.
- c. Make and type.
- d. Model number and size.
- e. Manufacturer's serial number.
- f. Arrangement and class.
- g. Sheave make, size in inches, and bore.
- h. Center-to-center dimensions of sheave, and amount of adjustments in inches.

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.

I. 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.

J. 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.

K. 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.

L. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:

1. Unit Data:

- a. Unit identification.
- b. Location.



- c. Service.
- d. Make and size.
- e. Model number and serial number.
- f. Water flow rate in gpm.
- g. Water pressure differential in feet of head or psig.
- h. Required net positive suction head in feet of head or psig.
- i. Pump rpm.
- j. Impeller diameter in inches.
- k. Motor make and frame size.
- l. Motor horsepower and rpm.
- m. Voltage at each connection.
- n. Amperage for each phase.
- o. Full-load amperage and service factor.
- p. Seal type.

2. Test Data (Indicated and Actual Values):

- a. Static head in feet of head or psig.
- b. Pump shutoff pressure in feet of head or psig.
- c. Actual impeller size in inches.
- d. Full-open flow rate in gpm.
- e. Full-open pressure in feet of head or psig.
- f. Final discharge pressure in feet of head or psig.
- g. Final suction pressure in feet of head or psig.
- h. Final total pressure in feet of head or psig.
- i. Final water flow rate in gpm.
- j. Voltage at each connection.
- k. Amperage for each phase.

M. Instrument Calibration Reports:

1. Report Data:

- a. Instrument type and make.
- b. Serial number.
- c. Application.
- d. Dates of use.
- e. Dates of calibration.

3.23 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.

3.24 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



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SECTION 23 07 13

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 outdoor air.
 - 2. Indoor, exposed supply and outdoor air.
 - 3. Indoor, concealed return located in unconditioned space.
 - 4. Indoor, exposed return located in unconditioned space.
- B. Related Sections:
 - 1. Section 23 07 16 "HVAC Equipment Insulation."
 - 2. Section 23 07 19 "HVAC Piping Insulation."
 - 3. Section 23 31 13 "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 23 05 29 "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.

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
- 2. 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 Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside roof flashing at least **2 inches** below top of roof flashing.
 4. Seal jacket to roof flashing with flashing sealant.



- B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least **2 inches**.
 4. Seal jacket to wall flashing with flashing sealant.
- C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- D. 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 07 84 00 "Firestopping" firestopping and fire-resistive joint sealers.
- E. Insulation Installation at Floor Penetrations:
1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least **2 inches**.
 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 07 84 00 "Firestopping."

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 07 84 00 "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 09 91 13 "Exterior Painting" and Section 09 91 23 "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, exposed supply and outdoor air.
3. Indoor, concealed return located in unconditioned space.
4. Indoor, exposed return located in unconditioned space.
5. Outdoor, concealed supply and return.
6. Outdoor, exposed supply and return.

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. Concealed, round and flat-oval, supply-air duct insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 1 inch thick and 0.75-lb/cu. ft. nominal density.

B. Concealed, round and flat-oval, return-air duct insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 1 inch thick and 0.75-lb/cu. ft. nominal density.

C. Concealed, round and flat-oval, outdoor-air and combustion-air duct insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 1 inch thick and 0.75-lb/cu. ft. nominal density.



- D. Concealed, round and flat-oval, exhaust-air duct insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch thick.
 2. Mineral-Fiber Blanket: 1 inch thick and 0.75-lb/cu. ft. nominal density.
- E. Concealed, rectangular, supply-air duct insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch thick.
 2. Mineral-Fiber Blanket: 1 inch thick and 0.75-lb/cu. ft. nominal density.
- F. Concealed, rectangular, return-air duct insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch thick.
 2. Mineral-Fiber Blanket: 1 inch thick and 0.75-lb/cu. ft. nominal density.
- G. Concealed, rectangular, outdoor-air and combustion-air duct insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch thick.
 2. Mineral-Fiber Blanket: 1 inch thick and 0.75-lb/cu. ft. nominal density.
- H. Concealed, supply-air plenum insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch thick.
 2. Mineral-Fiber Blanket: 1 inch thick and 0.75-lb/cu. ft. nominal density.
- I. Concealed, return-air plenum insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch thick.
 2. Mineral-Fiber Blanket: 1 inch thick and 0.75-lb/cu. ft. nominal density.
- J. Concealed, outdoor-air plenum insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch thick.
 2. Mineral-Fiber Blanket: 1 inch thick and 0.75-lb/cu. ft. nominal density.
- K. Exposed, round and flat-oval, supply-air duct insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch thick.
 2. Mineral-Fiber Blanket: 1 inch thick and 0.75-lb/cu. ft. nominal density.
- L. Exposed, round and flat-oval, return-air duct insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch thick.
- M. Exposed, round and flat-oval, outdoor-air and combustion-air duct insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch thick.
 2. Mineral-Fiber Blanket: 1 inch thick and 0.75-lb/cu. ft. nominal density.
- N. Exposed, rectangular, supply-air duct insulation shall be one of the following:



1. Flexible Elastomeric: 1 inch thick.
 2. Mineral-Fiber Blanket: 1 inch thick and 0.75-lb/cu. ft. nominal density.
- O. Exposed, rectangular, return-air duct insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch thick.
 2. Mineral-Fiber Blanket: 1 inch thick and 0.75-lb/cu. ft. nominal density.
- P. Exposed, rectangular, outdoor-air and combustion-air duct insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch thick.
 2. Mineral-Fiber Blanket: 1 inch thick and 0.75-lb/cu. ft. nominal density.
- Q. Exposed, supply-air plenum insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch thick.
 2. Mineral-Fiber Blanket: 1 inch thick and 0.75-lb/cu. ft. nominal density.
- R. Exposed, return-air plenum insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch thick.
 2. Mineral-Fiber Blanket: 1 inch thick and 0.75-lb/cu. ft. nominal density.

3.14 UNCONDITIONED SPACE DUCT INSULATION SCHEDULE

- A. Insulation materials and thicknesses are identified below. If more than one material is listed for a duct system, selection from materials listed is Contractor's option.
- B. Concealed, round and flat-oval, supply-air duct insulation shall be one of the following:
1. Flexible Elastomeric: 1.5 inches thick.
 2. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.
 3. Polyolefin: 1.5 inches thick.
- C. Concealed, round and flat-oval, return-air duct insulation shall be one of the following:
1. Flexible Elastomeric: 1.5 inches thick.
 2. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.
 3. Polyolefin: 1.5 inches thick.
- D. Concealed, round and flat-oval, outdoor-air and combustion-air duct insulation shall be one of the following:
1. Flexible Elastomeric: 1.5 inches thick.
 2. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.
 3. Polyolefin: 1.5 inches thick.
- E. Concealed, round and flat-oval, exhaust-air duct insulation shall be one of the following:
1. Flexible Elastomeric: 1.5 inches thick.



2. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.
 3. Polyolefin: 1.5 inches thick.
- F. Concealed, rectangular, supply-air duct insulation shall be one of the following:
1. Flexible Elastomeric: 1.5 inches thick.
 2. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.
 3. Polyolefin: 1.5 inches thick.
- G. Concealed, rectangular, return-air duct insulation shall be one of the following:
1. Flexible Elastomeric: 1.5 inches thick.
 2. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.
 3. Polyolefin: 1.5 inches thick.
- H. Concealed, rectangular, outdoor-air and combustion-air duct insulation shall be one of the following:
1. Flexible Elastomeric: 1.5 inches thick.
 2. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.
 3. Polyolefin: 1.5 inches thick.

3.15 ABOVEGROUND, OUTDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Insulation materials and thicknesses are identified below. If more than one material is listed for a duct system, selection from materials listed is Contractor's option.
- B. Exposed, round and flat-oval, supply-air duct insulation shall be one of the following:
1. Flexible Elastomeric: 3 inches thick.
 2. Polyolefin: 3 inches thick.
- C. Exposed, round and flat-oval, return-air duct insulation shall be one of the following:
1. Flexible Elastomeric: 3 inches thick.
 2. Polyolefin: 3 inches thick.
- D. Exposed, rectangular, supply-air duct insulation shall be one of the following:
1. Flexible Elastomeric: 3 inches thick.
 2. Polyolefin: 3 inches thick.
- E. Exposed, rectangular, return-air duct insulation shall be one of the following:
1. Flexible Elastomeric: 3 inches thick.
 2. Polyolefin: 3 inches thick.
- F. Exposed, supply-air plenum insulation shall be one of the following:
1. Flexible Elastomeric: 3 inches thick.
 2. Polyolefin: 3 inches thick.



G. Exposed, return-air plenum insulation shall be one of the following:

1. Flexible Elastomeric: 3 inches thick.
2. Polyolefin: 3 inches thick.

END OF SECTION

SECTION 23 09 00

BUILDING AUTOMATION SYSTEM

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. The Facility Management and Control System (FMCS) Contractor shall furnish and install a fully integrated building automation system, incorporating direct digital control (DDC) for energy management, equipment monitoring and control as herein specified. The system shall include all required computer software and licenses, hardware, controllers, sensors, transmission equipment, system workstations, local panels, conduit, wire, installation, engineering, database and setup, supervision, commissioning, acceptance test, training, warranty service and, at the owner's option, extended warranty service. Licenses for all software shall be registered to Intermountain Health Care. Include all upgrades for a period of two years.
- B. The system shall only employ BACnet communications in an open architecture with the capabilities to support a multi-vendor environment. The system shall be capable of integrating third party systems and utilizing the following standard protocols.
 - 1. BACnet communication according to ASHRAE standard ANSI/ASHRAE 135-2004.
- C. The FMCS shall utilize a JCI user interface and shall provide total integration with the existing JCI Metasys infrastructure with user access to all system data either locally over a secure Intranet within the building or by remote access by a standard Web Browser over the Internet.
- D. The FMCS shall demonstrate, with (3) proof sources, integration with HVAC industry open standard protocols, including BACnet and Internet standard SQL database and HTTP / HTML / XML text formats.
- E. All materials and equipment used shall be standard components, regularly manufactured with standard part numbers and owners manuals for this and/or other systems. One of a kind, third party or custom integrations devices designed specially for this project will not be allowed.
- F. **Existing flow meters, flow switches, temperature sensors, etc. serving the chilled water, condenser water, and heat pump water systems at the CUP shall be removed and replaced. This division shall coordinate the removal and installation of other divisions to include piping, electrical power, etc.**

1.2 RELATED WORK SPECIFIED ELSEWHERE:

- A. Drawings and general provisions of the Contract, including General and supplementary Conditions and Division-1 specification sections, apply to work of this section.
- B. Products furnished but not installed under this section:



1. Valves, flow switches, flow sensors, thermowells and pressure taps to be installed under division 23.
 2. Automatic dampers to be installed under division 23.
- C. Coordination with electrical:
1. Installation of all line voltage power wiring by division 26.
 2. Each motor starter provided under Division 26, shall be furnished with individual control power transformer to supply 120 volt control power and auxiliary contacts (one N.O. and one N.C.) for use by this section.

1.3 QUALITY ASSURANCE

- A. The system shall be furnished, engineered, and installed by the manufacturers' locally authorized representative. The controls contractor shall have factory-trained technicians to provide instruction, routine maintenance, and emergency service within 24 hours upon receipt of request.
- B. At the time of bid, all FMCS Application Specific Controllers and Programmable Equipment Controllers shall be listed as follows:
1. Underwriters Laboratory, UL 916
 2. FCC Regulation, Part 15, Class B

1.4 SUBMITTALS

- A. Submit 6 complete sets of documentation in the following phased delivery schedule:
1. Valve and damper schedules
 2. Equipment data cut sheets
 3. VAV Schedules indicating connected air handler.
 4. System schematics, including:
 - a. sequence of operations
 - b. point names
 - c. point addresses
 - d. point to point wiring (**identify both BacNET and hardwired points**)
 - e. interface wiring diagrams
 - f. panel layouts
 - g. system riser diagrams
 - h. **Obtain device ID and trunk ID's from Intermountain before adding engine to IH network. Coordinate instance numbers and indicate them in submittal.**
 5. AutoCAD® compatible as-built drawings.
 6. **Control contractor to resubmit a narrative response to all review comments provided by engineering team and owner during initial submittal review phase.**
 7. **Control graphics images shall be included in the submittals for owner review and approval.**



- B. Upon project completion, submit operation and maintenance manuals, consisting of the following:
1. Index sheet, listing contents in alphabetical order
 2. Manufacturer's equipment parts list of all functional components of the system, disk of system schematics, including wiring diagrams
 3. Description of sequence of operations
 4. As-Built interconnection wiring diagrams
 5. User's documentation containing product, system architectural and programming information.
 6. Trunk cable schematic showing remote electronic panel locations, and all trunk data
 7. List of connected data points, including panels to which they are connected and input device (ionization detector, sensors, etc.)
 - 8. Identify control points trending and alarms per IH recommended list.**
 - 9. Point naming and description in accordance with IH standards.**
 10. Conduit routing diagrams
 11. Copy of the warranty/guarantee
 12. Operating and maintenance cautions and instructions
 13. Recommended spare parts list
 - 14. Device locations and labeling of each point on the controller.**
 - 15. Save backup for new controller programming on the server and indicate server path.**

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Johnson Controls, Metasys Extended Architecture, furnished and installed by the local branch office.
1. Controls installation may be performed by a local subcontractor of JCI.

- 2.2 The Facility Management Control System (FMCS) shall be comprised of a network of interoperable, stand-alone digital controllers. The FMCS shall incorporate LonWorks technology using Free Topology Transceivers (FTT-10), or BACnet MSTP485 or Ethernet in all unitary, terminal and other device controllers. The system shall include:

- A. Programmable Equipment Controllers (PEC's) for control of primary mechanical systems and distributed system applications. Controllers shall be fully programmable to create custom control solutions.
- B. Network Area Controllers (NAC's) for distributed system applications, databases and networking functions.
- C. Application Specific Controllers (ASC's) for control of Fan coil terminal units, Unit Vent terminal units, Heat Pump units and other terminal equipment.
- D. Graphical User Interface (GUI), which includes the hardware and software necessary for a user to interface with the control system and devices.



2.3 The controller network shall use twisted pair wiring or loop. The PEC and ASC network shall communicate at a minimum 78Kbps using BACnet or Lontalk. The GUI and NAC shall reside on an Ethernet backbone.

2.4 All components and controllers supplied under this contract shall be true “peer-to-peer” communicating devices.

2.5 NETWORK AREA CONTROLLER (NAC)

A. The Network Area Controller (NAC) shall provide the interface between the field control devices, and provide global supervisory control functions over the control devices connected to the NAC. It shall be capable of executing application control programs to provide:

1. Calendar functions
2. Scheduling
3. Trending
4. Alarm monitoring and routing
5. Time synchronization
6. Integration of LonWorks controller data
7. Integration of BACnet and MODBUS networks

B. The NAC shall provide multiple, concurrent user access to the system and support for ODBC or SQL. A database resident on the NAC shall be an ODBC-compliant database or must provide an ODBC data access mechanism to read and write data stored within it. **The NAC shall be at the current revision at the time of installation.**

C. The NAC shall support standard Web browser access via the Intranet/Internet. It shall be capable of supporting multiple users, expandable to fifty.

D. The NAC shall provide alarm recognition, storage; routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers.

1. The NAC shall be able to route any alarm condition to any defined user location whether connected to a local network or remote via dial-up, telephone connection, or wide-area network.
2. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including, but not limited to:
 - a. To alarm
 - b. Return to normal
 - c. To fault
3. Provide for the creation of an unlimited number of alarm classes for the purpose of routing types and or classes of alarms, i.e.: security, HVAC, Fire, etc.
4. Provide timed (schedule) routing of alarms by class, object, group, or node.
5. Provide alarm generation from binary object “runtime” and /or event counts for equipment maintenance. The user shall be able to reset runtime or event count values with appropriate password control.



- E. Alarms shall be annunciated in any of the following manners as user defined:
1. Screen message text
 2. Email of the complete alarm message to multiple recipients. **A list of required alarm points to be provided by owner.** Provide the ability to route and email alarms based on:
 - a. Day of week
 - b. Time of day
 - c. Recipient
 3. Pagers via paging services that initiate a page on receipt of email message
 4. Graphic with flashing alarm object(s)
 5. Cell phones
- F. The following shall be recorded by the NAC for each alarm (at a minimum):
1. Time and date
 2. Location (building, floor, zone, office number, etc.)
 3. Equipment (air handler #, accessway, etc.)
 4. Acknowledge time, date, and user who issued acknowledgement.
- G. Defined users shall be given proper access to acknowledge any alarm, or specific types or classes of alarms defined by the user.
- H. A log of all alarms shall be maintained by the NAC and/or a server and shall be available for review by the user.
- I. Provide a “query” feature to allow review of specific alarms by user defined parameters.
- J. A separate log for system alerts (controller failures, network failures, etc.) shall be provided and available for review by the user.
- K. An Error Log to record system errors shall be provided and available for review by the user.
- L. Data Collection and Storage
1. The NAC shall collect data for any property of any object and store this data for future use.
 2. **A list of required trends shall be provided by the owner. Coordinate trending requirements during submittal phase.**
 3. The data collection shall be performed by log objects, resident in the NAC that shall have, at a minimum, the following configurable properties:
 - a. Designating the log as interval or deviation.
 - b. For interval logs, the object shall be configured for time of day, day of week and the sample collection interval.
 - c. For deviation logs, the object shall be configured for the deviation of a variable to a fixed value. This value, when reached, will initiate logging of the object.
 - d. For all logs, provide the ability to set the maximum number of data stores for the log and to set whether the log will stop collecting when full, or rollover the data on a first-in, first-out basis.



- e. Each log shall have the ability to have its data cleared on a time-based event or by a user-defined event or action.
- 4. All log data shall be stored in a relational database in the NAC and the data shall be accessed from a standard Web Browser.
- 5. All log data, when accessed from a server, shall be capable of being manipulated using standard SQL statements.
- 6. All log data shall be available to the user in the following data formats:
 - a. HTML
 - b. XML
 - c. Plain Text
 - d. Comma or tab separated values
- 7. The NAC shall have the ability to archive its log data either locally (to itself), or remotely to a server or other NAC on the network. Provide the ability to configure the following archiving properties, at a minimum:
 - a. Archive on time of day
 - b. Archive on user-defined number of data stores in the buffer (size)
 - c. Archive when buffer has reached its user-defined capacity
- M. Provide and maintain an Audit Log that tracks all activities performed on the NAC. Provide the ability to specify a buffer size for the log and the ability to archive log based on time or when the log has reached its user-defined buffer size. Provide the ability to archive the log locally (to the NAC), to another NAC on the network, or to a server. For each log entry, provide the following data:
 - 1. Time and date
 - 2. User ID
 - 3. Change or activity: i.e., Change setpoint, add or delete objects, commands, etc.
- N. The NAC shall have the ability to automatically backup its database. The database shall be backed up based on a user-defined time of day.
 - 1. Copies of the current database and, at the most recently saved database shall be stored in the NAC. The age of the most recently saved database is dependent on the user-defined database save interval.
 - 2. The NAC database shall be stored, at a minimum, in XML format to allow for user viewing and editing, if desired. Other formats are acceptable as well, as long as XML format is supported.

2.6 PROGRAMMABLE EQUIPMENT CONTROLLERS (PEC)

- A. Programmable Equipment Controllers (PEC's) shall be stand-alone, multi-tasking, real-time digital control processors.
- B. The PEC's shall communicate via BACnet communication according to ASHRAE standard ANSI/ASHRAE 135-2004.
- C. The PEC must communicate peer-to-peer with all of the network application specific, programmable controllers.



- D. The PEC software database must be able to execute all of the specified mechanical system controls functions. The programming software shall be able to bundle software logic to simplify control sequencing. All values, which make up the PID output value, shall be readable and modifiable at a workstation or portable service tool. Each input, output, or calculation result shall be capable of being shared/bound with any controller or interface device on the network.
- E. Provide programming, engineering, and configuration tools used for the project duly licensed to the owner for owner's use.
- F. PEC's shall be able to execute custom, job-specific processes defined by the user, to automatically perform calculations and special control routines.
- G. A single process shall be able to incorporate measured or calculated data from any and all other PEC's on the network. In addition, a single process shall be able to issue commands to points in any and all other PEC's on the network.
- H. Each PEC shall support firmware upgrades without the need to replace hardware.
- I. Each PEC shall continuously perform self-diagnostics, which include communication diagnosis and diagnosis of all components.
- J. In the event of the loss of normal power, there shall be an orderly shutdown of all PEC's to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and **battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.**
 - 1. Upon restoration of normal power, the PEC shall automatically resume full operation without manual intervention.
 - 2. All PEC's control programming and databases must be stored in Flash memory, therefore eliminating data loss, downtime and re-load time.
- K. Provide a separate PEC for each AHU or other HVAC system such that the inputs, calculations, and outputs shall reside on a single controller.

2.7 APPLICATION SPECIFIC CONTROLLERS (ASC)

- A. Each Application Specific Controller (ASC) shall operate as a stand-alone BacNet controller capable of performing its specified control responsibilities independent of other controllers in the network. Each ASC shall be a minimum 16-BIT microprocessor based, multi-tasking, multi-user, real time digital control processor.
- B. Controllers shall include all inputs and outputs necessary to perform the specified control sequences. Analog and digital outputs shall be industry standard signals such as 0-10V and 3-point floating control allowing for interface to a variety of industry standard modulating actuators. The ASC inputs and outputs shall consist of industry standards types. Inputs shall be electrically isolated from outputs, communications and power.
- C. All controller sequences and operation shall provide closed loop control of the intended application. Closing control loops over the network is not acceptable.



- D. The control program shall reside in the ASC. The application program and the configuration information shall be stored in non-volatile memory with no battery back-up required.
- E. After a power failure the ASC must run the control application using the current setpoints and configuration. Reverting to default or factory setpoints are not acceptable.

2.8 GRAPHICAL USER INTERFACE SOFTWARE (GUI)

- A. Contractor to create new system graphics pages and integrate them with the existing Metasys interface.
- B. Command of points from multiple manufacturers shall be transparent to the operator.
- C. Mobile, Web Based, User Interface (MUI)
 - 1. General
 - a. The mobile, web-based, user interface shall be HTML5-compliant and provide access to the system from smartphones, tablets, portable and desktop computers. User Interfaces that require software installation on the client device (e.g. Java, MicrosoftSilverlight®, Adobe® Flash®), or software downloads from an online app store shall not be acceptable for these purposes.
 - b. The mobile user interface shall provide system operators with a simple location-based navigation approach to finding information, including the ability to search for any location by name and to bookmark a location in a standard browser.
 - c. The same user interface elements shall be accessible from any type of personal computer or mobile device running any type of operating system supported (e.g. iOS, Android, Windows®). It shall automatically adapt and optimize the display for the screen size and touch screen navigation.
 - 2. Navigation Trees
 - a. A dedicated location based navigation tree shall be provided as part of the user interface in order to navigate to specific places within the facility on a hierarchical basis (typ. Facility, Building, Wing, Floor, Room.)
 - b. The location-based tree shall use place names familiar to the operator without training or familiarization regarding special codes and conventions utilized in the generation of the BMS.
 - c. Clicking or tapping on a location name in the tree shall display the home page associated with the space and simultaneously expand the tree to display the next level of spaces below the one selected.
 - d. It shall be possible for qualified users to view a navigation tree of devices connected to the BMS network in order to enable troubleshooting of equipment and communications. Clicking or tapping on the Network Icon at the top of the



Navigation Tree will access this alternate view. Users without the necessary access rights shall not see the Network Icon.

- e. A click or tap on a device in the network tree shall display a dashboard for that device including information regarding related equipment and access to a separate focus view of commandable points associated with the piece of hardware. A click or tap on such a point shall display a control dialogue box allowing the user to modify or command that point as indicated. The dialog box shall contain an annotation box for describing why the action was taken or special circumstances that apply.
- f. It shall be possible to restrict user access to any space in the Spaces Tree and thereby prevent manipulation of equipment associated with the space.

3. Dashboard Displays

- a. The user interface shall provide the ability to view equipment visualizations, floor plans, and/or other graphics on mobile or desktop client devices in a browser environment, without the need for additional plugins or software. Graphics shall be accessible via a space (for floorplans, campus maps, etc.) or equipment dashboard.
- b. Standard dashboards shall be configured for each defined space including one of the following predefined or custom elements:
 - Equipment Serving Space
 - Potential Problem Areas
 - Equipment Summary
 - Graphic Display (if specified)
 - Schedule
- c. Standard dashboards shall be configured for each system or device (typ. mechanical or electrical equipment) including the following predefined or custom elements:
 - Trend
 - Equipment Activity Summary
 - Equipment Relationships Summary
 - Equipment Data
 - Graphic Display (if specified)
 - Schedule
- d. Users with appropriate permissions shall have access to a Dashboards Manager that can change the display order of Summaries and Data elements, add or remove elements and apply custom dashboards layouts to equipment and space by type.
- e. Dashboard Manager shall apply dashboards to spaces or equipment based on the viewing platform (Desktop/Tablet or Phone) in order to tailor the user experience to the needs of the specific user base.

4. Alarm Management



- a. The user interface shall provide a single display of all potential issues in a facility including items currently in alarm, warning, override, out-of-service and offline.
 - b. The user interface shall provide notification of new alarms, visually and audibly.
 - c. The user interface shall provide the ability to view a summary of alarms, including a chart of the number of alarms in each of the defined alarm priority ranges. The priority ranges should be filterable.
 - d. The user interface shall provide the capability to view multiple occurrences of the same alarm, ultimately providing the ability to acknowledge or discard all occurrences of the alarm in a single action.
 - e. The user interface shall provide the capability to view, and filter on, all alarms present in a well-defined mechanical system using the equipment serving equipment relationships.
 - f. The user interface shall provide the capability to acknowledge and discard all occurrences of at least 1000 alarms in one operation.
 - g. The user interface shall provide the user with the understanding of what physical space is being affected when an alarm occurs. The user interface shall provide the ability to filter alarms by physical space affected when the alarm occurred.
 - h. The user interface shall provide the capability to monitor alarms 24/7 without requiring an active login to the system, accessible via segregated web page. The user interface shall provide the capability to enable or disable the 24/7 alarm monitor mode if desired.
 - i. The user interface shall provide the capability to annotate alarms using a pre-defined selection list or by providing custom text.
 - j. The user interface shall provide the capability to filter down alarm list and bookmark the filtered list, allowing automatic filtering to be applied when the bookmark is accessed.
 - k. It shall be possible to export a .csv or .pdf copy of the currently displayed alarm list.
 - l. If an alarm is not acknowledged or discarded by recipients within a user-selected time, the alarm shall be sent to an additional set of recipients.
5. Send Announcement
- a. Administrative users should have the ability to alert staff of planned outages in advance. The communication avenues should include:
 - Email
 - A message shown on the login screen
 - A banner shown to logged in users



6. Equipment Activity Summary

- a. The user interface shall provide a filterable, single display, of all activity related to a specific piece of equipment including user changes, discarded user changes, pending alarms, discarded alarms, and acknowledged alarms for at least one year of historical data.
- b. Items shall be listed in timed order with the latest activity at the top of the list.
- c. Filters shall allow only specific activities for specific data points occurring within a specific time and date window to be displayed.
- d. It shall be possible to export a .csv copy of the currently displayed summary by clicking or tapping on the export icon.
- e. It shall be possible to create a custom trend graph containing the data shown in the currently displayed summary by tapping or clicking on the trend icon in the header bar and selecting the specific points to trend in the resulting selection panel.
- f. Clicking on the information icon in front of any displayed activity listed in the summary shall expand the display to include the name of the user, server time, value prior to the activity, the ability to annotate the activity and a user selectable icon for displaying a trend graph of the point.

7. Equipment Relationships Summary

- a. The user interface shall provide a summary of all equipment and spaces related to the operation of the system or device currently selected for viewing.
- b. The user interface shall include the capability to navigate to the home page of any related piece of equipment or space with a single click or tap on the desired element.

8. Equipment Data Summary

- a. The user interface shall provide a summary of all data pertaining to a particular piece of mechanical or electrical equipment in a tabular format. Clicking or tapping on any value in the summary shall display a related command panel allowing the user to command, override, or change service condition of the point selected and to annotate such actions for future reference.
- b. It shall be possible to export a .pdf copy of the report with a single click on the associated export icon.

9. Equipment Serving Space Summary

- a. The user interface shall provide a summary of all mechanical and electrical equipment as defined in the points list that serves a selected space from the navigation tree.
- b. The summary shall be capable of including a subset of the viewable points for each system representing the key elements of interest to operators without subjecting them to long lists of points irrelevant to basic operation.



- c. Clicking or tapping on any item in the summary shall navigate to the item's assigned home page in the user interface.
- d. It shall be possible to view a custom trend of information contained in the summary with a single click of the trend icon residing in the title header.
- e. It shall be possible to display specific systems and points by filtering equipment types desired.
- f. Because the data is intended to be a snapshot of the current conditions in the space it shall not dynamically update but a click or tap on the update icon at any time performs that function.

10. Potential Problem Areas

- a. The user interface shall provide a summary of all points in the system related to the space that are not operating correctly (e.g. alarm, off normal or not communicating correctly) in order to provide the operator with a quick update on current conditions.
- b. The information shall include:
 - Point status (via color)
 - Point name
 - Value of the point when the summary was taken
 - Equipment that contains the offending point
 - Space that is served by that equipment
- c. Data points in the summary may be filtered by one or more types of off-normal condition (e.g. above setpoint, offline and overridden).
- d. The summary may be exported in .csv format for inclusion in spreadsheets or other documents.

11. Equipment Summary

- a. The user interface shall provide a summary that allows the user to compare all similar equipment that serves the space as well as downstream (child) spaces in order to evaluate conditions quickly and determine patterns for troubleshooting purposes.
- b. Each unique equipment type shall be selectable and display a representative set of values along with the space(s) being served by the device. Equipment types can be selected from a dropdown menu in the summary.
- c. Clicking or tapping on a selected device in the summary shall navigate to the home page for that piece of equipment while clicking or tapping a data point shall display the command panel for that point.
- d. It shall be possible to export a .pdf copy of the currently displayed summary by clicking or tapping on the export icon.



- e. It shall be possible to create a custom trend graph containing the data shown in the currently displayed summary by clicking on the trend icon in the header bar and selecting the specific points to trend in the resulting selection panel.

12. Trend

- a. The user interface shall provide the capability to view historical trend data from multiple pieces of equipment in both bar and line formats.
- b. The user shall have the ability to navigate to a selection list of frequently viewed trends.
- c. Trend graphs shall have to ability to be smartly auto-generated based on equipment and space relationships.
- d. The user shall have the ability to view up to 3 graphs in a single screen and select which data points to plot on each to help with readability.
- e. Each graph shall include a dedicated selection icon to export a copy of the graphic and data in .pdf format or the data only as a .csv file.
- f. Trend graphs shall allow the plotting of non-trended point's default values.
- g. The user shall have the ability to add any trended to point a custom trend graph.
- h. The user shall have the ability to save trend graphs for reference later.
- i. The user shall be able to specify the duration of time and aggregation period for each trend line.
- j. The user shall have the ability to decide whether to show raw or aggregate trend data.

13. Graphics

- a. The user interface shall display an equipment visualization or graphic within the context of its associated space (building, floor, room, etc.) or equipment dashboard.
- b. Graphics shall include the ability to define individual information layers for operator selection in order to clarify systems status and simplify operation on mobile devices. Where desired a master layer may be defined to include important information about the facility on all graphic screens.
- c. Graphics shall support the use of photo-realistic symbols as well as color change and animation to match the status of the related system control point.
- d. It shall be possible to export a time stamped .pdf file of the graphic being viewed in order to communicate the current conditions in the space or the equipment being viewed and to provide a historic record.

14. Scheduling



- a. The user interface shall provide the capability to display, in a singular view, all of the effective schedules in the context of the space (building/floor/room, etc.) or equipment that the schedule effects. The software should have the ability to display an effective schedule, for the present, or a future date.
- b. The user interface shall provide a report of all schedules affecting a space or equipment. The report shall provide the user details of events that comprise the weekly schedule and exception schedule(s). The report shall provide a means of viewing individual breakout scheduling elements for Weekly Schedule, Exceptions and Default Commands.
- c. The user interface shall provide the capability to efficiently change or modify schedules in mass quantities. This includes the capability to add, in bulk, exceptions to schedules, in addition to assigning, in bulk, weekly schedules.

15. Command and Control

- a. It shall be possible to command system analog and binary points via a dropdown menu accessed by clicking or tapping on the value shown in any equipment summary or graphic display and completing the task in the resultant menu including an optional annotation.
- b. Commanding multiple points shall be possible on displays where multiple like system elements can be chosen.
- c. The user interface shall support users adding notes on their commands.
- d. The user interface shall support a choice of either permanent or temporary commands.

16. Cyber Health Dashboard

- a. The Cyber Health Dashboard shall provide a centralized view of potential cybersecurity related issues or system issues, grouped into critical issues, potential risks, and informational items.
- b. The Cyber Health Dashboard shall identify user account information, including:
 - 1. Total number of users
 - 2. Dormant users
 - 3. Active users
 - 4. Locked users
 - 5. Temporary users
 - 6. Disabled users
 - 7. Users with Administrator role



8. Policy related information

- c. The Cyber Health Dashboard shall indicate out-of-date software.
- d. The Cyber Health Dashboard shall identify when security certificates are set to expire.
- e. The Cyber Healthy Dashboard shall provide insight into user activity such as number of successful logins, unsuccessful logins, and locked out accounts.

17. Search

- a. Typing a text string in the Search box shall display a list of all occurrences of that string in the mobile user interface. When a string is represented in the description of a space or network element, selecting it shall display its default dashboard.
- b. Clicking or tapping on the Advanced Search Icon shall display the Advanced Search dialog box permitting the following:
 - Search by Space and Equipment, Equipment Definition or Network Reference
 - Filter the search by wildcard name or object type
 - Multi-selection of objects for commanding or the creation of reports including Trend, Alarm, Audit and Activity for a specific period of time

2.9 PROJECT SPECIFIC PAGES:

- A. Home page shall include a campus layout of the individual buildings at the site.
 - 1. All project graphic pages shall be included in the submittal for review and approval by the owner.**
- B. Once an individual building is selected the following minimum web-based tree structure shall be provided:
 - 1. Documents Page: The document page shall include the O&M Manuals for the control system in PDF format along with AutoCAD drawings for each drawing provided in the control system O&M Manual. This document page shall include links between the control diagrams and associated data sheet in PDF format, such that the system user shall be able to click on the control device and retrieve, in PDF format, the factory O&M sheets associated with that device.
 - 2. Station Functions:
 - a. Logging separate sheet of station functions for a particular selected building shall be the viewing of one or more logs or the creation of logs in which any value at any point, or the mode of any point, shall be selected via the web to be trended against any other point with an adjustable frequency in seconds, minutes, hours or days.
 - b. The alarm acknowledgement via the web shall allow the viewing and acknowledgement of the alarms.



- c. Audit log shall be provided via the web to show the operator actions as well as other audit logs as specified in section 2.4 Network Area Controller (NAC) paragraph “M” Data Collection and Storage.

3. Floor Plans:

- a. AutoCAD drawings of floor plans shall be provided in the control system such that via the web the user shall be able to turn layers on and off on the mechanical floor plans. These floor plans shall also include an overlay of the temperature control as-built wiring for the project showing thermostat locations, communication runs, transformer locations, controller locations, etc.
- b. Floor Display Summaries. The operator shall be able to select floor plans displaying the following formats:
 - 1) All zone temperatures
 - 2) All zone heating percentages
 - 3) All zone cooling percentages
 - 4) All zone room names and numbers as per architectural matrix and owner input.
 - 5) All zones cfm delivered.

4. Systems:

- a. On selecting the systems menu, a tree structure shall allow the operator to select the air handlers, fan coil units, energy recovery ventilators, etc. systems associated with that building. The graphics shall also show the piping and ductwork associated with the air handler as well as the safeties, temperature sensors, humidity sensors, dampers, VFD's, associated with that fan system. See points lists for specifics. Each system in the points list shall be treated as a branch of the above tree.
- b. All devices that provide dynamic function in the primary equipment, i.e., fans, pumps, coils, dampers shall be dynamic in nature showing their operating status/percentage of capacity by movement on the web page.
- c. The set points for the various control loops shall be adjustable via the web page. Individual controlled devices, i.e., valves, dampers, fans shall be controlled via the web page and be stopped or started or placed in a command state or percentage of value output.

2.10 FIELD DEVICES

- A. Provide automatic control valves, automatic control dampers, thermostats, clocks, sensors, controllers, and other components as required for complete installation. Except as otherwise indicated, provide manufacturer's standard control system components as indicated by published product information, designed and constructed as recommended by manufacturer.
- B. VAV Transformers: Install VAV transformers in electrical rooms located on each building level and as indicated on the plans.
- C. 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
- D. 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
- E. Humidity Sensors: Humidity sensors shall be of the solid-state type using a capacitance-sensing element. The sensor shall vary the output voltage with a change in relative humidity. Room humidity sensors shall have a minimum range of 10% to 90% \pm 5%. Supply air humidity sensors shall have a range of 10% to 90% \pm 5%.
- F. Pressure Sensors: The differential pressure sensor shall be temperature compensated and shall vary the output voltage with a change in differential pressure. Sensing range shall be suitable for the application with linearity of 1.5% of full scale and offset of less than 1% of full scale. Sensor shall be capable of withstanding up to 150% of rated pressure without damage.
- G. Switches and Thermostats
- 1. The FMCS Contractor shall furnish all electric relays and coordinate with the supplier of magnetic starters for auxiliary contact requirements. All electric control devices shall be of a type to meet current, voltage, and switching requirement of their particular



application. Relays shall be provided with 24 VAC coils and contacts shall be rated at 10 amps minimum.

2. Duct Smoke Detectors: Duct smoke detectors shall be supplied by others with an integral auxiliary contact to be used by the FMCS contractor to provide a digital input to the FMCS.
3. Low Temperature Detection Thermostats: Shall be the manual reset type. The thermostat shall operate in response to the coldest one-foot length of the 20-foot sensing element, regardless of the temperatures at other parts of the element. The element shall be properly supported to cover the entire downstream side of the coil with a minimum of three loops. Separate thermostats shall be provided for each 25 square feet of coil face area or fraction thereof.
4. Differential Pressure Switches: Pressure differential switches shall have SPDT changeover contact, switching at an adjustable differential pressure setpoint.
5. Current Sensing Relays: Motor status indications, where shown on the plans, shall be provided via current sensing relays. The switch output contact shall be rated for 30 VDC, .15 amps.
6. Flow Switches: Motor status indications, where shown on the plans, shall be provided via flow switches. Flow switches shall be of the paddle type equipped with SPDT contacts to establish proof of flow.
7. Carbon Monoxide Detector and Controller shall meet or exceed UL 2034 standard and OSHA standards for CO exposure. Controller shall be solid state sensor. Fan relay shall activate at 35 ppm of CO averaged over 5 minutes. Alarm relay shall activate at 100 ppm after 30 minutes. Approved manufacturers shall be Macurco, Inc or approved equal.

H. Control Valves

1. General: Control Valves shall be sized for a 3 to 5 psi pressure drop. Valves shall be packless, modulating, electrically or magnetically actuated, with a control rangeability of 100 to 1. These valves shall have equal percentage flow characteristics in relationship to valve opening.
2. ½ inch to 4 inch: Valves to be of characterized ball valve type. They shall be equipped with handwheel, or manual position mounted dial adjacent to valve, to allow manual positioning of valve in absence of control power. (Valves with a rangeability of less than 200 to 1 shall utilize two valves in a 1/3 – 2/3 parallel arrangement in order to achieve control rangeability).
3. 4 inches to 6 inches: Valves for heating shall be globe valves modulating electrically actuated, 2-way or 3-way as required, with a rangeability of 50 to 1. Valve body shall be flanged and shall be equipped with a handwheel, or manual position dial mounted adjacent to the valve, to allow manual positioning of the valve in the absence of control power. Valves for cooling shall be butterfly with a rangeability of 25 to 1.
4. Butterfly Valves: 2-way and 3-way butterfly valves shall be cast iron valve body, with stainless steel stem, and available with disc seal for bubble-tight shut off.
5. Steam Valves: Valves shall have an ANSI Class 250 lb. body, teflon v-ring packing rated to 377°F., stainless steel trim rated to 50 psi, with rangeability greater than 100:1, Class 4 leakage and close off rating, linear flow characteristics, via perforated throttling cylinder.

I. Damper Actuators

1. Actuators shall be of the push-pull or rotary type of modulating, 3-point floating, or 2-position control as required by the application. The actuator shall use an overload-proof synchronous motor or an electric motor with end switches to de-energize the motor at the end of the stroke limits. Control voltage shall be 24 VAC, 0-20 VDC, or 4-20 ma as



required. Actuators shall be available with spring return to the normal position when required. Actuators shall have a position indicator for external indication of damper position. Actuators shall have manual override capability without disconnecting damper linkage.

J. Control Dampers

1. Motorized dampers, unless otherwise specified elsewhere, shall have damper frames using 13 gauge galvanized steel channel or 1/8" extruded aluminum with reinforced corner bracing. Damper blades shall not exceed ten (10) inches in width or 48" in length. Blades are to be suitable for high velocity performance. Damper bearings shall be as recommended by manufacturer for application. Bushings that turn in the bearing are to be oil impregnated sintered metal. All blade edges and top and bottom of the frame shall be provided with replaceable, butyl rubber or neoprene seals. Side seals may be spring-loaded stainless steel. The seals shall provide a maximum of 1% leakage at a wide open face velocity of 1500 FPM and 4: W.C. close-off pressure. The damper linkage shall provide a linear flow or equal percentage characteristic as required. Provide Ruskin RCD46 model or equal.
2. Control dampers shall be parallel or opposed blade type as scheduled on drawings or outdoor and return air mixing box dampers shall be parallel blade, arranged to direct air streams towards each other. All other dampers may be parallel or opposed blade types.

K. Airflow Measuring Station (AFMS)

1. Provide Ebtron-Gold airflow measuring stations (AFMS) as indicated on plans.
2. AFMS shall consist of single or multiple probes as required to achieve an airflow measurement accuracy of +/- 3% of reading.
3. AFMS probe assemblies must have multiple sensors that use instrument grade thermal dispersion, temperature compensation, thermistor sensing technology and digital electronics.
4. The AFMS manufacturer and/or their local representative shall recommend and approve the actual location for the AFMS and determine whether or not a honeycomb straightener is required.
5. Vortex shedding or pitot tube arrays and differential pressure sensing arrays with sensors that require auto-zeroing will not be accepted.
6. Ebtron is the basis of design and is powered by the low voltage controls. If line voltage power is required, it will be the responsibility of this section to coordinate and provide at no additional cost to the owner.
7. The AFMS shall provide the air temperature measurement for the air handler control sequences. Provide additional wiring to the AFMS necessary to monitor air temperature.

L. Hydronic Flow Meters

1. Provide Onicon electromagnetic flow meters as indicated on the plans for hydronic flow measurement.
2. Flow meter shall achieve a flow measurement accuracy of +/- 0.2% of reading from 1.6 to 33 ft/s and shall have a measurement flow range of 0.1 ft/s to 20 ft/s (200:1) turndown.
3. 1 inch to 10 inch: Flow meter to be inline type (Onicon F-3000). Meter to include remote mounted digital display. Provide Onicon BTU meter (System 10) for a complete energy measurement system.
4. 12 inches and larger: Flow meter to be insertion type (Onicon F-3500). Meter to include remote mounted digital display. Provide Onicon BTU meter (System 10) for a complete energy measurement system.



5. The flow measurement vendor shall recommend and approve the actual location for the flow measuring station. At a minimum the meter shall be installed with 5 diameters upstream / 3 diameters downstream of straight pipe run.
- M. Room Air Differential Pressure Monitor and Display
1. Provide Bi-Directional through the wall pressure sensor for monitoring of single room or up to two critical rooms plus an ante room as indicated on the plans.
 2. Pressure monitor has a range of -0.20000" to +0.20000" w.g. with an accuracy of +/-10% of reading +/-0.00001" w.g.
 3. Pressure monitor display on 4.3 inch flush-mounted color touchscreen capable of audible and visual alarms.
 4. Monitor provides seamless integration to BMS vis BACnet MS/TP, (BACnet IP also acceptable).
 5. Door switch provides indication of open door and delays alarm to prevent nuisance alarms. Door switch coordination and wiring is the responsibility of this section.
 6. TSI Pressura RPM10 and RPM20 are the basis of design and powered by low voltage controls. If line voltage power is required, it will be the responsibility of this section to coordinate at no additional cost to the owner. Differences in manufacturer may be allowed pending owner approval.

2.11 AIRFLOW CONTROL DEVICE – GENERAL

- A. The airflow control device shall be a Venturi valve by Phoenix controls or Triatek/JCI valve by Johnson 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	0.005 CFM	0.010



	(472 l/s)		CFM/ ft ²
	Low leakage shutoff devices up to 1,300 CFM	0.010 CFM	0.010
	(708 l/s)		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 capability 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.

2.12 EXHAUST AND SUPPLY TRACKING PAIR DEVICE CONTROLLER

- A. Airflow Measuring Stations: Airflow measuring stations (see control schematics) shall be provided as shown on each air handler. AFMS shall be Ebtron GT116-P+ or equivalent.
- B. 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.
- C. 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.
- D. 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.
- E. Room-level flow tracking control functions shall be embedded in and executed by one controller mounted on one of the airflow devices.
- F. 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.
- G. The airflow control device shall use 24 Vac power $\pm 15\%$, the industry standard.
- H. The airflow control device shall be able to connect a notebook PC commissioning tool. Every node on the local network shall be accessible.
- I. 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- $\pm 1\%$ F.S. into 10 K ohms minimum
 - b. 4 to 20 mA- $\pm 1\%$ F.S. into 500 ohms, +0 ohms/ -50 ohms
- J. The airflow control device shall meet the following agency compliance requirements: FCC Part 15 Subpart J Class A, CE and CSA.

2.13 METERS

- A. The FMS contractor shall furnish all meters associated with this project. The mechanical system design requires natural gas, chilled water system, building heating hot water, building steam, domestic cold water, domestic hot water, condenser water, heat pump circulation, and cooling tower makeup and blowdown water. The FMS contractor shall furnish the following meters (Refer to Sequence of Operation on Drawings for additional info):
 1. Central Utility Plant:
 - a. Natural Gas Meter:
 - 1) Sub-Meters for Steam boiler (E)SB-1, (E)SB-2, SB-3. (Qty-3)
 - b. BTU Meters
 - 1) Chilled Water Energy Meter (Measures total campus chiller usage, BTU meter)
 - 2) Condenser Water Energy Meter (Measures total campus chiller usage, BTU meter)
 - 3) Heat Pump Circulation Energy Meter (Measures total heat pump energy usage, BTU meter)
 - c. Flow Meter
 - 1) Primary Chilled Water Meter (Measures flow in primary CHW piping)
 - d. Domestic Water Use Meters shall be installed in the following:
 - 1) Cooling tower make-up
 - 2) Cooling tower blowdown
 - 3) Outdoor Irrigation Systems. Coordinate location with civil.
 2. Patient Tower
 - a. Natural Gas Meter:
 - 1) Sub-Meter for Food Service (Kitchen).
 - b. BTU Meters
 - 1) Chilled Water Energy Meter (Measures patient tower CHW usage, BTU meter)



- 2) Heating Hot Water Energy Meter (Measures patient tower HW usage, BTU meter)
 - 3) Glycol Heating Hot Water Energy Meter (Measures patient tower GHW usage, BTU meter)
- c. Domestic Water Use Meters shall be installed in the following:
 - 1) Domestic water to patient tower
 - 2) Cold water make-up for domestic hot water systems in patient tower.
- 3. BTU Meters shall be as follows:
 - a. Chilled Water, Hot Water, & Condenser Water Btu Meters shall be Onicon F-3000/F-3500 Electromagnetic Flow Meters. Accuracy of 0.4%. Complete with graphic LCD display & remote mount display.
 - b. Steam Btu Meters shall be Spirax Sarco model TVA flow meters with remote mount display.
 - c. Steam Condensate Btu Meters shall be Onicon F-1130 with remote mount display.
- 4. Natural Gas Meters:
 - a. Provide diaphragm type flow meters for sizes up to 1,000,000 Btu/h. Provide rotary type flow meters for sizes above 1,000,000 Btu/h. Accuracy on diaphragm meters shall be +/- 3% over the published flow range of the meter. Accuracy of the rotary meter shall be +/- 2% over the published flow range of the meter. Verify that maximum and minimum flow requirements for the project are suitable for the meter selected. Include requirement in the contract documents to correct meter multiplier for project gas pressure.
 - b. Provide a strainer upstream of all meters. Provide a bypass around meters. If meter is installed outside, route output wiring to local display inside building mechanical room. Orient pipe horizontally where meter is installed. Meter installation shall be in accordance with manufacturer's specifications. Provide 12 pipe diameters upstream and 7 pipe diameters downstream, unless more is required by manufacturer. Strainers and bypass fittings are not to be included in the straight pipe length.
- 5. Domestic Water Meters:
 - a. Provide positive displacement type flow meters for sizes up to 2" and direct coupled turbine type flow meters for sizes up to 20". Insertion turbine type flow
 - b. Provide a strainer upstream of all meters. Provide a bypass around meters that are installed inline. Bypasses are not required for insertion turbine meters that can be removed from the pipeline for maintenance without interrupting flow. Provide a test port downstream of meters.
- 6. Advanced metering is installed for all building energy sources and individual energy end uses, all electrical consuming equipment and system is capable of storing data for up to 36 months. All data is remotely accessible and all meters are capable of reporting hourly, daily, monthly and annual energy use.

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, inter-locks, 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.

3.13 WARRANTY/GUARANTEE

- 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 4 - SEQUENCES OF OPERATION

4.1 See project drawings for sequences.

PART 5 - POINTS LIST

	Input / Output						Web Pages Graphics										Alarms					Trends Archive Size Verify w/ Owner				
	Digital Input	Digital Output	Analog Input	Analog Output	Hardware Interlock	BAS Communication	Status	Temperature of Other Value	Cooling Percentage	Heating Percentage	Dynamic Flow Diagrams	O&M Manuals	Start/Stop	Status	Display Value	Adjust Value	Run Time Totalize or Totalize	Operator Workstation	Remote Device/Email	Building Manager	User	Life Safety Alarm	Run Time / Totalize	30 Minute / Week	Change of Value / 800 Samples	Change of Value / 30 Samples
AIR HANDLER, PATIENT																										
Supply Fan Return/ VFD (Points per VFD)						X					X		X	X	X		X									
Fan Start/Stop		X				X							X													
Fan Status	X					X	X							X				X					X			
Fan Signal				X				X		X	X			X												X
Discharge Air Static Pressure			X					X			X	X			X	X	X	X						X		X
Low Temp Sensor (Freeze Stat)	X				X	X	X				X	X		X	X			X	X			X	X			X
Smoke Detectors - Supply Air/Return Air	X	X				X	X				X			X	X			X	X			X	X			X
Pre-Filter Differential Pressure			X					X			X	X			X		X	X	X							X
Final Filter Differential Pressure			X					X			X	X			X		X	X	X							X
Return Air CO2 Sensor			X					X			X	X			X	X		X								
Building Static Pressure			X								X				X											X



Outside Supply Air Flow Station			X				X			X	X	X		X					X	X	
Supply Air Flow Station			X				X			X	X	X		X					X	X	
Return Air Flow Station			X				X			X	X	X		X					X	X	
High Static Pressure Switch	X				X	X	X			X	X		X	X		X	X		X	X	X
Mixed Air Temperature			X										X								
Outside Air Damper				X			X			X			X	X							X
Return Air Damper				X			X			X			X	X							X
Relief Air Damper				X			X			X			X	X							X
Return Air Temperature and Humidity				X				X		X			X		X	X					X
Cooling Coil Valve				X			X	X	X	X	X		X	X	X						X
Heating Coil Valve				X			X		X	X			X	X	X						X
Heating Coil Discharge Air Temperature				X				X		X			X		X	X					X
Humidifier				X		X	X		X				X								X
Supply Duct Pressure		X								X		X									
Fan Pressure Plenum		X								X		X									
Supply Air Temperature, Humidity and Dew Point Sensors				X				X		X			X		X	X					X
Cooling Coil Discharge Air Temperature				X				X		X			X		X	X					X
All VFD's (as available in VFD)																					
Start/Stop		X				X						X									
Status	X					X	X					X			X				X		
System Fault						X	X								X	X					
Speed				X		X		X					X								X
Frequency Output				X		X							X								
Percent Output				X		X							X								
Current			X			X							X								
Torque			X			X							X								
Power			X			X							X						X		



Heating Pumps Stop/Start (each)		X								X															
Heating Pumps Status (each)	X									X					X	X	X								
VFD Signal				X			X	X	X			X	X							X				X	
Hot Water Differential Pressure			X						X				X	X											X
Supply Water Temperature			X				X		X				X	X		X	X	X							X
Return Water Temperature			X				X		X				X												X
Flow Rate						X	X			X	X			X	X								X		
GLYCOL PREHEAT SYSTEM																									
Pre-Heat System Enable (each)		X			X		X			X		X	X			X	X			X					X
Pre-Heat System Status (each)	X				X		X			X		X	X			X	X			X	X				X
Heating Pumps Stop/Start (each)		X								X															
Heating Pumps Status (each)	X									X						X	X	X			X				
VFD Signal				X			X	X	X			X	X												X
Glycol Low Level			X							X			X	X											X
Pre-Heat Loop Supply Water Temperature			X																						X
Pre-Heat Loop Return Water Temperature			X																						X
Control Valve				X			X			X			X	X		X	X	X							X
HX Set Point						X	X			X	X		X	X							X				
Pre-Heat Loop Water Differential Pressure				X						X			X	X											X
CHILLED WATER SYSTEM																									
Chilled Water Pumps Enable (each)		X			X		X			X		X	X		X	X	X	X						X	X
Chilled Water Pumps Status (each)	X				X		X			X	X		X	X		X	X	X			X	X			
Chilled Water Flow Each Chiller			X		X		X			X			X								X	X			
Building Chilled Water Supply Temp			X		X		X			X	X		X	X	X										X



Condenser Water Systems	X									X			X	X					X			
Domestic Water Heaters Cold Water Supply	X									X			X	X					X			
ENERGY METERS																						
See sequence of operation						X				X			X	X					X			
IRRIGATION WATER																						
Outdoor Irrigation systems	X									X			X	X					X			
GENERATOR																						
Points determined by Generator manufacturer						X	X	X														
Fuel Oil Monitoring							X	X														
MEDICAL GAS STORAGE RM EXHAUST																						
Fan Start/Stop		X				X				X												
Fan Status	X					X	X			X				X	X	X			X			
Glycol Snow Melt Zones SMZ-1,2,3,4,5																						
Stop/Start		X								X			X			X	X					
Leaving Water Temp			X							X			X		X	X						X
Entering Water Temp			X							X			X		X	X						X
Control Valve				X						X			X	X								X
Snow Sensor			X				X			X			X		X	X						X
Snow Melt Pumps P-5,6,7,8,9,10																						
Pump Start/Stop		X								X			X			X	X					
Pump Status	X						X			X				X	X	X	X		X			
Power Consumption																						
See M&V Documents for all requirements							X						X						X			
Electrical Power Meters (supplied by 260000)							X						X						X			
KW							X						X						X			



PF							X							X							X	
KWH							X							X							X	
Volt							X							X							X	
Amperage							X							X							X	
Total Harmonic Distortion (main Meter only) & supplied by 26000							X							X							X	
Gas Meters																						
Building Meter	X						X							X							X	
Automatic Transfer Switches																						
Switch Status	X						X	X							X	X				X		
Additional points determined by ATS manufacturer							X															
ISOLATION ROOM																						
Pressure Monitors							X	X				X			X	X	X		X			X
GLYCOL MAKEUP SYSTEM																						
Pump Status	X										X		X			X	X	X				X
Pressure			X								X		X			X	X	X				X
Low Level Switch	X										X		X			X	X	X				X
PENTHOUSE RELIEF SYSTEMS																						
Building Static Pressure																						
Relief Air Campers																						

END OF SECTION



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SECTION 23 30 01

COMMON DUCT REQUIREMENTS

PART 1 - PRODUCTS

1.1 SUMMARY

A. Includes But Not Limited To:

1. General procedures and requirements for ductwork.
2. Repair leaks in ductwork, as identified by smoke test, at no additional cost to Owner.
3. Soundproofing procedures for duct penetrations of walls, ceilings, and floors in mechanical equipment rooms.

B. Related Sections:

1. Division 07: Quality of Acoustic Sealant.
2. Section 23 05 00: Common Work Results for HVAC
3. Section 23 05 93: Testing Adjusting and Balancing for HVAC.

1.2 SUBMITTALS

A. Samples: Sealer and gauze proposed for sealing ductwork.

B. Quality Assurance / Control:

1. Manufacturer's installation manuals providing detailed instructions on assembly, joint sealing, and system pressure testing for leaks.
2. Specification data on sealer and gauze proposed for sealing ductwork.

1.3 QUALITY ASSURANCE

A. Requirements: Construction details not specifically called out in Contract Documents shall conform to applicable requirements of SMACNA HVAC Duct Construction Standards.

B. Pre-Installation Conference: Schedule conference immediately before installation of ductwork.



PART 2 - PRODUCTS

- 2.1 Finishes, Where Applicable: Colors as selected by Architect.
- 2.2 Duct Hangers:
- A. One inch by 18 ga galvanized steel straps or steel rods as shown on Drawings, and spaced not more than 96 inches apart. Do not use wire hangers.
 - 1. Attaching screws at trusses shall be 2 inch No. 10 round head wood screws. Nails not allowed.
 - 2. Attach threaded rod to steel joist with Grinnell Steel washer plate Fig. 60 - ph-1. Double nut connection.
- 2.3 Penetration Soundproofing Materials:
- A. Insulation for Packing: Fiberglass.
 - B. Calking: Polysulphide.
 - C. Escutcheon Frame: 22 ga galvanized iron 2 inches wide.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. During installation, protect open ends of ducts by covering with plastic sheet tied in place to prevent entrance of debris and dirt.
- B. Make necessary allowances and provisions in installation of sheet metal ducts for structural conditions of building. Revisions in layout and configuration may be allowed, with prior written approval of Architect. Maintain required airflows in suggesting revisions.
- C. Hangers And Supports:
 - 1. Install pair of hangers close to each transverse joint and elsewhere as required by spacing indicated in table on Drawings.
 - 2. Install upper ends of hanger securely to floor or roof construction above by method shown on Drawings.
 - 3. Attach strap hangers to ducts with cadmium-plated screws. Use of pop rivets or other means will not be accepted.
 - 4. Where hangers are secured to forms before concrete slabs are poured, cut off flush all nails, strap ends, and other projections after forms are removed.
 - 5. Secure vertical ducts passing through floors by extending bracing angles to rest firmly on floors without loose blocking or shimming. Support vertical ducts, which do not pass through floors, by using bands bolted to walls, columns, etc. Size, spacing, and method of attachment to vertical ducts shall be same as specified for hanger bands on horizontal ducts.
- D. Penetration Soundproofing



1. Pack space between ducts and structure full of fiberglass insulation of sufficient thickness to be wedged tight, allowing space for application of calking.
2. Provide calking at least 2 inches thick between duct and structure on both ends of opening through structure.
3. Provide metal escutcheon on Equipment Room side. Secure escutcheon to wall.

3.2 CLEANING

- A. Clean interior of duct systems before final completion.

END OF SECTION



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SECTION 23 31 13

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. Double-wall rectangular ducts and fittings.
3. Single-wall round ducts and fittings.
4. Exhaust Air Stacks
5. Guy wires and connectors.
6. Sheet metal materials.
7. Duct liner.
8. Sealants and gaskets.
9. Hangers and supports.
10. Seismic-restraint devices.

- B. Related Sections:

1. Section 23 05 93 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 23 31 19 "HVAC Casings" for factory- and field-fabricated casings for mechanical equipment.
3. Section 23 33 00 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.
4. Section 23 07 13 "Duct Insulation" for duct insulation and fire wrap.

- C. Stacks from the exhaust systems are to be designed per SMACNA guidelines. Use the "Guide for steel stack design and Construction" the latest edition. The outside of the stacks are to be painted with Pota-Pox. 80 series 141 material. Color is to be selected by the architect. Provide guy wires and angle supports. Construction shall be a minimum of 10 gauge and shall be painted on the inside of the stack and on the exterior where the stack is exterior to the building.

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. Seismic Performance: Duct hangers and supports shall withstand the effects of earthquake motions determined according to SEI/ASCE 7 and with the requirements specified in Section 23 05 48 "Vibration and Seismic Controls for HVAC."
 - 1. For equipment 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."
 - 2. For equipment 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."
- C. Structural Performance: Duct 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"
- D. 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.
 - 3. Seismic-restraint devices.
- B. LEED Submittals:
 - 1. Product Data for Prerequisite IEQ 1: Documentation indicating that duct systems comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
 - 2. Product Data for Prerequisite EA 2: Documentation indicating that duct systems comply with ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."
 - 3. Leakage Test Report for Prerequisite EA 2: Documentation of work performed for compliance with ASHRAE/IESNA 90.1, Section 6.4.4.2.2 - "Duct Leakage Tests."
 - 4. Duct-Cleaning Test Report for Prerequisite IEQ 1: Documentation of work performed for compliance with ASHRAE 62.1, Section 7.2.4 - "Ventilation System Start-up."
 - 5. Laboratory Test Reports for Credit IEQ 4: For adhesives and sealants, documentation indicating that products 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."
 - 6. Product Data for Credit IEQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content.
- C. 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. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.
14. **Duct fabrication shall not begin until shop drawings have been submitted and reviewed by the mechanical engineer.**

D. 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 DOUBLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. Rectangular Ducts: Fabricate ducts with indicated dimensions for the inner duct.
- B. Duct dimensions shown on drawings are inside clear dimensions.



- C. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- D. 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."
- E. 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."
- F. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
 - 1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
 - 2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
 - 3. Coat insulation with antimicrobial coating.
 - 4. Cover insulation with polyester film complying with UL 181, Class 1.
- G. Interstitial Insulation: Flexible elastomeric duct liner complying with ASTM C 534, Type II for sheet materials, and with NFPA 90A or NFPA 90B.
 - 1. Maximum Thermal Conductivity: 0.25 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
- H. Inner Duct: Minimum 0.028-inch solid sheet steel.
- I. Formed-on Transverse Joints (Flanges): 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."
- J. 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."

2.3 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."

2.4 EXHAUST AIR STACKS

- 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. 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.
- C. Longitudinal Seams: Not allowed.
- D. 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."
- E. Design Wind Loads: 150 mph.
- F. Design for seismic conditions at Project site.
- G. Accessories: Terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as duct straight sections.
1. Termination: Antibackdraft damper.
- H. Drain: Provide drain section incorporated into base of stack with trap. Seal depth design to prevent seal blowout at highest estimated static pressure.
- I. Guying and Bracing Materials
1. Cable: Three minimum galvanized or stainless steel, stranded wires of the following thickness:
 - a. Minimum Size: 1/4 inch in diameter.



- b. For ID Sizes 4 to 15 Inches: 5/16 inch.
 - c. For ID Sizes 18 to 24 Inches: 3/8 inch.
 - d. For ID Sizes 27 to 30 Inches: 7/16 inch.
 - e. For ID Sizes 33 to 36 Inches: 1/2 inch.
 - f. For ID Sizes 39 to 48 Inches: 9/16 inch.
 - g. For ID Sizes 51 to 60 Inches: 5/8 inch.
- 2. Cable Hardware: Provide duct angle ring, turnbuckles, cable loop thimbles, cable clamps and all hardware necessary to brace stack.
 - 3. Pipe: Two galvanized steel, NPS 1-1/4.
 - 4. Angle Iron: Two galvanized steel, 2 by 2 by 0.25 inch.

2.5 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. Carbon-Steel Sheets: Comply with ASTM A 1008, with oiled, matte finish for exposed ducts.
- D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.
- E. 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.
- F. 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.

2.6 DUCT LINER

- A. Per ASHRAE Standard 170 section 6.9 duct liner shall not be installed in supply ductwork downstream of filter bank #2 for this project.
- B. 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).
 - c. Adhesive 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."
- C. Flexible Elastomeric Duct Liner: Preformed, cellular, closed-cell, sheet materials complying with ASTM C 534, Type II, Grade 1; and with NFPA 90A or NFPA 90B.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Aeroflex USA Inc.
 - b. Armacell LLC.
 - c. Rubatex International, LLC
 - 2. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
 - 3. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.
 - a. 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).
 - b. Adhesive 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. 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.



- E. 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.

2.7 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).
11. Sealant 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."

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. Sealant 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."
11. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
12. Service: Indoor or outdoor.
13. 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).
7. Sealant 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."



- 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.

2.8 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 23 33 00 "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 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 ADDITIONAL INSTALLATION REQUIREMENTS FOR COMMERCIAL KITCHEN HOOD EXHAUST DUCT

- A. Install commercial kitchen hood exhaust ducts without dips and traps that may hold grease, and sloped a minimum of 2 percent to drain grease back to the hood.



- B. Install fire-rated access panel assemblies at each change in direction and at maximum intervals of 12 feet in horizontal ducts, and at every floor for vertical ducts, or as indicated on Drawings. Locate access panel on top or sides of duct a minimum of 1-1/2 inches from bottom of duct.
- C. Do not penetrate fire-rated assemblies except as allowed by applicable building codes and authorities having jurisdiction.
- D. Perform a light test of grease ductwork per 2018 International Mechanical Code paragraph 506.3.2.5. prior to concealment by insulation or covered by shaft.
 - 1. Perform light test in the presence of local Inspector/Engineer.
 - 2. Document whether test passed or failed.
 - 3. Repair any joints or duct welds that fail light test to the point the ductwork passes the light test.
- E. Install grease duct with minimum clearance to combustibles as required by IBC and local codes. Installations that do not meet the minimum required clearances shall be fire wrapped as specified in Section 23 07 13 "Duct Insulation".
- F. Provide approved fire-wrap insulation that meets ASTM C 656.
- G. **All duct joints and seams are to be sealed by a continuous, liquid-tight weld applied to the external surfaces.**
- H. **Provide a water leak test. A high-pressure spin jet is passed through the duct system so that the entire duct interior is exposed to spray water. The duct is then inspected for water anywhere on the exterior. A welder shall be onsite to repair any leaks as they are discovered, and the duct re-tested until no more leaks are discovered.**

3.4 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. Outdoor, Supply-Air Ducts: Seal Class A.
 - 3. Outdoor, Exhaust Ducts: Seal Class A.
 - 4. Outdoor, Return-Air Ducts: Seal Class A.
 - 5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class A.
 - 6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
 - 7. Unconditioned Space, Exhaust Ducts: Seal Class A.
 - 8. Unconditioned Space, Return-Air Ducts: Seal Class A.
 - 9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class A.
 - 10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
 - 11. Conditioned Space, Exhaust Ducts: Seal Class A.
 - 12. Conditioned Space, Return-Air Ducts: Seal Class A.



3.5 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.

3.6 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 23 05 48 "Vibration and Seismic Controls for HVAC."
 - 1. Comply with **ASCE/SEI 7**.

3.7 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Section 23 33 00 "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.8 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 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."

3.9 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.
 - d. Outdoor Air 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.

3.10 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 23 33 00 "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.



3.11 START UP

- A. Air Balance: Comply with requirements in Section 23 05 93 "Testing, Adjusting, and Balancing for HVAC."

3.12 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 Constant-Volume Air-Handling Units:
 - a. Pressure Class: Positive 3-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 8.
 - d. SMACNA Leakage Class for Round: 4.
 - 3. 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.
 - 4. 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.
 - 2. Ducts Connected to Air-Handling Units:
 - 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.
 - 3. 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.
 - 4. Ducts Connected to Type I (Grease) Commercial Kitchen Hoods: Comply with NFPA 96.
 - a. Exposed to View: 18 gauge Type 304, stainless-steel sheet, No. 4 finish.
 - b. Concealed: 16 gauge black steel.
 - c. Pressure Class: Positive or negative 3-inch wg.
 - d. Welded seams and joints.
 - e. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
 - f. SMACNA Leakage Class: 2.
 - g. A light test shall be performed for grease duct prior to concealing the duct.
 - h. **A water leak test shall be performed for grease duct prior to concealing the duct.**
 - 5. Ducts Connected to Type II (Heat) Commercial Kitchen Hoods:
 - a. Type 304, stainless-steel sheet.
 - b. Exposed to View: No. 4 finish.
 - c. Pressure Class: Positive or negative 3-inch wg.
 - d. Concealed: No. 2D finish.
 - e. Welded seams and joints.
 - f. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
 - g. SMACNA Leakage Class: 2.
 - 6. Ducts Connected to Dishwasher and Low Temperature Vapor and Odor Hoods:
 - a. Type 304, stainless-steel sheet.



- b. Exposed to View: No. 4 finish.
 - c. Pressure Class: Positive or negative 3-inch wg.
 - d. Concealed: No. 2D finish.
 - e. Welded seams and flanged joints with watertight EPDM gaskets.
 - f. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations, flanged joints class A.
 - g. SMACNA Leakage Class: 2.
- 7. Branch Ducts Connected to Fans Exhausting Laboratory and Process (ASHRAE 62.1, Class 3 and 4) Air:
 - a. Type 304, stainless-steel sheet.
 - 1) 0.05-inch thick.
 - 2) Exposed to View: No. 4 finish.
 - 3) Concealed: No. 2B finish.
 - b. Pressure Class: Positive or negative 6-inch wg.
 - c. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
 - d. SMACNA Leakage Class: 2.
 - e. Main laboratory exhaust trunks to be galvanized steel with same pressure, seal and leakage class.
- 8. Ducts Connected to radioactive fume hoods:
 - a. Type 316 .05-inch thick stainless-steel sheet.
 - 1) Exposed to View: No. 4 finish.
 - 2) Concealed: No. 2B finish.
 - b. Pressure Class: Positive or negative 6-inch wg.
 - c. Minimum SMACNA Seal Class: A. Flanged and gasketed joints for future disassembly for decontamination.
 - d. SMACNA Leakage Class: 2.
- 9. Ducts Connected to Equipment Not Listed Above:
 - a. Pressure Class: Positive or negative 4-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 4 .
 - d. SMACNA Leakage Class for Round: 2 .
- F. Outdoor-Air (Not Filtered, Heated, or Cooled) 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 and Flat Oval: 4.
 - 2. Ducts Connected to Air-Handling Units:
 - 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.



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.
- G. Intermediate Reinforcement:
1. Galvanized-Steel Ducts: Galvanized steel.
 2. Stainless-Steel Ducts:
 - a. Exposed to Airstream: Match duct material.
 - b. Not Exposed to Airstream: Match duct material.
 3. Aluminum Ducts: Aluminum.
- H. Duct Liner Restrictions:
1. **Duct liner shall not be used on supply ductwork downstream of the air handler final filter on this project per ASHRAE Standard 170 section 6.9.**
 2. Duct Liner exposed to air movement shall not be used on medium pressure ductwork (2000 to 4000 FPM velocity). See section 23 07 13 "Duct Insulation" for insulation requirements.
 3. Duct Liner exposed to air movement shall not be used on high pressure ductwork (Greater than 4000 FPM velocity). See section 23 07 13 "Duct Insulation" for insulation requirements.
 4. All duct liner shall meet all of the requirements found in 2018 IECC
- I. Liner: (Ductwork located in Unconditioned space)
1. Return Air Ducts: Fibrous glass, Type I, 1-1/2 inch thick with a minimum R value of 6.0 for ducts in unconditioned spaces.
 2. Return Air Ducts: Fibrous glass, Type I, 1 inch thick for ducts in conditioned spaces.
 3. Exhaust Air Ducts: Fibrous glass, Type I, 1 inch thick.
 4. Supply Fan Plenums: Fibrous glass, Type I, 1-1/2 inch thick with a minimum R value of 6.0.
 5. Return- and Exhaust-Fan Plenums: Fibrous glass, Type II, 1-1/2 inch thick with a minimum R value of 6.0.
 6. Transfer Ducts: Fibrous glass, Type I, 1 inch thick.
- J. Liner: (Ductwork located Interior to building Insulated Envelope)
1. Return Air Ducts: Fibrous glass, Type I, 1 inch thick with a minimum R value of 4.0 for ducts in unconditioned spaces.
 2. Return Air Ducts: Fibrous glass, Type I, 1 inch thick for ducts in conditioned spaces.
 3. Exhaust Air Ducts: Fibrous glass, Type I, 1 inch thick.
 4. Supply Fan Plenums: Fibrous glass, Type I, 1 inch thick with a minimum R value of 4.0.
 5. Return- and Exhaust-Fan Plenums: Fibrous glass, Type II, 1 inch thick with a minimum R value of 4.0.
 6. Transfer Ducts: Fibrous glass, Type I, 1 inch thick.
- K. Double-Wall Duct Interstitial Insulation:



1. Supply Air Ducts: 1-1/2 inch thick with a minimum R value of 6.0.
2. Return Air Ducts: 1-1/2 inch thick with a minimum R value of 6.0.
3. Exhaust Air Ducts: 1-1/2 inch thick with a minimum R value of 6.0.

L. Exterior Ductwork Liner Insulation:

1. Supply Air Ducts: 2 inch thick with a minimum R value of 8.0.
2. Return Air Ducts: 2 inch thick with a minimum R value of 8.0.
3. Exhaust Air Ducts: 2 inch thick with a minimum R value of 8.0.

M. 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.

N. 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



SECTION 23 33 00

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. Pressure relief dampers.
 - 3. Barometric relief dampers.
 - 4. Manual volume dampers.
 - 5. Control dampers.
 - 6. Fire dampers.
 - 7. Smoke dampers.
 - 8. Combination fire and smoke dampers.
 - 9. Duct silencers.
 - 10. Turning vanes.
 - 11. Remote damper operators.
 - 12. Duct-mounted access doors.
 - 13. Flexible connectors.
 - 14. Flexible ducts.
 - 15. Duct accessory hardware.
 - 16. High efficiency take-offs.
- B. Related Requirements:
 - 1. Division 23 "Diffusers, Registers and Grilles".
 - 2. Division 28 "Digital, Addressable Fire-Alarm System" for duct-mounted fire and smoke detectors.
 - 3. 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 PRESSURE RELIEF 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.
- B. Function:
 - 1. Provide component designed to protect HVAC systems by relieving air pressure from within a space that is beyond a pre-determined limit.
 - 2. To automatically begin to open at a pre-set pressure difference above maximum system pressure.
 - 3. Internally self-controlled with system pressure utilizing adjustable arms and weights.
 - 4. Self-actuated with system pressure utilizing adjustable arms and weights.
 - 5. Employs blade counterbalancing.
 - 6. Automatically closes and re-sets when pressures return to normal conditions.



- C. Air Velocity:
 - 1. 3900 fpm.
- D. Maximum System Pressure (MSP):
 - 1. 5-inch wg.
 - 2. 4-inch wg.
- E. Differential Pressure Preset above MSP:
 - 1. 1-inch wg.
- F. Maximum Damper Pressure Limit:
 - 1. 5.0-inch wg.
- G. Frame Material: Flanged Channel:
 - 1. 14GA 0.079-inch- thick galvanized steel.
- H. Frame Depth: 8-inch- minimum.
- I. Blades:
 - 1. Material:
 - a. 16GA 0.063-inch- formed galvanized steel.
 - 2. Type:
 - a. Formed Sheetmetal.
 - 3. Blade-stop:
 - a. With stop.
- J. Blade Action: Parallel.
- K. Blade Seals:
 - 1. Thermo Plastic Elastomer.
- L. Blade Axles:
 - 1. Material:
 - a. Plated steel.
 - 2. Diameter: 0.375 inch.
- M. Linkage:
 - 1. External heavy duty type with galvanized steel clevis arms and plated steel tie bars & pivot pins with nylon pivot bearings.
- N. Bearings:
 - 1. Galvanized Steel ball.

2.5 BAROMETRIC RELIEF 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.
- B. Function:
1. Senses and compares outdoor ambient and indoor pressures.
 2. Allows any higher pressure indoor air to escape.
- C. Description: Suitable for horizontal or vertical mounting.
- D. Maximum Air Velocity:
1. 1000 fpm
- E. Maximum System Pressure:
1. 3-inch wg .
- F. Frame: Hat-shaped, with welded corners or mechanically attached and mounting flange.
1. 13GA 0.094-inch- thick, galvanized sheet steel.
- G. Blades: Multiple:
1. 16GA 0.050-inch- thick aluminum sheet.
 2. Maximum Width: 6 inches.
 3. Action: Parallel.
 4. Balance: Gravity.
 5. Pivot:
 - a. Eccentric.
- H. Blade Seals:
1. Neoprene
- I. Blade Axles:
1. Galvanized steel .
- J. Tie Bars and Brackets: Rattle free with 90-degree stop.
1. Material:
 - a. Galvanized steel.
- K. Return Spring: Adjustable tension.
- L. Bearings:
1. Synthetic

2.6 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. Low-Leakage, 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. Comply with AMCA 500-D testing for damper rating.
 - 3. Low-leakage rating , with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
 - 4. Suitable for horizontal or vertical applications.
 - 5. Frames:
 - a. Frame: Hat-shaped,
 - 1) 16GA 0.064-inch thick, galvanized sheet steel.
 - b. Mitered and welded corners.
 - c. Flanges for attaching to walls and flangeless frames for installing in ducts.



6. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Material:
 - 1) Galvanized, roll-formed steel, 16GA 0.064 inch thick.
7. Blade Axles:
 - a. Nonferrous metal.
8. Bearings:
 - a. Molded synthetic.
 - b. Dampers in ducts with pressure classes of 3-inch wg or more shall have axles full length of damper blades and bearings at both ends of operating shaft.
9. Blade Seals:
 - a. Neoprene.
10. Jamb Seals: Cambered Stainless steel or aluminum.
11. Tie Bars and Brackets: Galvanized steel or aluminum.
12. Accessories:
 - a. Include locking device to hold single-blade dampers in a fixed position without vibration.

C. 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.

D. 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.

2.7 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.

2.8 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.

2.9 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: See electrical for smoke detector requirements.
- 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 23 05 13 "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.

2.10 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 calking.
 - 1. Thickness:
 - a. 18GA 0.05-inch-.



- K. Master control panel for use in dynamic smoke-management systems.
- L. Damper Motors: Damper Motors to be Belimo or approved equal. Honeywell motors are not allowed.
 - 1. Locate outside air stream unless otherwise indicated.
 - 2. Action: 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 23 05 13 "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.

2.11 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.
 - 4. Ductmate Industries, Inc.
 - 5. Duro Dyne Inc.
 - 6. Elgen Manufacturing.
- 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, "Vanes 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.

2.12 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: Galvinsed, 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.

2.13 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
 - 6. American Warming and Ventilating; a division of Mestek, Inc.
 - 7. Cesco Products; a division of Mestek, Inc.



8. Ductmate Industries, Inc.
 9. Elgen Manufacturing.
 10. Flexmaster U.S.A., Inc.
 11. Nailor Industries Inc.
 12. Ventfabrics, Inc.
- 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.

2.14 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.
- F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
1. Minimum Weight: 24 oz./sq. yd..
 2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
 3. Service Temperature: Minus 50 to plus 250 deg F.

2.15 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.



2.16 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.

2.17 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.
- R. Install pressure relief damper immediately upstream of main fire damper.

Volume Damper

- S. 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.



- T. Set dampers to fully open position before testing, adjusting, and balancing. Exception: Pressure relief damper.
- U. A balance damper with locking quadrant will be provided downstream of take-off from trunk duct.

Fans And Test Holes

- V. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- W. 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.
- X. Install duct test holes where required for testing and balancing purposes.
- Y. Install test holes at fan inlets and outlets and elsewhere as indicated.

FIRE, SMOKE AND FIRE-SMOKE DAMPERS

- Z. Install fire and smoke dampers according to UL listing.
 - 1. Install fusible links in fire dampers.
- AA. For round ductwork 24-inch and smaller a true round fire damper with the same rating may be used.

Access Doors

- BB. 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.
- CC. Install access doors with swing against duct static pressure.
- DD. 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.
- EE. Label access doors according to Section 23 05 53 "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. Coordinate testing requirements with fire alarm system and provide startup reports with O&M manual.
 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



SECTION 23 37 13

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 23 37 14 "Fixed Louvers" for fixed and louvers and wall vents, whether or not they are connected to ducts.
 - 2. Section 23 33 00 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.
 - 3. Section 23 05 93 "Testing, Adjusting and Balancing for HVAC" 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. AJ Manufacturing.

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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DIVISION 26

ELECTRICAL



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SECTION 26 05 00

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 SUBMITTALS

- A. Product Data: For sleeve seals.

1.5 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. 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).
- C. Fire-Rated Assemblies for Low Voltage Penetrations (Communications, etc.): Engineered prefabricated fire stop system. The acceptable manufacturers of firestop systems are:
 - 1. STI Firestop (EZ-Path)

2.2 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 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 cable or conduit. Include type and number required for material and size of raceway or cable.
 - 3. Pressure Plates: Carbon steel. Include two for each sealing element.
 - 4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating 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.
 - F. Mock Ups: In each of the rooms listed below, coordinate with the architect and owner to provide one mock up room prior to further work in any identical or similar room for owner review and approval. In rooms or parts of rooms with stud walls, provide in the frame of each room box locations only, without conduits, identified with colored tape as to purpose (receptacle, tele/data, switch, etc.). In rooms with masonry or concrete walls, provide either a layout chalked on the floor of the room or, alternately, a hung sheet of paper with the locations of devices color coded:
 - 1. Procedure Room
 - 2. Prep Room
 - 3. Recovery Room
 - 4. Exam Room
 - 5. Medication Room
 - 6. Consult Room
 - 7. Workroom
 - G. Storage: Store all equipment and components in locked, inaccessible spaces during construction. The contractor shall be responsible for the replacement of any lost or damaged equipment.
 - H. Workmanship: All work shall be performed by qualified individuals and shall meet the highest standard of workmanship. Any work found by the owner, architect, or engineer to be less than the required standard of workmanship shall be replaced at the contractor's expense.
- 3.2 SLEEVE INSTALLATION FOR ELECTRICAL AND LOW VOLTAGE 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 for Electrical Penetrations: 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. Fire-Rated Assemblies for Low Voltage Penetrations (Communications, etc.): Install listed firestop system from one of the acceptable manufacturer products listed below during construction of floor or wall at each point where communications cabling, cable tray, conduit, sleeves, etc., penetrate a fire-rated assembly. The acceptable manufacturers of firestop systems are:
 - 1. STI EZ-Path



- F. Cut sleeves to length for mounting flush with both surfaces of walls.
- G. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.
- H. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable, unless indicated otherwise.
- I. 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.
- J. 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."
- K. 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 where engineered prefabricated fire stop system is not installed per specifications. Comply with requirements in Division 07 Section "Penetration Firestopping."
- L. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- M. 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.
- N. 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."

3.5 COMMISSIONING

- A. Refer to the commissioning specifications for additional scope of work required for commissioning of various project components included in Divisions 26, 27, and 28. The



requirements and scope of work included in the commissioning specifications is hereby incorporated by reference.

END OF SECTION 26 05 00

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SECTION 26 05 19

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. Section Includes:
 - 1. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.
- B. Related Requirements:
 - 1. Section 26 05 33 "Raceways and Boxes for Electrical Systems"
 - 2. Section 26 09 23 "Lighting Control Devices"
 - 3. Section 26 09 36 "Standalone Modular Preset Dimming Controls"
 - 4. Section 26 09 43 "Relay-Based Lighting Controls"
 - 5. Section 27 41 33 "Master Antenna Television System"
 - 6. Section 27 51 17 "Networked Public Address and Paging System"
 - 7. Section 27 51 19 "Sound Masking Systems"
 - 8. Section 28 13 00 "Access Control"
 - 9. Section 28 31 11 "Digital, Addressable Fire-Alarm System"
 - 10. Section 27 00 00 "Intermountain Healthcare Networked Structured Cable & Standards" for cabling used for voice and data circuits.

1.3 DEFINITIONS

- A. Outlet Box: Electrical box used to support utilization equipment such as a receptacle or light fixture.
- B. Pull Box: Electrical box through which branch circuit or feeder conductors are run but are not spliced.
- C. Junction Box: Electrical box used for splicing branch circuit or feeder conductors.
- D. Multiwire Branch Circuit: A branch circuit as defined by the National Electrical Code that shares a grounded conductor between two or more phase conductors.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.



1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 SINGLE CONDUCTORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Alpha Wire Company.
 - 2. Belden Inc.
 - 3. Cerro Wire LLC.
 - 4. Encore Wire Corporation.
 - 5. General Cable; General Cable Corporation.
 - 6. Southwire Company.
 - 7. Thomas & Betts Corporation; A Member of the ABB Group.
- B. Aluminum and Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.
- C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN/THWN-2, Type XHHW-2 and Type SO.
- D. LEED Standard: Provide all products with a lead content of less than 300 ppm.

2.2 MULTI-CONDUCTOR CABLES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Southwire Company.
 - 2. AFC Cable Systems.
- B. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.
- C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN/THWN-2, Type XHHW-2 and Type SO.
- D. Multi-conductor Cable, Type AC-HCF:
 - 1. Armor: Galvanized Interlocking Steel Strip (green striped or solid green) or aluminum.
 - 2. Conductors: Solid Copper
 - 3. Conductor Insulation: THHN-2 with individual moisture resistant, fire retardant paper wrap on each individual conductor.
 - 4. Grounding: 16 AWG integral bond wire and insulated green copper grounding conductor.
 - 5. Neutral (Grounded) Conductor: White for 120Y/208 volt systems and Grey 480Y/277 volt systems.
 - 6. Maximum Voltage Rating: 600 volts.
 - 7. References and Ratings:
 - a. UL 4, 83, 1479, 1581, 2556, File Reference E7330
 - b. NEC 250.118(8), 300.22(C), 392, 320, 517.13, 518, 645



- c. Federal Specification A-A-59544 (formerly J-C-30B)
 - d. UL Classified 1, 2, and 3-hour through (Fire) penetration product, R-14141
 - e. Environmental Air-Handling Space Installation per NEC 300.22(C)
- E. Other Multi-conductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for Type SO with ground wire.
- F. LEED Standard: Provide all products with a lead content of less than 300 ppm.

2.3 CONNECTORS AND SPLICES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. 3M.
 - 2. AFC Cable Systems; a part of Atkore International.
 - 3. Hubbell Power Systems, Inc.
 - 4. Ideal Industries, Inc.
 - 5. ILSCO.
 - 6. O-Z/Gedney; a brand of Emerson Industrial Automation.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.4 CORD REELS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. APC Group; Kitchen Leash
- B. Case (housing):
 - 1. Dimensions: 9" x 12" x 3'
 - 2. Material: Molded Polypropylene 3.175 mm thickness
 - 3. 94v-2 flammability rating
- C. Power Cord
 - 1. Conductors: 14/3 AWG copper type SJOW
 - 2. Length: 10 feet
 - 3. Rating: 200 degrees F
- D. Receptacle/Plug
 - 1. Rated: 125vac/20 amp
 - 2. Receptacle: NEMA 5-15P
 - 3. Plug: Dual Duplex rated 20 amp
- E. Mounting Bracket: Designed for installation on the ceiling type where the cord reel will be installed.



2.5 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.

2.6 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.
 - 1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire-alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a two-hour rating.
- C. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation, and complying with requirements in UL 2196 for a two-hour rating.
 - 1. Low-Voltage Circuits: No. 14 AWG, minimum, in pathway.
 - 2. Line-Voltage Circuits: No. 12 AWG, minimum, in pathway.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper for feeders smaller than No. 4 AWG; for feeders No. 4 AWG and larger provide copper feeders unless aluminum is specifically indicated on the one-line diagrams. 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. Refer to Section 26 05 33 "Raceways and Boxes for Electrical Systems" for raceway types and applications.
- B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway or metal clad cabling.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN/THWN-2, single conductors in raceway or metal clad cabling.
- D. Feeders below Slabs-On-Grade, and Underground: Type THWN-2, single conductors in raceway.



- E. Multiwire Circuits: may not be used for branch circuit wiring. All 120 volt and 277 volt circuits shall be provided with a dedicated grounded conductor (neutral) for each phase conductor. Up to three of these circuits may be installed in a single conduit but not more than one conductor of each phase may be installed in a single conduit.
- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.
 - 1. Armored cable, Type AC-HCF may be installed for normal and equipment system single branch circuits concealed in walls, and partitions in lengths between outlet boxes 30' or less and not as homeruns or wiring between pullboxes or junction boxes.
 - 2. Armored cable, Type AC-HCF may be installed between the first outlet box concealed in a wall or partition and a junction box above an accessible ceiling immediately above the location where the cable exits the wall or partition framing.
- G. Branch Circuits below Slabs-on-Grade and Underground: Type THHN/THWN-2, single conductors in raceway. Installation of raceways within any concrete slab or composite concrete and steel deck is prohibited. NEC 517.13 (A) requires that all branch circuits serving patient care areas are provided with an effective ground-fault current path by installation in a metal raceway system, or a cable having a metallic armor or sheath assembly that qualifies as an equipment grounding conductor. Metallic raceways are not a specified raceway for branch circuits installed below slabs-on-grade. To assure compliance with the NEC requirement, both initially and when remodels occur in the future, the installation of branch circuit wiring under slabs-on-grade is limited to circuits supplying only the following rooms and area types without extension beyond the room or area to a room or area not listed here:
 - 1. Mechanical Spaces.
 - 2. Electrical Rooms.
 - 3. Food Service.
- H. Branch circuit wiring may also be installed under slabs-on-grade to supply power for the following:
 - 1. Systems Furniture.
 - 2. Floor Boxes.
 - 3. Direct wired equipment that is not located against a wall.
- I. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain-relief device at terminations to suit application.
- J. Isolated Power System Conductors: #10 AWG, Type XHHW-2 stranded with cross-linked PE insulation and a dielectric constant of 3.5 or less, installed in EMT conduit. To limit leakage-current the branch circuit conductors must be reduced to the shortest overall length possible. Install conduits for Isolated Power System branch circuits in the most direct path between the panel and the outlet box, which is not necessarily parallel and perpendicular to the structure and framing, to reduce conductor length. Install only one circuit in per conduit. Do not use pulling compounds when installing the branch circuit conductors of Isolated Power Systems.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.



- B. Complete raceway installation between conductor and cable termination points according to Section 26 05 33 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values. Do not use pulling compounds or lubricant for installation of branch circuit conductors for Isolated Power Systems.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Section 26 05 29 "Hangers and Supports for Electrical Systems."

3.4 CORD REELS

- A. Coordinate location of cord reels to align with kitchen equipment supplied by the cord reel.
- B. Fasten brackets to structure using minimum 3/8" threaded rod and to rigidly support the cord reel. Minimum of 2 rods per bracket with addition if required to provide a rigid support.
- C. Adjust cord stopper as coordinated with owner.

3.5 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
 - 1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches (300 mm) of slack.
- D. Comply with requirements in Section 28 31 11 "Digital, Addressable Fire-Alarm System" for connecting, terminating, and identifying wires and cables.

3.6 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 26 05 53 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with panel and circuit number and identify as spare conductor.



3.7 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 05 44 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.8 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 07 84 13 "Penetration Firestopping."

3.9 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test feeder conductors and conductors feeding the following critical equipment and services for compliance with requirements.
 - a. Imaging Equipment
 - 2. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.
 - a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
 - b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- B. Test and Inspection Reports: Prepare a written report to record the following:
 - 1. Procedures used.
 - 2. Results that comply with requirements.
 - 3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- C. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION



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SECTION 26 05 23

CONTROL-VOLTAGE ELECTRICAL POWER CABLES

PART 1 - GENERAL

1.1 SUMMARY

- A. Application
 - 1. This specification section covers provision and installation of control and low-voltage electrical power cables including cables associated with building automatic systems (BAS), low voltage lighting controls, mechanical systems control cables, and all similar control and low-voltage cabling utilized for control of devices and equipment not associated with data and telecommunications systems which are covered by Division 27 and fire alarm, security, and specialty systems which are covered by Division 28. However, comply with the requirements of Division 27 where related to non-data and telecommunications cabling.
- B. Section Includes:
 - 1. Category 5e balanced twisted pair cable.
 - 2. Category 6 balanced twisted pair cable.
 - 3. Category 6a balanced twisted pair cable.
 - 4. RS-485 cable.
 - 5. Control cable.
 - 6. Control-circuit conductors.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

- A. Source quality-control reports.
- B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 CABLING

- A. Provide style and type of cabling as specified herein or as otherwise directed by the manufacturer of the equipment bring controlled or controlling devices and/or relevant specification section for the respective equipment.



2.2 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Flame Travel and Smoke Density in Plenums: As determined by testing identical products according to NFPA 262, by a qualified testing agency. Identify products for installation in plenums with appropriate markings of applicable testing agency.
 - 1. Flame Travel Distance: 60 inch (1520 mm) or less.
 - 2. Peak Optical Smoke Density: 0.5 or less.
 - 3. Average Optical Smoke Density: 0.15 or less.
- C. Flame Travel and Smoke Density for Riser Cables in Non-Plenum Building Spaces: As determined by testing identical products according to UL 1666.
- D. Flame Travel and Smoke Density for Cables in Non-Riser Applications and Non-Plenum Building Spaces: As determined by testing identical products according to UL 1685.

2.3 BACKBOARDS

- A. Description: Plywood, fire-retardant treated, 3/4 by 48 by 96 inch (19 by 1220 by 2440 mm). Comply with requirements for plywood backing panels in Section 06 10 00 "Rough Carpentry."
- B. Painting: Paint plywood on all sides and edges with flat white latex paint. Comply with requirements in Section 09 91 23 "Interior Painting."

2.4 CATEGORY 5e BALANCED TWISTED PAIR CABLE

- A. Description: Four-pair, balanced-twisted pair cable, certified to meet transmission characteristics of Category 5e cable at frequencies up to 100 MHz.
- B. Standard: Comply with ICEA S-90-661, NEMA WC 63.1, and TIA-568-C.2 for Category 5e cables.
- C. Conductors: 100 ohm, No. 24 AWG solid copper.
- D. Shielding/Screening: Unshielded twisted pairs (UTP) unless owner specific requirements require screened twisted pairs (F/UTP).
- E. Cable Rating: Plenum.
- F. Jacket: White thermoplastic unless otherwise specified by relevant specification section.

2.5 CATEGORY 6 BALANCED TWISTED PAIR CABLE

- A. Description: Four-pair, balanced-twisted pair cable, certified to meet transmission characteristics of Category 6 cable at frequencies up to 250 MHz.



- B. Standard: Comply with NEMA WC 66/ICEA S-116-732 and TIA-568-C.2 for Category 6 cables.
- C. Conductors: 100 ohm, No. 23 AWG solid copper.
- D. Shielding/Screening: Unshielded twisted pairs (UTP) unless owner specific requirements require screened twisted pairs (F/UTP).
- E. Cable Rating: Plenum.
- F. Jacket: White thermoplastic unless otherwise specified by relevant specification section.

2.6 CATEGORY 6a BALANCED TWISTED PAIR CABLE

- A. Description: Four-pair, balanced-twisted pair cable, certified to meet transmission characteristics of Category 6a cable at frequencies up to 500 MHz.
- B. Standard: Comply with TIA-568-C.2 for Category 6a cables.
- C. Conductors: 100 ohm, No. 23 AWG solid copper.
- D. Shielding/Screening: Unshielded twisted pairs (UTP) unless owner specific requirements require screened twisted pairs (F/UTP).
- E. Cable Rating: Plenum.
- F. Jacket: White thermoplastic unless otherwise specified by relevant specification section.

2.7 BALANCED TWISTED PAIR CABLE HARDWARE

- A. Description: Hardware designed to connect, splice, and terminate balanced twisted pair copper communications cable.
- B. General Requirements for Balanced Twisted Pair Cable Hardware:
 - 1. Comply with the performance requirements of selected cable.
 - 2. Comply with TIA-568-C.2, IDC type, with modules designed for punch-down caps or tools.
 - 3. Cables must be terminated with connecting hardware of same category or higher.
 - 4. Provide balanced twisted pair cable hardware suitable for the application and consistent with recommendations of manufacturer of respective device and/or equipment controlled by control wiring.

2.8 RS-232 CABLE

- A. PVC-Jacketed, TIA 232-F:
 - 1. Three or nine, No. 22 AWG, stranded (7x30) tinned copper conductors, as required by specific control application.



2. Polypropylene insulation.
3. Aluminum foil-polyester tape shield with 100 percent shield coverage.
4. PVC jacket.
5. Conductors are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
6. NFPA 70 Type: Type CM.
7. Flame Resistance: Comply with UL 1581.

B. Plenum-Type, TIA 232-F:

1. Three or nine, No. 22 AWG, stranded (7x30) tinned copper conductors, as required by specific control application.
2. PE insulation.
3. Aluminum foil-polyester tape shield with 100 percent shield coverage.
4. Fluorinated ethylene propylene jacket.
5. Conductors are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
6. Flame Resistance: Comply with NFPA 262.

2.9 RS-485 CABLE

A. Standard Cable: NFPA 70, Type CMG.

1. Paired, one pair or two pairs, twisted, No. 22 AWG, stranded (7x30) tinned-copper conductors, as required by specific control application.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1685.

B. Plenum-Rated Cable: NFPA 70, Type CMP.

1. Paired, one pair or two pairs, twisted, No. 22 AWG, stranded (7x30) tinned-copper conductors, as required by specific control application.
2. Fluorinated ethylene propylene insulation.
3. Unshielded.
4. Fluorinated ethylene propylene jacket.
5. Flame Resistance: NFPA 262.

2.10 CONTROL CABLE

A. Paired Cable: NFPA 70, Type CMG.

1. One or multi-pair, twisted, No. 18 AWG, stranded (19x30) tinned-copper conductors, as required by specific control application.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1685.



- B. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.
 - 1. One or multi-pair, twisted, No. 18 AWG, stranded (19x30) tinned-copper conductors, as required by specific control application.
 - 2. PVC insulation.
 - 3. Unshielded.
 - 4. PVC jacket.
 - 5. Flame Resistance: Comply with NFPA 262.

2.11 CONTROL-CIRCUIT CONDUCTORS

- A. Class 1 Control Circuits: Stranded copper, Type THHN/THWN-2, complying with UL 83 in raceway.
- B. Class 2 Control Circuits: Stranded copper, Type THHN/THWN-2, complying with UL 83 in raceway, Type XHHW-2, complying with UL 44 in raceway, power-limited cable, concealed in building finishes, or power-limited tray cable, in cable tray, based on application.
- C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type THHN/THWN-2, complying with UL 83 in raceway, Type XHHW-2, complying with UL 44 in raceway, power-limited cable, concealed in building finishes, or power-limited tray cable, in cable tray, based on application.

2.12 SOURCE QUALITY CONTROL

- A. Factory test twisted pair cables according to TIA-568-C.2.
- B. Cable will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 INSTALLATION OF RACEWAYS AND BOXES

- A. Comply with requirements in Section 26 05 33 "Raceways and Boxes for Electrical Systems" for raceway selection and installation requirements for boxes, conduits, and wireways as supplemented or modified in this Section.
 - 1. Outlet boxes must be no smaller than 2 inch (50 mm) wide, 3 inch (75 mm) high, and 2-1/2 inch (64 mm) deep.
 - 2. Flexible metal conduit must not be used.
- B. Comply with TIA-569-D for pull-box sizing and length of conduit and number of bends between pull points.
- C. Install manufactured conduit sweeps and long-radius elbows if possible.



D. Raceway Installation in Equipment Rooms:

1. Position conduit ends adjacent to a corner on backboard if a single piece of plywood is installed, or in the corner of the room if multiple sheets of plywood are installed around perimeter walls of the room.
2. Install cable trays to route cables if conduits cannot be located in these positions.
3. Secure conduits to backboard if entering the room from overhead.
4. Extend conduits 3 inch (75 mm) above finished floor.
5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

E. Backboards: Install backboards with 96 inch (2440 mm) dimension vertical. Butt adjacent sheets tightly and form smooth gap-free corners and joints.

3.2 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Terminate all conductors; cable must not contain unterminated elements. Make terminations only at outlets, terminals, and cross-connect and patch panels.
2. Category 5e, 6, and 6A cables may not be spliced and must be continuous from terminal to terminal. Do not splice cable between termination, tap, or junction points.
3. Cables serving a common system may be grouped in a common raceway. Install control wiring and cable in separate raceway from power wiring. Do not group conductors from different systems or different voltages.
4. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii.
5. Do not install bruised, kinked, scored, deformed, or abraded cable. Remove and discard cable if damaged during installation and replace it with new cable.
6. Cold-Weather Installation: Bring cable to room temperature before dereeling. Do not use heat lamps for heating.
7. Secure: Fasten securely in place with hardware specifically designed and installed so as to not damage cables.
8. Provide strain relief.
9. Keep runs short. Allow extra length for connecting to terminals. Do not bend cables in a radius less than 10 times the cable OD. Use sleeves or grommets to protect cables from vibration at points where they pass around sharp corners and through penetrations.

C. Installation and Support:

1. Support: Secure and support all control cables, including cables associated with building automatic systems (BAS), low voltage lighting controls, mechanical systems control cables, and all similar control and low-voltage cabling utilized for control of devices and equipment not associated with data and telecommunications systems which are covered by Division 27 and fire alarm, security, and specialty systems which are covered by Division 28, at intervals not exceeding 30 inch (760 mm) and not more than 6 inch (150 mm) from cabinets, boxes, equipment, fittings, outlets, racks, frames, and terminals. Provide supports



(cable trays, j-hooks, raceway, etc.) as required; do not support control cabling from ceiling, conduits, ducts, equipment, etc.

2. Cabling not supported per the specification which is draped over ceilings, conduits, ducts, equipment, etc., will be rejected and require reinstallation in compliance with the support provisions of this specification.

D. Balanced Twisted Pair Cable Installation:

1. Comply with TIA-568-C.2.
2. Install termination hardware as specified in Section 27 15 13 "Communications Copper Horizontal Cabling" unless otherwise indicated.
3. Do not untwist balanced twisted pair cables more than 1/2 inch (12 mm) at the point of termination to maintain cable geometry.

E. Installation of Control-Circuit Conductors:

1. Install wiring in raceways.
2. Use insulated spade lugs for wire and cable connection to screw terminals.
3. Comply with requirements specified in Section 26 05 33 "Raceways and Boxes for Electrical Systems."

F. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-D recommendations for separating unshielded copper voice and data communications 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 electrical equipment must be as follows:
 - a. Electrical Equipment or Circuit Rating Less Than 2 kVA: A minimum of 5 inch (127 mm).
 - b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 12 inch (305 mm).
 - c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 24 inch (600 mm).
3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment must be as follows:
 - a. Electrical Equipment or Circuit Rating Less Than 2 kVA: A minimum of 2-1/2 inch (64 mm).
 - b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 6 inch (150 mm).
 - c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 12 inch (305 mm).
4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures must be as follows:
 - a. Electrical Equipment or Circuit Rating Less Than 2 kVA: No requirement.



- b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 3 inch (75 mm).
 - c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 6 inch (150 mm).
- 5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or 5 HP and Larger: A minimum of 48 inch (1200 mm).
 - 6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inch (127 mm).

3.3 REMOVAL OF CONDUCTORS AND CABLES

- A. Remove abandoned conductors and cables. Abandoned conductors and cables are those installed that are not terminated at equipment and are not identified with a tag for future use.

3.4 CONTROL-CIRCUIT CONDUCTORS

- A. Minimum Conductor Sizes:
 - 1. Class 1 remote-control and signal circuits; No 14 AWG.
 - 2. Class 2 low-energy, remote-control, and signal circuits; No. 16 AWG.
 - 3. Class 3 low-energy, remote-control, alarm, and signal circuits; No. 12 AWG.

3.5 FIRESTOPPING

- A. Comply with requirements in Section 07 84 00 "Firestopping."
- B. Comply with TIA-569-D, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping" Chapter.

3.6 GROUNDING

- A. For control-voltage wiring and cabling, comply with requirements in Section 26 05 26 "Grounding and Bonding for Electrical Systems."

3.7 IDENTIFICATION

- A. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."
- B. Identify data and communications system components, wiring, and cabling according to TIA-606-B; label printers must use label stocks, laminating adhesives, and inks complying with UL 969.



- C. Identify each wire on each end and at each terminal with a number-coded identification tag. Each wire must have a unique tag.

3.8 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Visually inspect cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA-568-C.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Test cabling for direct-current loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination, but not after cross-connection.
 - a. Test instruments must meet or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in its "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in its "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

- B. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.

- C. End-to-end cabling will be considered defective if it does not pass tests and inspections.

- D. Prepare test and inspection reports.

END OF SECTION 26 05 23



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SECTION 26 05 29

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. Section Includes:
 - 1. Hangers and supports for electrical equipment and systems.
 - 2. Construction requirements for concrete bases.
- B. Related Requirements:
 - 1. Section 26 05 48.16 "Seismic Controls for Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

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 the following:
 - a. Hangers.
 - b. Steel slotted support systems.
 - c. Nonmetallic support systems.
 - d. Trapeze hangers.
 - e. Clamps.
 - f. Turnbuckles.
 - g. Sockets.
 - h. Eye nuts.
 - i. Saddles.
 - j. Brackets.
 - 2. Include rated capacities and furnished specialties and accessories.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. For fabrication and installation details for electrical hangers and support systems.
 - 1. Trapeze hangers. Include product data for components.
 - 2. Steel slotted-channel systems.
 - 3.
 - 4. Nonmetallic slotted-channel systems.
 - 5. Equipment supports.
 - 6. Vibration Isolation Base Details: 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 hangers and supports for electrical systems.
 - 1. Include design calculations and details of trapeze hangers.
 - 2. Include design calculations for seismic restraints.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) 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. Suspended ceiling components.
 - 2. Structural members to which hangers and supports will be attached.
 - 3. Size and location of initial access modules for acoustical tile.
 - 4. Items penetrating finished ceiling, including the following:
 - a. Lighting fixtures and lighting control.
 - b. Electrical power devices
 - c. Communications devices.
 - d. Air outlets and inlets.
 - e. Speakers.
 - f. Fire sprinklers.
 - g. Access panels.
 - h. Projectors.
 - i. Fire alarm system devices.
 - j. Nurse call system devices.
- B. Seismic Qualification Certificates: For hangers and supports for electrical equipment and systems, 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.
- C. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design hanger and support system.
- B. Seismic Performance: Hangers and supports shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.



1. The term "withstand" means "the supported equipment and systems 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."
 2. Component Importance Factor: 1.5.
- C. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Flame Rating: Class 1.
 2. Self-extinguishing according to ASTM D 635.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4 factory-fabricated components for field assembly.
1. Material: Galvanized steel.
 2. Channel Width: Use 1-1/4 inches (31.75 mm) where possible and minimum 13/16 inches (20.64 mm) where necessary due to space restrictions.
 3. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 4. Channel Dimensions: Selected for applicable load criteria.
- B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for electrical conductors in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.
- D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include and are limited to the following:
1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
 5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
 6. Hanger Rods: Threaded steel.



2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Section 05 50 00 "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 unless requirements in this Section are stricter.
- B. Comply with requirements for raceways and boxes specified in Section 26 05 33 "Raceways and Boxes for Electrical Systems."
- C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMTs, IMCs, and RMCs as scheduled in NECA 1, where Table 1 lists maximum spacings that are less than those stated in NFPA 70. Minimum rod size shall be 3/8 inch (9 mm) in diameter.
- D. Multiple Raceways: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 - 1. Secure raceways and cables to these supports with single-bolt conduit clamps.
- E. 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, EMTs, IMCs, and RMCs may be supported by openings through structure members, according to NFPA 70. Only prefabricated openings in structure members may be used. Do not create openings in structure members unless directed to do so by the structural engineer of record.
- C. Cable Support Methods: Cables used for Circuits and Equipment Operating at Less Than 50 Volts and Class 1, 2 or 3 Remote-Control, Signaling and Power-Limited Circuits shall be installed in J-hooks. Where cables extend from J-hooks to equipment cables shall be supported from the structure by straps, hangers, cable ties or similar fittings designed and installed so as not to damage the cable. Do not fasten or secure cables to the raceways of the power system.
- D. 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)**.

- E. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
1. To Wood: Fasten with lag screws or through bolts.
 2. To New Concrete: Bolt to concrete inserts.
 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 4. To Existing Concrete: Expansion anchor fasteners.
 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete **4 inches (100 mm)** thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than **4 inches (100 mm)** thick.
 6. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
 7. To Light Steel: Sheet metal screws.
 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on **13/16 inches (20.64 mm)** slotted-channel racks attached to substrate by means that comply with seismic-restraint strength and anchorage requirements.
- F. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Section 05 50 00 "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 Section 03 30 00 "Cast-in-Place Concrete" or Section 03 30 53 "Miscellaneous Cast-in-Place Concrete."
- C. Anchor equipment to concrete base as follows:



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. Touchup: Comply with requirements in Section 09 91 13 "Exterior Painting", Section 09 91 23 "Interior Painting" and Section 09 96 00 "High-Performance Coatings" for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION



SECTION 26 05 33

RACEWAYS 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. Section Includes:
 - 1. Metal conduits, tubing, and fittings.
 - 2. Nonmetal conduits, tubing, and fittings.
 - 3. Metal wireways and auxiliary gutters.
 - 4. Surface raceways.
 - 5. Boxes, enclosures, and cabinets.
 - 6. Handholes and boxes for exterior underground cabling.
- B. Related Requirements:
 - 1. Section 26 05 43 "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.

1.3 DEFINITIONS

- A. ARC: Aluminum Rigid Conduit.
- B. EMT: Electrical Metallic Tubing.
- C. GRC: Galvanized rigid steel conduit.
- D. IMC: Intermediate metal conduit.
- E. RTRC: Reinforced Thermosetting Resin Conduit.

1.4 ACTION SUBMITTALS

- A. Product Data: For color coded EMT conduit, surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. LEED Submittals:
 - 1. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.



- 2. Laboratory Test Reports for Credit IEQ 4: For solvent cements and adhesive primers, documentation indicating that products 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."
- C. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.
- D. Samples: For receptacle raceways and for each color and texture specified, 12 inches (300 mm) long.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
 - 1. Structural members in paths of conduit groups with common supports.
 - 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
- B. Qualification Data: For professional engineer.
- C. Seismic Qualification Certificates: For enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal 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.
 - 4. Detailed description of conduit support devices and interconnections on which the certification is based and their installation requirements.
- D. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

- A. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. GRC: Comply with ANSI C80.1 and UL 6.
- C. ARC: Comply with ANSI C80.5 and UL 6A.
- D. IMC: Comply with ANSI C80.6 and UL 1242.



- E. EMT: Comply with ANSI C80.3 and UL 797. Factory applied color finish available in black, orange, green, purple, red, yellow, blue, and white. Refer to Specification Section 26 05 53 "Identification for Electrical Systems" for color coding of raceways.
- F. FMC: Comply with UL 1; zinc-coated steel.
- G. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- H. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
 - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
 - 2. Fittings for EMT:
 - a. Material: Steel.
 - b. Type: compression.
 - 3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
- I. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

- A. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- C. Continuous HDPE: Comply with UL 651B.
- D. RTRC: Comply with UL 1684A and NEMA TC 14.
- E. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
- F. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- G. Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.
 - 1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.



- B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- C. Wireway Covers: Hinged type unless otherwise indicated.
- D. Finish: Manufacturer's standard enamel finish.

2.4 RECEPTACLE RACEWAYS

- A. Listing and Labeling: Receptacle raceways shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Surface Metal Raceways: Aluminum with snap-on covers complying with UL. Clear anodized finish.
 - 1. Raceways for receptacles only: Wiremold AL3300 series.
 - 2. Raceways for applications where both receptacles and data devices are installed in the raceway and at all laboratory locations: Wiremold ALA4800 series two-channel and dual-cover. Satin anodized finish.
 - 3. Provide duplex receptacles at 12 inches on center in all receptacle raceways. Provide GFCI receptacles as noted on drawings.

2.5 BOXES, ENCLOSURES, AND CABINETS

- A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.
- D. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- E. Floor Boxes and Poke-Through Devices: Refer to Specification Section 26 07 26 "Wiring Devices" for floor boxes and poke-through devices
- F. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing **50 lb (23 kg)**. Outlet boxes designed for attachment of luminaires weighing more than **50 lb (23 kg)** shall be listed and marked for the maximum allowable weight.
- G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- H. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.
- I. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- J. Device Box Dimensions:



1. **Wiring Devices other than data or communications devices: Minimum 4 inches square by 2-1/8 inches deep** with switch ring as required for the device configuration and wall or ceiling surface. Where light switches are indicated at a common location provide multi-gang boxes to accommodate the quantity and type of switches indicated. Where deeper boxes are required provide masonry type boxes which do not require a separate switch ring.
 2. Data and communications devices: Minimum 4-11/16 inches square by 3 inches deep with single-gang 5/8 inch deep (or deeper if wall or ceiling finish is deeper) ring.
- K. Pull boxes behind monitors: Minimum 6 inches square by 3-1/2 inches deep with two-gang ring.
- L. Gangable boxes are prohibited.
- M. Partitions: Provide partitions to separate emergency system conductors from conductors or other systems, where voltage between adjacent switches exceeds 300 volts and where switches controlling Low Voltage Controllers for interface to Nurse Call systems are installed in common boxes with line voltage switches.
- N. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250.
1. Indoor: Type 1 with continuous-hinge cover with flush latch unless otherwise indicated. Steel, finished inside and out with manufacturer's standard enamel.
 2. Outdoor: Type 4X with continuous-hinge cover with flush latch unless otherwise indicated. 304 stainless steel with smooth brushed finish.
 3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel. Provide interior panels when there are control devices or power blocks located inside the enclosure.
- O. Handholes and Boxes for Exterior Underground Wiring: Refer to Specification Section 26 05 43 "Underground Ducts and Raceways for Electrical Systems".

2.6 PUTTY PADS

- A. Moldable intumescent wall opening-protective pads designed for application to the back of electrical outlet boxes prior to installation of the wall finish to provide up to 2-hour fire barrier ratings and minimum Sound Transmission Class (STC) of 52 when tested in an STC-53 rated wall assembly or 59 according to ASTM E90-97.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. 3M Company.
 2. Hilti

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed Conduit: GRC or IMC.
 2. Concealed Conduit, Aboveground: EMT.
 3. Underground Conduit for branch circuits: RNC, Type EPC-40-PVC, direct buried.



4. Underground Conduit for feeders: Refer to Specification Section 26 05 43 “Underground Ducts and Raceways for Electrical Systems”.
 5. Raceways Embedded in slabs or composite steel and concrete decks are prohibited.
 6. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 7. Boxes and Enclosures, Aboveground: NEMA 250, Type 4X, 304 stainless steel.
- B. Indoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: EMT.
 2. Exposed, Not Subject to Severe Physical Damage: EMT.
 3. Exposed and Subject to Severe Physical Damage: GRC or IMC. Raceway locations include the following:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms below 8 feet.
 - d. Gymnasiums.
 4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 5. Feeder Raceways under Slabs: RNC, Type EPC-40-PVC encased in not less than 2 inches of 3000 psi concrete. Change from RNC, Type EPC-40-PVC to GRC or IMC before rising above floor.
 6. Branch Circuit Raceways under Slabs: Refer to Specifications Section 26 05 19 “Low-Voltage Electrical Power Conductors and Cables” for allowable application of under slab raceways. RNC, Type EPC-40-PVC direct buried. Change from RNC, Type EPC-40-PVC to GRC or IMC before rising above floor.
 7. Raceways Embedded in slabs or composite steel and concrete decks are prohibited.
 8. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 9. Damp or Wet Locations: GRC or IMC.
 10. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4X, 304 stainless steel in kitchens and 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 and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 2. EMT: Use setscrew or compression, steel fittings. Comply with NEMA FB 2.10.
 3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- 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, boxes, or fittings in contact with concrete or earth.
- G. Install surface raceways only where indicated on Drawings.



3.2 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Separation of Life Safety and Critical Branch Wiring: Comply with NFPA 70 Article 517.
- C. 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.
- D. Complete raceway installation before starting conductor installation.
- E. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for hangers and supports.
- F. Arrange stub-ups so curved portions of bends are not visible above finished slab except where concealed in chases.
- G. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within **12 inches (300 mm)** of changes in direction.
- H. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- I. Support conduit within **12 inches (300 mm)** of enclosures to which attached.
- J. Raceways Embedded in Slabs are prohibited.
- K. Stub-ups to Above Recessed Ceilings:
 - 1. Use EMT, IMC, or RMC for raceways.
 - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- L. 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.
- M. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- N. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- O. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to **1-1/4-inch (35mm)** trade size and insulated throat metal bushings on **1-1/2-inch (41-mm)** trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.



- P. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- Q. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- R. Cut conduit perpendicular to the length. For conduits **2-inch (53-mm)** trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- S. 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. Cap underground raceways designated as spare above grade alongside raceways in use.
- T. Surface Raceways:
 - 1. Install surface raceway with a minimum **2-inch (50-mm)** radius control at bend points.
 - 2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding **48 inches (1200 mm)** and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- U. Install raceway sealing fittings at accessible locations according to NFPA 70 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 according to NFPA 70.
- V. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where an underground service raceway enters a building or structure.
 - 3. Where otherwise required by NFPA 70.
- W. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
- X. Expansion(Seismic)-Joint Fittings:
 - 1. Install flexible metal conduit at all locations where conduits cross building or structure expansion joints. Allow for minimum 4 inches deflection in all directions or greater if expansion joint exceeds 4 inches. Provide droop in flexible conduit to accommodate movement. Do not loop the flexible conduit. When calculating total bend degrees in conduit runs with expansion fittings use minimum 60 degrees for each expansion-joint fitting
 - 2. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- Y. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of **72 inches (1830 mm)** of flexible conduit for recessed and semi-recessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
 - 1. Use LFMC in damp or wet locations.



- Z. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- AA. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- BB. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- CC. Locate boxes so that cover or plate will not span different building finishes.
- DD. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- EE. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- FF. Set metal floor boxes level and flush with finished floor surface.
- GG. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 05 44 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.4 FIRESTOPPING AND SOUND TRANSMISSION MITIGATION

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 07 84 13 "Penetration Firestopping."
- B. Install putty pads with acoustical and firestopping capabilities on all boxes that are installed in wall or partition cavities and in gypsum board ceilings.

3.5 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION



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SECTION 26 05 44
SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND 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.

1.2 SUMMARY

- A. Section Includes:
1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
 2. Sleeve-seal systems.
 3. Sleeve-seal fittings.
 4. Grout.
 5. Silicone sealants.
- B. Related Requirements:
1. Section 07 84 13 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. LEED Submittals:
1. Product Data for Credit EQ 4.1: For sealants, documentation including printed statement of VOC content.
 2. Laboratory Test Reports for Credit EQ 4: For sealants, documentation indicating that products 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."

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Wall Sleeves:
1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.



2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.
 - C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
 - D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.
 - E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
 - F. Sleeves for Rectangular Openings:
 1. Material: Galvanized sheet steel.
 2. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and with no side larger than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
 - b. For sleeve cross-section rectangle perimeter 50 inches (1270 mm) or more and one or more sides larger than 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE-SEAL SYSTEMS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 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: Stainless steel.
 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

- A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

2.4 GROUT

- A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.



- D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

- A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
 - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
 - 2. Sealant shall have VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Comply with NEMA VE 2 for cable tray and cable penetrations.
- C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
 - 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
 - a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 07 92 00 "Joint Sealants."
 - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
 - 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 3. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.
 - 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
 - 5. Install sleeves for floor penetrations. Extend sleeves installed in floors 4 inches above finished floor level. Install sleeves during erection of floors.
- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
 - 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.



- E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using 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.
- G. Underground, Exterior-Wall and Floor 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 sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
- B. Install 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.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION



SECTION 26 05 48

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. Section Includes:
 - 1. Restraint channel bracings.
 - 2. Restraint cables.
 - 3. Seismic-restraint accessories.
 - 4. Mechanical anchor bolts.
 - 5. Adhesive anchor bolts.
- B. Related Requirements:
 - 1. Section 26 05 29 "Hangers and Supports for Electrical Systems" for commonly used electrical supports and installation requirements.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. 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.
- B. Delegated-Design Submittal: For each seismic-restraint device.
 - 1. Include design calculations and details for selecting seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional or structural engineer responsible for their preparation.
 - 2. Design Calculations: Calculate static and dynamic loading caused by equipment weight, operation, and seismic forces required to select 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 Sections for equipment mounted outdoors.
 - 3. 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. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
- d. 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).

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show coordination of seismic bracing for electrical components with other systems and equipment in the vicinity, including other supports and seismic restraints.
- B. Qualification Data: For professional or structural engineer.
- C. Welding certificates.
- D. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Observation Report signed by the professional or structural engineer responsible for the design calculations and details for the seismic restraint devices indicating that all restraints have been installed and tested per the approved action submittal documents.

1.6 QUALITY ASSURANCE

- A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- B. Welding Qualifications: 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. They shall bear anchorage preapproval, showing maximum seismic-restraint ratings, by ICC-ES or another agency acceptable to authorities having jurisdiction. 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) that support seismic-restraint designs must be signed and sealed by a qualified professional engineer.
- D. Comply with NFPA 70.



PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic-Restraint Loading: Refer to Structural criteria for the project.

2.2 RESTRAINT CHANNEL BRACINGS

- A. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end, with other matching components, and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.3 RESTRAINT CABLES

- A. Restraint Cables: ASTM A 492 stainless-steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; with a minimum of two clamping bolts for cable engagement.

2.4 SEISMIC-RESTRAINT ACCESSORIES

- A. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.
- B. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.
- C. 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.
- D. 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.
- E. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.5 MECHANICAL ANCHOR BOLTS

- A. 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.



2.6 ADHESIVE ANCHOR BOLTS

- A. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing PVC 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.

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 for 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 evaluation service member of ICC-ES.
- 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 caused by 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. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 03 30 00 "Cast-in-Place Concrete" and Section 03 30 53 "Miscellaneous Cast-in-Place Concrete."
- B. Equipment and Hanger Restraints:
 - 1. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds **0.125 inch (3.2 mm)**.
 - 2. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES providing required submittals for component.
- C. Install cables so they do not bend across edges of adjacent equipment or building structure.



- D. 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.
- E. 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.
- F. 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 connection is terminated to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 - 2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
 - 3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 - 4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
 - 5. Test to 90 percent of rated proof load of device.
- B. Seismic controls will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.



3.6 ADJUSTING

- A. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION

SECTION 26 05 53

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. Instruction signs.
 - 7. Equipment identification labels, including arc-flash warning labels.
 - 8. Miscellaneous identification products.

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 electrical identification products.
- B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.
- C. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.
- D. Delegated-Design Submittal: For arc-flash hazard study.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with ASME A13.1 and IEEE C2.
- 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.
- F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: **120 deg F (67 deg C)**, ambient; **180 deg F (100 deg C)**, material surfaces.

2.2 COLOR AND LEGEND REQUIREMENTS

- A. Use the following color code for all electrical equipment that is specified to be labeled:
 - 1. Standby Power Circuits: Black letters on red field.
 - 2. Life Safety Branch Circuits: White letters on orange Field
 - 3. Critical Branch Circuits: White letters on red Field
 - 4. Equipment System Circuits: White letters on green field.
 - 5. Normal Power Circuits: White letters on black field.
 - ~~6. Uninterruptible Power Supply (UPS): White letters on gray field.~~
 - 6. Uninterruptible Power Supply (UPS):**
 - a. UPS-A: Blue letters on a grey field.**
 - b. UPS-B: Red letters on a grey field.**
 - 7. Fire Alarm: Red letters on white field.
 - 8. Communications: White letters on blue field.
- B. Warning labels and signs 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 **XX INCHES**" where XX is replaced by the clearance requirements of NFPA 70.
- C. Raceways:
 - 1. Labeling: Black on orange. Include system voltage and type.
 - 2. Color Coding for Raceways:
 - a. Fire Alarm: Red

2.3 LABELS

- A. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: printed, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.
- B. Indoor Equipment Labels: Self-adhesive, engraved, laminated acrylic or melamine plastic 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. Color coded as indicated in Color and Legend Requirements.



- C. Outdoor Equipment: Engraved, laminated acrylic or melamine plastic label, punched or drilled for mechanical fasteners. 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. Color coded as indicated in Color and Legend Requirements.

2.4 BANDS AND TUBES:

- A. Snap-Around, Color-Coding Bands for Cables: Slit, pretensioned, flexible, solid-colored acrylic sleeves, **2 inches (50 mm)** long, with diameters sized to suit diameters of raceways or cables they identify, and that stay in place by gripping action.

2.5 TAPES AND STENCILS:

- A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.6 Signs

- A. Laminated Acrylic or Melamine Plastic Signs:
 - 1. Engraved legend.
 - 2. Thickness:
 - a. For signs up to **20 sq. inches (129 sq. cm)**, minimum **1/16-inch- (1.6-mm-)**.
 - b. For signs larger than **20 sq. inches (129 sq. cm)**, **1/8 inch (3.2 mm)** thick.
 - c. Engraved legend with white letters on a dark grey background.
 - d. Punched or drilled for mechanical fasteners.
 - e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.



3.2 INSTALLATION

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- B. Install identifying devices before installing acoustical ceilings and similar concealment.
- C. Verify identity of each item before installing identification products.
- D. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- G. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.
- H. System Identification for Feeder Raceways: 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.
- I. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at **6 to 8 inches (150 to 200 mm)** below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds **16 inches (400 mm)** overall.

3.3 IDENTIFICATION SCHEDULE

- A. Switchboards and Panelboards: Include Identification per the One-Line Diagrams and the Source Location, including the circuit number.
- B. Disconnect Switches, Enclosed Circuits Breakers and Motor Controllers. Identify the equipment that is controlled and the Source, including the circuit number.
- C. Accessible Raceways, including above accessible ceilings, for all Feeder Circuits and for Branch Circuit rated more than 30A: Identify with self-adhesive vinyl label. Install labels at **30-foot (10-m)** maximum intervals.
- D. Accessible Raceways and Cables, including above accessible ceilings, within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels containing the wiring system legend and system voltage. System legends shall be as follows:
 - 1. Standby Power
 - 2. Life Safety Branch
 - 3. Critical Branch



4. Equipment System
 5. Normal Power
 6. UPS
 7. Fire Alarm
 8. Communications
 9. Access Control
- E. Identify EMT conduits used for branch circuit wiring as follows:
1. Standby Power - Black
 2. Life Safety Branch – Yellow
 3. Critical Branch – Orange
 4. Equipment Branch – Green
 5. Normal – No Color
 6. UPS - White
 7. Fire alarm – Red
 8. Communications - Blue
 9. Access Control - Purple
- F. 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. Grounded Systems: Color-Coding for Phase-, Neutral- and Voltage-Level Identification: Use colors listed below for feeder and branch-circuit conductors.
 - a. Colors for 208/120-V Circuits:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - 4) Feeder Neutral: White
 - 5) Branch Circuit Neutral: White with colored stripe matching the color of the phase circuit that is paired with the neutral.
 - b. Colors for 480/277-V Circuits:
 - 1) Phase A: Brown.
 - 2) Phase B: Orange.
 - 3) Phase C: Yellow.
 - 4) Feeder Neutral: Grey
 - 5) Branch Circuit Neutral: Grey with colored stripe matching the color of the phase circuit that is paired with the neutral.
 2. Isolated Power Systems: Color-Coding for Circuit Identification: Use colors listed below for Isolated Power conductors.
 - a. Isolated Conductor No.1: Orange with at least one distinctive colored stripe other than white, green, or grey along the entire length of the conductor.
 - b. Isolated Conductor No. 2: Brown with at least one distinctive colored stripe other than white, green, or grey along the entire length of the conductor.
 3. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.
 - a. 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.
 4. Provide a sign at each panelboard identifying the color coding scheme.
- G. Install instructional sign, including the color code for grounded and ungrounded conductors using adhesive-film-type labels.



- H. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive vinyl labels with the conductor or cable designation, origin, and destination.
- I. Control-Circuit Conductor Termination Identification: For identification at terminations, provide self-adhesive vinyl labels with the conductor designation.
- J. Conductors To Be Extended in the Future: Attach write-on tags to conductors and list source.
- K. 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 operation and maintenance manual.
- L. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.
 - 1. Limit use of underground-line warning tape to direct-buried cables.
 - 2. Install underground-line warning tape for direct-buried cables and cables in raceways.
- M. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- N. 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. Power-transfer switches.
 - b. Controls with external control power connections.
- O. Arc Flash Warning Labeling: Self-adhesive thermal transfer vinyl labels.
 - 1. Comply with NFPA 70E and ANSI Z535.4.
 - 2. Comply with Section 26 05 74 "Overcurrent Protective Device Arc-Flash Study" requirements for arc-flash warning labels.
- P. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- Q. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum ~~3/8-inch-~~ (10-mm-) high letters for emergency instructions at equipment used for power transfer or load shedding.



- R. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and 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 unless equipment is provided with its own identification.
1. Labeling Instructions:
 - a. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
 - b. Fasten mechanically fastened 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.
 - b. Enclosures and electrical cabinets.
 - c. Lighting control relay cabinets.
 - d. Access doors and panels for concealed electrical items.
 - e. Switchgear.
 - f. Switchboards.
 - g. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
 - h. Emergency system boxes and enclosures.
 - i. Motor-control centers.
 - j. Enclosed switches.
 - k. Enclosed circuit breakers.
 - l. Enclosed controllers.
 - m. Variable-speed controllers.
 - n. Push-button stations.
 - o. Power-transfer equipment.
 - p. Contactors.
 - q. Remote-controlled switches, dimmer modules, and control devices.
 - r. Battery-inverter units.
 - s. Battery racks.
 - t. Power-generating units.
 - u. Monitoring and control equipment.
 - v. UPS equipment.
 - w. Communications Equipment Racks.
 - x. Fire Alarm System.
 - y. Access Control System.
 - z. Overhead Paging System.
 - aa. Nurse Call System.

END OF SECTION



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SECTION 26 09 23

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. Section Includes:
 - 1. Photoelectric switches.
 - 2. Standalone daylight-harvesting switching controls.
 - 3. Daylight-harvesting dimming controls.
 - 4. Room Controllers.
 - 5. Stand Alone Indoor occupancy sensors.
 - 6. Lighting contactors.
 - 7. Emergency shunt relays.
 - 8. Low-Voltage Controllers
- B. Related Requirements:
 - 1. Section 26 27 26 "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show installation details for occupancy and light-level sensors.
 - 1. Submit complete scale drawing showing recommended location for each sensor, optimized for project conditions and coverage patterns for submitted devices.
 - 2. Interconnection diagrams showing field-installed wiring.
 - 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 lighting control device to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 OUTDOOR PHOTOELECTRIC SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cooper Industries, Inc.
 2. Intermatic, Inc.
 3. Leviton Manufacturing Co., Inc.
 4. NSi Industries LLC.
 5. TE Connectivity Ltd.
- B. Description: Solid state, with SPST dry contacts rated for 1800 VA, to operate connected load, complying with UL 773.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Light-Level Monitoring Range: **1.5 to 10 fc (16.14 to 108 lux)**, with an adjustment for turn-on and turn-off levels within that range.
 3. Time Delay: Thirty-second minimum, to prevent false operation.
 4. Lightning Arrester: Air-gap type.
 5. Mounting: Twist lock complying with NEMA C136.10, with base.

2.2 DAYLIGHT-HARVESTING SWITCHING CONTROLS

- A. Provide products that are of the same manufacturer or compatible with the manufacturers listed in Section 26 09 43, Relay Based Lighting Controls.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton (Cooper Controls), Inc.
 2. Lutron, Inc.
 3. Leviton Manufacturing Co., Inc.
 4. Philips Controls
 5. Acuity Controls
 6. Nextlite
 7. ETC
 8. Douglas Controls
 9. WattStopper
- C. Ceiling-Mounted Switching Controls: Solid-state, light-level sensor unit, with separate power pack, to detect changes in indoor lighting levels that are perceived by the eye.



D. Electrical Components, Devices, and Accessories:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Operating Ambient Conditions: Dry interior conditions, **32 to 120 deg F (0 to 49 deg C)**.
3. Sensor Output: Contacts rated to operate the associated power pack, complying with UL 773A. Sensor is powered by the power pack.
4. Power Pack: Dry contacts rated for **20-A** ballast load at 120- and 277-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
5. General Space Sensors Light-Level Monitoring Range: **10 to 200 fc (108 to 2152 lux)**, with an adjustment for turn-on and turn-off levels within that range.
6. Atrium Space Sensors Light-Level Monitoring Range: **100 to 1000 fc (1080 to 10 800 lux)**, with an adjustment for turn-on and turn-off levels within that range.
7. Skylight Sensors Light-Level Monitoring Range: **1000 to 10,000 fc (10 800 to 108 000 lux)**, with an adjustment for turn-on and turn-off levels within that range.
8. Time Delay: Adjustable from 5 to 300 seconds to prevent cycling.
9. Set-Point Adjustment: Equip with deadband adjustment of 25, 50, and 75 percent above the "on" set point, or provide with separate adjustable "on" and "off" set points.
10. Test Mode: User selectable, overriding programmed time delay to allow settings check.
11. Control Load Status: User selectable to confirm that load wiring is correct.
12. Indicator: Two digital displays to indicate the beginning of on-off cycles.

2.3 DAYLIGHT-HARVESTING DIMMING CONTROLS

A. Provide products that are of the same manufacturer or compatible with the manufacturers listed in Section 26 09 43, Relay Based Lighting Controls.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton (Cooper Controls), Inc.
2. Lutron, Inc.
3. Leviton Manufacturing Co., Inc.
4. Philips Controls
5. Acuity Controls
6. NextLite
7. Douglas Controls
8. ETC
9. WattStopper



- C. System Description: Sensing daylight and electrical lighting levels, the system adjusts the indoor electrical lighting levels. As daylight increases, the lights are dimmed.
 - 1. Lighting control set point is based on two lighting conditions:
 - a. When no daylight is present (target level).
 - b. When significant daylight is present.
 - 2. System programming is done with two hand-held, remote-control tools.
 - a. Initial setup tool.
 - b. Tool for occupants to adjust the target levels by increasing the set point up to 25 percent, or by minimizing the electric lighting level.
- D. Ceiling-Mounted Dimming Controls: Solid-state, light-level sensor unit, with separate controller unit, to detect changes in lighting levels that are perceived by the eye. The separate dimming control may be located in the appropriate relay cabinet for these circuits.
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Sensor Output: 0- to 10-V dc to operate electronic dimming ballasts. Sensor is powered by controller unit.
 - 3. Power Pack: Sensor has 24-V dc, Class 2 power source, as defined by NFPA 70.
 - 4. Light-Level Sensor Set-Point Adjustment Range: 20 to 100 fc (120 to 600 lux).

2.4 ROOM CONTROLLERS

- A. Room Controllers are used to independently control lighting and switched receptacles.
- B. Provide products that are compatible with Indoor Occupancy Sensors.
- C. Digitally addressable room controller with the following functions.
 - 1. Autonomous space control.
 - 2. Networking to a central Dialog control system.
 - 3. Networking to a central BACnet based management system.
- D. The Room Controller shall consist of:
 - 1. A universal voltage type (120Vac/277Vac/347Vac) power supply.
 - 2. Four 20A rated relays complete with manual override. Circuit Load rating dependent on usage. One circuit dedicated for 20A receptacle control.
 - 3. Four 0-10V control channels, capable of 100mA current sinking
 - 4. A port to connect downstream switches, occupancy sensors and daylight sensors.
 - 5. A port to connect upstream to BACnet IP building management system. The Controller shall communicate using native BACnet command objects appropriate for the application.
 - 6. An indicating LED to aid in locating the controller in a darkened ceiling space.
 - 7. Circuit testing buttons
 - 8. Capable of connecting with WUL-3924
 - 9. Output 24Vac 120mA



10. Relay Ratings
 - a. 20A Suitable for General Purpose Loads @ 120/277 VAC
 - b. 20A Suitable for Standard Ballasts and Tungsten Loads @ 120/277 VAC
 - c. 16A Suitable for Electronic Ballasts @ 120/277 VAC
 - d. 0.5HP @ 120/277 VAC.
11. The Room Controller relays shall be connected such that 120Vac plug load(s) and 277Vac lighting loads can be switched by a single Controller with no additional add-ons or remote modules
12. The Room Controller shall mount to electrical junction box via threaded ½" chase nipple. No other mounting hardware shall be required.
13. Switches shall connect to the lighting control network via a common low voltage, 2-wire, non-polarized data line.
 - a. Switches shall be factory configured and programmed to control one or more outputs in the lighting control system.
 - b. Switches can be programmed for preset control to set a specific lighting scene.
 - c. Switches, with LED indicators to indicate both ON and OFF output/group status, shall be available with 2 or 4 single button switches per gang. Switch to fit standard Decora opening.
 - d. Switches and switch hardware shall mount to standard wall boxes.
 - e. Each switch shall provide a location for a label to identify function. The label shall be under a clear plastic cover and shall be field replaceable should the operation of the switch change. Permanently etched switches are not acceptable.
14. Dimmer switches shall be connected to the lighting control network via a common low voltage 2-wire, non-polarized data line.
 - a. Dimmer switches shall be capable of raising or lowering light levels of individual or groups of lighting fixtures.
15. Space Control Requirements:
 - a. Provide manual-on / auto-off control for lighting in all spaces that are controlled by a Room Controller.
 - b. Provide auto-on / auto-off control for all switched receptacles that are controlled by a Room Controller.
 - c. Provide auto-on / auto-off control for HVAC serving all spaces that contain a Room Controller. Control to be provided by either two-wire signal based on relay contact position or direct communication with the building management system using BACnet commands. Coordinate with building management system installer.
16. Shall have a built in dimmer memory, the light output will remain at the previous setting when the lights are turned off and back on.

2.5 INDOOR OCCUPANCY SENSORS

- A. Provide products that are of the same manufacturer or compatible with the manufacturers listed in Section 26 09 43, Relay Based Lighting Controls.
- B. General Requirements for Sensors: Wall- or ceiling-mounted, solid-state indoor occupancy sensors with a separate power pack.



1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 3. In locations where vacancy sensors are indicated on plans the sensor shall turn the lights off automatically upon room vacancy. The lights shall turn on only upon activation from the associated wall station.
 4. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor is powered from the power pack.
 5. Power Pack: 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. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70. Provide second set of contacts/relays for control and/or monitoring of VAV serving space.
 6. 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.
 7. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
 8. Bypass Switch: Override the "on" function in case of sensor failure.
 9. Automatic Light-Level Sensor: Adjustable from **2 to 200 fc (21.5 to 2152 lux)**; turn lights off when selected lighting level is present.
- C. Dual-Technology Type: Ceiling mounted; detect occupants in coverage area using both PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is 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.
 4. Remote powerpacks using one or more sensors shall be used to cover space as indicated on drawings.
 5. Device shall be vacancy sensing (in conjunction with local wall station) if marked "VS". Otherwise device shall be occupancy sensing.



2.6 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

- A. Provide products that are of the same manufacturer or compatible with the manufacturers listed in Section 26 09 43, Relay Based Lighting Controls.
- B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor, suitable for mounting in a single gang switchbox.
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application,
 - 2. Operating Ambient Conditions: Dry interior conditions, **32 to 120 deg F (0 to 49 deg C)**.
 - 3. Switch Rating: Not less than 800-VA LED at 120 V, 1200-VA LED loads at 277 V,
- C. Wall-Switch Sensor:
 - 1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of **900 sq. ft. (84 sq. m)**.
 - 2. Sensing Technology: Dual technology - PIR and ultrasonic.
 - 3. Switch Type: SP. SP, manual "on," automatic "off."
 - 4. Voltage: Dual voltage, 120 and 277 V;
 - 5. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from **10 to 150 fc (108 to 1600 lux)**. The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
 - 6. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
 - 7. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.
 - 8. Device shall be Vacancy sensing if marked VS or occupancy sensing if not otherwise marked.

2.7 LIGHTING CONTACTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. [Allen-Bradley/Rockwell Automation.](#)
 - 2. [ASCO Power Technologies, LP; a division of Emerson Electric Co.](#)
 - 3. [Eaton Corporation.](#)
 - 4. GE Industrial Systems; Total Lighting Control.
 - 5. [Square D; a brand of Schneider Electric.](#)
- B. Description: Electrically operated, electrically held, combination-type lighting contactors with fusible switch complying with NEMA ICS 2 and UL 508.
 - 1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).



2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
 3. Enclosure: Comply with NEMA 250.
 4. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.
- C. Interface with DDC System for HVAC: Provide hardware interface to enable the DDC system for HVAC to monitor and control lighting control systems and contactors.
1. Monitoring: On-off status
 2. Control: On-off operation

2.8 EMERGENCY SHUNT RELAY

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton (Cooper Controls), Inc.
 2. Lutron, Inc.
 3. Leviton Manufacturing Co., Inc.
 4. Philips Controls
 5. Acuity Controls
 6. NextLite
 7. Douglas Controls
 8. Wattstopper
- B. Description: Normally closed, electrically held relay, arranged for wiring in parallel with automatic switching contacts; complying with UL 924.
1. Coil Rating: as scheduled.

2.9 LOW-VOLTAGE CONTROLLERS

- A. Low-Voltage Controllers are used to turn on and dim line voltage lighting safely when used with Nurse Call Pillow Speakers, Bed Side-Rail Controls and Momentary Dry Contact Switches.
- B. Manufacturers: Subject to compliance with requirements, provide the following:
1. Curbell Medical Products (Basis of Design is # LVC-2000-001)
- C. Description: 3 Channel lighting controller to continuously dim 2 channels using 0-10 vdc signals to the dimming LED drivers for the ambient light and reading light channels in the luminaire and to switch one channel via the LED driver(s) for the exam light portion of the luminaire. Controller shall have control inputs from nurse call pillow speaker contacts and also be switched from wall switches as shown.
- D. Installation: Lighting Controller shall be installed above the accessible ceiling outside the patient room for ease of access. All leads shall be extended from the switches, luminaire and nurse call system in an approved manner. Installer shall provide a NEMA 12 enclosure suitable for the purpose and mount the controller in this box. Observe required high and low voltage separation and physical barriers. Label the cover with the words "LIGHTING CONTROLLER FOR ROOM #####".



2.10 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 26 05 19 "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 Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."
- C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

- 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 systems, and partition assemblies.
- B. 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 CONTACTOR INSTALLATION

- A. Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.3 WIRING INSTALLATION

- A. Wiring Method: Comply with Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 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.



3.4 IDENTIFICATION

- A. Identify components and power and control wiring according to Section 26 05 53 "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.
- B. Label time switches and contactors with a unique designation.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified commissioning agent to evaluate lighting control devices and 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 with the assistance of a factory-authorized service representative:
 - 1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Lighting control devices will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

3.6 ADJUSTING

- A. Occupancy Adjustments: When requested within **12** months from date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to **two** visits to Project during other-than-normal occupancy hours for this purpose.
 - 1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
 - 2. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.
 - 3. Align high-bay occupancy sensors using manufacturer's laser aiming tool.

3.7 DEMONSTRATION

- A. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control systems specified in Section 26 09 43.13 "Addressable-Fixture Lighting Controls" and Section 26 09 43 "Relay-Based Lighting Controls."



- B. Train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION

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SECTION 26 27 26

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. Section Includes:
 - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
 - 2. Twist-locking receptacles.
 - 3. USB charger devices.
 - 4. Hospital-grade receptacles.
 - 5. Tamper-resistant receptacles.
 - 6. Weather-resistant receptacles.
 - 7. Snap switches and wall-box dimmers.
 - 8. Floor service outlets (floor boxes) and poke-through assemblies.
 - 9. Pendant Cord Connector Devices (Drop Cords).
 - 10. Cord Reels

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- D. RFI: Radio-frequency interference.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Receptacles for Owner-Furnished Equipment: Match plug configurations.
 - 2. Cord and Plug Sets: Match equipment requirements.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.



1.6 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton (Arrow Hart).
 - 2. Hubbell Incorporated; Wiring Device-Kellems.
 - 3. Leviton Manufacturing Co., Inc.
 - 4. Pass & Seymour/Legrand (Pass & Seymour).
- B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.
- C. All devices must be manufactured for use with modular plug-in connectors, shall comply with UL 2459 and shall be made with stranded building wire. Devices shall comply with the requirements in this Section.

2.3 STRAIGHT-BLADE RECEPTACLES

- A. Hospital-Grade, **Tamper Resistant**, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, and FS W-C-596.
 - 1. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap. Mechanical shutter system to help prevent insertion of foreign objects. Labeled shall comply with NFPA 70, "Health Care Facilities" Article, "Pediatric Locations" Section.
- B. **Tamper-Resistant** Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, and FS W-C-596.



1. Description: Labeled shall comply with NFPA 70, "Health Care Facilities" Article, "Pediatric Locations" Section.

2.4 GFCI RECEPTACLES

- A. General Description:
 1. Straight blade, non-feed-through type.
 2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
 3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.
- B. **Tamper-Resistant** GFCI Convenience Receptacles, 125 V, 20 A:
- C. Hospital-Grade, **Tamper Resistant**, Duplex GFCI Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, and FS W-C-596.

2.5 TWIST-LOCKING RECEPTACLES

- A. Provide NEMA configurations as indicated on drawings.

2.6 PENDANT CORD-CONNECTOR DEVICES

- A. Description:
 1. Matching, locking-type plug and receptacle body connector.
 2. NEMA WD 6 Configurations L5-20P and L5-20R, heavy-duty grade, and FS W-C-596.
 3. Body: Nylon, with screw-open, cable-gripping jaws and provision for attaching external cable grip.
 4. 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 REELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Kitchen Leash by APC Group
- B. Description:
 1. Molded Polypropylene Housing.
 2. Retracting cord with adjustable stop.
 3. SJOW Power cord, 10 foot; rated 200 degrees.
 4. Receptacles Dual Duplex NEMA 5-20R unless noted otherwise.
 5. Impact: UL746C
 6. Hose Down: CSA 6.8.2
 7. Strain Relief: CSA 6.4
 8. Flame Retardant: UL 94-94V-2
 9. Mounting Bracket for ceiling mount.



2.8 CORD AND PLUG SETS

- A. Description:
 - 1. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
 - 2. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
 - 3. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.9 TOGGLE SWITCHES

- A. Comply with NEMA WD 1, UL 20, and FS W-S-896.
- B. Switches, 120/277 V, 20 A:
 - 1. Single Pole and Three Way:
 - a. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - 1) [Eaton \(Arrow Hart\)](#).
 - 2) [Hubbell Incorporated; Wiring Device-Kellems](#).
 - 3) [Leviton Manufacturing Co., Inc.](#).
 - 4) [Pass & Seymour/Legrand \(Pass & Seymour\)](#).
- C. Key-Operated Switches, 120/277 V, 20 A:
 - 1. Description: Single pole, with factory-supplied key in lieu of switch handle.
 - a. Public Restrooms and Other Spaces: Keyed switch, heavy duty specification grade (Pass & Seymour PS20AC1-WL or equivalent).
 - b. Behavioral Health Patient Accessible Spaces: Keyed locking switch, extra heavy duty specification grade security switch (Pass & Seymour PS20AC1-KL or equivalent). Coordinate keying of switches with owner.
- D. Momentary Contact Switches: 2-Button, Single Pole, Low-voltage switch, mounts in standard single gang ring.
- E. Key-Operated, Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches: 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.

2.10 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. Incandescent Lamp Dimmers: 120 V; control shall follow square-law dimming curve. On-off switch positions shall bypass dimmer module for off.
 - 1. These shall be used to control power modules driving large quantity of LED drivers using 0-10VDC control signals. This interface shall operate either 120 or 277 volt circuits, 200 ma rating.
- D. LED Dimmer Switches: Modular; compatible with LED drivers; trim potentiometer to adjust low-end dimming used where “LR” is shown, otherwise full range of 1% to 100% light or as noted. This dimmer shall operate either 120 or 277 volt circuits, 28 ma minimum rating.

2.11 WALL PLATES

- A. Single and combination types shall match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.
 - 2. Material for Finished Spaces, except Operating Rooms, Food Service Kitchens, **and Behavioral Health Spaces**: Smooth, high-impact thermoplastic.
 - 3. Material for Operating Rooms and Food Service Kitchen: **0.035-inch- (1-mm-) thick, satin-finished, Type 302 stainless steel.**
 - 4. **Material for Behavioral Health Spaces designated as Risk Level 3 or greater in the Risk Assessment: Powder coated steel with a minimum of two (2) screws per gang; provide Torx head tamper resistant screws.**
 - 5. Material for Unfinished Spaces: Galvanized steel.
 - 6. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable, weatherproof-in-use cover.

2.12 FLOOR SERVICE FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Wiremold / Legrand.
- B. Type: Modular, flush-type, dual- or multi- service units suitable for wiring method used.
- C. Compartments: Barrier separates power from voice and data communication cabling.
- D. Service Plate: Round, die-cast aluminum with satin finish.
- E. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.
- F. Voice and Data Communication Outlet: Two modular, keyed, color-coded, RJ-45 jacks for UTP cable complying with requirements in owner’s Section 27 00 00 requirements.
- G. Description by Device Type:

FB1	Flush, Dual Service, Furniture Feed. One .75” conduit for power and One 2” conduit for data cabling. See plans for circuits and data drops. Finish selected by architect.	Legrand EFBFF Hubbell CFB2G30/2GCFFCVR
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FB4	Flush, Dual Service, one piece finish flange. Four gang capacity. One .75" conduit for power and one 2" conduit for data cabling. See plans for circuits and data drops. Finish selected by architect.	Legrand EFG45S Hubbell CFB2G30/24GCCVR
FB6	Flush, Dual Service, one piece finish flange. Six gang capacity. One .75" conduit for power and one 2" conduit for data cabling. See plans for circuits and data drops. Finish selected by architect.	Legrand EFB6S Evolution Hubbell CFB6G30/610GCCVR
FB8	Flush, Dual Service, one piece finish flange. Eight gang capacity. One .75" conduit for power and one 2" conduit for data cabling. See plans for circuits and data drops. Finish selected by architect.	Legrand EFB8S Evolution
FB10	Flush, Dual Service, one piece finish flange. Ten gang capacity. One .75" conduit for power and one 2" conduit for data cabling. See plans for circuits and data drops. Finish selected by architect.	Legrand EFB10S Evolution Hubbell CFB10G30/610GCCVR
FB11	Flush single service floor box suitable for the wiring method used. NEMA 5-20R duplex receptacle with brushed aluminum flange and cover plate. Hinged receptacle covers. Housing material shall be stamped steel above grade and cast iron at grade. Provide appropriate carpet and tile flanges.	Legrand 880MS(CS)/817/828 Hubbell B2431/S3825

2.13 POKE-THROUGH ASSEMBLIES

- A. **Manufacturers:** Subject to compliance with requirements, provide products by the following:
1. **Wiremold / Legrand.**
- B. **Description:**
1. Factory-fabricated and -wired assembly of below-floor junction box with multichanneled, through-floor raceway/firestop unit and detachable matching floor service-outlet assembly.
 2. Comply with UL 514 scrub water exclusion requirements.
 3. Size: Selected to fit cored holes in floor and matched to floor thickness.
 4. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.
 5. Closure Plug: Arranged to close unused cored openings and reestablish fire rating of floor.
- C. **Description by Device Type:**

PT1	Flush, Dual Service, 4" Diameter Furniture Feed Poke-Thru. One piece finish flange. One .75" conduit for power, One 1.5" conduit for data cabling. See plans for circuits and data drops. Finish selected by architect.	Legrand 4FFATC Hubbell PT73FFS/FRF3
PT2	Flush, Dual Service Capable, 4"Diameter Poke-Thru. One .75" conduit for power, one 1.5" conduit for data cabling. Two Gang Capacity. See plans for circuits and data drops. Receptacles shall be NEMA 5-20R, Finish selected by architect.	Legrand 4AT Evolution Hubbell S1R4PT
PT3	Flush, Dual Service Capable, 6"Diameter Poke-Thru. One .75" conduit for power, one 1.5" conduit for data cabling. Three Gang Capacity. See plans for circuits and data drops. Receptacles shall be NEMA 5-20R, Finish selected by architect.	Legrand 6AT Evolution Hubbell S1R6PT
PT8	Flush, Dual Service Capable, 8"Diameter Poke-Thru. One .75" conduit for power, one 2" conduit for data cabling. Five Gang Capacity. See plans for circuits and data drops. Receptacles shall be NEMA 5-20R, Finish selected by architect.	Legrand 8AT Evolution Hubbell S1R8PT
PT10	Flush, Dual Service Capable, 10"Diameter Poke-Thru. One .75" conduit for power, one 2" conduit for data cabling. Eight Gang Capacity. See plans for circuits and data drops. Receptacles shall be NEMA 5-20R, Finish selected by architect.	Legrand 10AT Evolution Hubbell S1R10PT



PT11	Flush single service floor box suitable for the wiring method used. NEMA 5-20R duplex receptacle with brushed aluminum flange and cover plate. Hinged receptacle covers.	Legrand RC7CTC Hubbell PT7FS/FRF
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2.14 FINISHES

- A. Device Color:
1. Wiring Devices Connected to Normal Power System: Gray in Food Service Kitchen. As selected by Architect in other finished spaces unless otherwise indicated or required by NFPA 70 or device listing.
 2. Wiring Devices Connected to Essential Power System: Red.
 3. Isolated-Ground Receptacles: Orange.
- B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Coordination with Other Trades:
1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
 4. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.
- D. Device Installation:
1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
 2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.



3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
 4. Connect devices to branch circuits using pigtails that are not less than **6 inches (152 mm)** in length.
 5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
 6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
 7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
 8. Tighten unused terminal screws on the device.
 9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.
- E. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.
 2. Install hospital-grade receptacles in patient-care areas with the ground pin or neutral blade at the top.
- 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. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.
 3. Install 0-10VDC control wiring in conduit with power wiring. Use conductors with insulation equivalent to insulation of power wiring.
- 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 boxes and pokethroughs to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

- A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

- A. Comply with Section 26 05 53 "Identification for Electrical Systems."
- B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.



3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 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 digital-display 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 unacceptable.
 - 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. 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). Submit test report indicating each receptacle and test result.
- D. Wiring device will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

END OF SECTION



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SECTION 26 51 19

LED 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. Section Includes:
 - 1. Interior solid-state luminaires that use LED technology.
 - 2. Lighting fixture supports.
 - 3. Standby Emergency Power supplies for individual luminaires
- B. Related Requirements:
 - 1. Section 26 09 23 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
 - 2. Section 26 09 36 "Standalone Multipreset Modular Dimming Controls" for architectural dimming systems and for fluorescent dimming controls with dimming ballasts specified in interior lighting Sections.
 - 3. Section 26 09 43 "Relay-Based Lighting Controls" for manual or programmable control systems with low-voltage control wiring or data communication circuits.

1.3 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. LED: Light-emitting diode.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.



1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
1. Arrange in order of luminaire designation.
 2. Include data on features, accessories, and finishes.
 3. Include physical description and dimensions of luminaires.
 4. Include emergency lighting units, including batteries and chargers.
 5. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
 6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing and Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps and accessories identical to those indicated for the lighting fixture as applied in this Project. Report data compliant with IES LM-79 and IES LM-80. Only Absolute Photometry is acceptable.
 - a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products (NVLAP).
- B. Shop Drawings: For nonstandard or custom luminaires.
1. Include plans, elevations, sections, and mounting and attachment details.
 2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 3. Include diagrams for power, signal, and control wiring.
- C. LEED Submittals:
1. Product Data for Credit IEQ 4.2: For paints and coatings, documentation including printed statement of VOC content.
 2. Laboratory Test Reports for Credit IEQ 4.2: For paints and coatings, documentation indicating that products comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- D. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) 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. Lighting luminaires.
 2. Suspended ceiling components.
 3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches (300 mm) of the plane of the luminaires.
 4. Structural members to which equipment and or luminaires will be attached.
 5. Initial access modules for acoustical tile, including size and locations.
 6. Items penetrating finished ceiling, including the following:
 - a. Other luminaires.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.



- e. Access panels.
 - f. Ceiling-mounted projectors.
 - g.
- 7. Moldings.
- B. Qualification Data: For testing laboratory providing photometric data for luminaires.
- C. Seismic Qualification Certificates: For luminaires, 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.
- D. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- E. Product Certificates: For each type of luminaire.
- F. Product Test Reports: For each luminaire, for tests performed by manufacturer or a qualified testing agency holding NVLAP accreditation.
- G. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.
 - 1. Provide a list of all lamp types LED Modules and LED Drivers used on Project; use ANSI and manufacturers' codes.

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 citing lighting fixture types.
 - 1. Lamps: 2 for every 100 of each type and rating installed. Furnish at least one of each type.
 - 2. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
 - 3. Drivers: 2 for every 100 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.
- B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as



defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.

- C. Provide luminaires from a single manufacturer for each luminaire type.
- D. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.
- E. Mockups: For interior lighting luminaires in room or module mockups, complete with power and control connections.
 - 1. Obtain Architect's approval of luminaires in mockups before starting installations.
 - 2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.10 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- B. Seismic Performance: Luminaires and lamps shall be labeled vibration and shock resistant.
 - 1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified and the luminaire will be fully operational during and after the seismic event."

2.2 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.



- B. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.
- C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
- D. Recessed Fixtures: Comply with NEMA LE 4.
- E. Bulb shape complying with ANSI C79.1.
- F. Lamp base complying with ANSI C81.61 or IEC 60061-1, where employing universal base or mount.
- G. CRI of minimum 80. CCT of 3500 K.
- H. L70 rated lamp life of 50,000 hours.
- I. Lamps dimmable as indicated or 0.5 to 100 percent of maximum light output, via 0-10 VDC control signal or, where indicated, Digital Dimming Control Signal.
- J. Field Replaceable driver.
- K. Nominal Operating Voltage: Universal voltage 120 V ac or 277 V ac unless scheduled differently.
 - 1. Lens Thickness: At least **0.125 inch (3.175 mm)** minimum unless otherwise indicated.
- L. Housings:
 - 1. Hydroformed, cast or extruded-aluminum housing and heat sink suitable for the environment.
 - 2. Anodized or powder-coat finish.

2.3 LED LAMPS AND DRIVERS:

- A. Minimum CRI Ra- 82 or as specified.
- B. Lumen output shall be Luminaire Lumens or Delivered Lumens. Source lumens shall not be used.
- C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.
- D. LED Rated life L70 of 50,000 hours per (IES LM-80). Luminaire shall maintain LED operating temperature to achieve this rating per TM-21.
- E. Flicker: No visible or detectable flicker, operating on all dimmed intensities.
- F. Dimming drivers shall be compatible with the control method shown on the drawings. All dimmed drivers shall use 0-10vdc control unless specified differently. Minimum level as scheduled.



- G. Inrush current shall be reported and the lighting controls adjusted for inrush of LED product supplied.
- H. THD: THD shall not exceed 80%.
- I. Minimum driver efficiency shall be 83%.
- J. LED module shall be replaceable in the field using modules with digitally traceable matching modules.
- K. Luminaire shall be NRTL Listed at intended operating temperature.
- L. Photometry shall be measured or absolute photometry. Derived or calculated photometry shall not be provided for consideration.
- M. Approved Manufacturers- Drivers
 - 1. General Electric.
 - 2. Philips.
 - 3. Osram / Sylvania.
 - 4. Lutron
 - 5. EldoLED
 - 6. Thomas Research
- N. Approved Manufacturers- LEDs
 - 1. General Electric
 - 2. Philips
 - 3. Osram
 - 4. Cree
 - 5. Xicato
 - 6. Nichia
- O. Approved Manufacturers for Luminaires shall be as scheduled.

2.4 MATERIALS

- A. Metal Parts:
 - 1. Free of burrs and sharp corners and edges.
 - 2. Sheet metal components shall be steel unless otherwise indicated.
 - 3. Form and support to prevent warping and sagging.
- B. 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.
- C. Diffusers and Globes:
 - 1. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - 2. Glass: Annealed crystal glass unless otherwise indicated.
 - 3. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.



- D. Housings:
 - 1. Hydroformed, cast or extruded-aluminum housing and heat sink suitable for the environment.
 - 2. Anodized or powder-coat finish.
- E. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and line wattage. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
 - 1. Label shall include the following lamp characteristics:
 - a. "USE ONLY" and include specific lamp type.
 - b. Lamp diameter, shape, size, wattage, and coating.
 - c. CCT and CRI for all luminaires.

2.5 METAL FINISHES

- A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.6 LUMINAIRE FIXTURE SUPPORT COMPONENTS

- A. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.
- C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gauge (2.68 mm).
- D. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.
- E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

2.7 GENERAL REQUIREMENTS FOR EMERGENCY LIGHTING

- 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. NRTL Compliance: Fabricate and label emergency lighting units, exit signs, and batteries to comply with UL 924.
- C. Comply with NFPA 70 and NFPA 101.
- D. Comply with NEMA LE 4 for recessed luminaires.
- E. Internal Type Emergency Power Unit: Self-contained, modular, battery-inverter unit, factory mounted within luminaire body and compatible with LED light source and driver, including dimming driver.



1. Emergency Connection: Operate luminaire continuously at an output of 5 watts upon loss of normal power. Connect unswitched circuit to battery-inverter unit and switched circuit to luminaire ballast.
2. Operation: Relay automatically turns driver/led module on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
3. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - a. Ambient Temperature: Less than 0 deg F or exceeding 104 deg F with an average value exceeding 95 deg over a 24-hour period.
 - b. Ambient Storage Temperature: Not less than minus 4 deg F and not exceeding 140 deg F
 - c. Humidity: More than 95 percent (condensing).
 - d. Altitude: Exceeding 3300 feet
4. Battery: Sealed, maintenance-free, lead-acid type.
5. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
6. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

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. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before fixture installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

- A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

3.3 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.



- C. Supports:
1. Sized and rated for luminaire weight.
 2. Able to maintain luminaire position after cleaning and repair.
 3. Provide support for luminaire without causing deflection of ceiling or wall.
 4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.
- D. Flush-Mounted Luminaire Support:
1. Secured to outlet box.
 2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
 3. Trim ring flush with finished surface.
- E. Wall-Mounted Luminaire Support:
1. Attached to structural members or approved backer plate in walls
 2. Do not attach luminaires directly to gypsum board.
- F. Ceiling-Mounted Luminaire Support:
1. Ceiling mount with four **5/32-inch- (4-mm)** diameter steel wire or aircraft cable supports.
 2. Ceiling mount with hook mount.
- G. Suspended Luminaire Support:
1. Pendants and Rods: Where longer than **48 inches (1200 mm)**, brace to limit swinging.
 2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
 3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and wire support for suspension for each unit length of luminaire chassis, including one at each end.
 4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.
- H. Ceiling-Grid-Mounted Luminaires:
1. Secure to any required outlet box.
 2. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
 3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.
- I. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

3.4 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:



1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
 2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Prepare test and inspection reports.

3.6 STARTUP SERVICE

- A. Comply with requirements for startup specified in Section 26 09 43 "Relay-Based Lighting Controls."

3.7 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.
1. During adjustment visits, inspect all luminaires. Replace luminaires that are defective.
 2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION

SECTION 27 00 00

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.
 - 3. The Contractor shall procure and maintain for the duration of this agreement, insurance against claims.
 - 4. 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.
 - 5. 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 UPSs 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 27 01 00

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 manufacture'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 27 01 13

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 27 01 19

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 11e or 111e 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 50/125µm and 62.5/125µm 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 50/125µm and 62.5/125µm multimode cabling and both 1310 nm and 1550 nm for 8.5/125µm 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

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SECTION 27 01 33

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 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.
- B.

END OF SECTION



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SECTION 27 01 43

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 27 01 71

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 27 05 00

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 27 05 26

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 27 05 28

PATHWAYS FOR COMMUNICATIONS 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 27 05 29.
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 27 05 29

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 space 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



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SECTION 27 05 33

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 27 05 28.

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 27 05 53

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

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SECTION 27 11 19

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

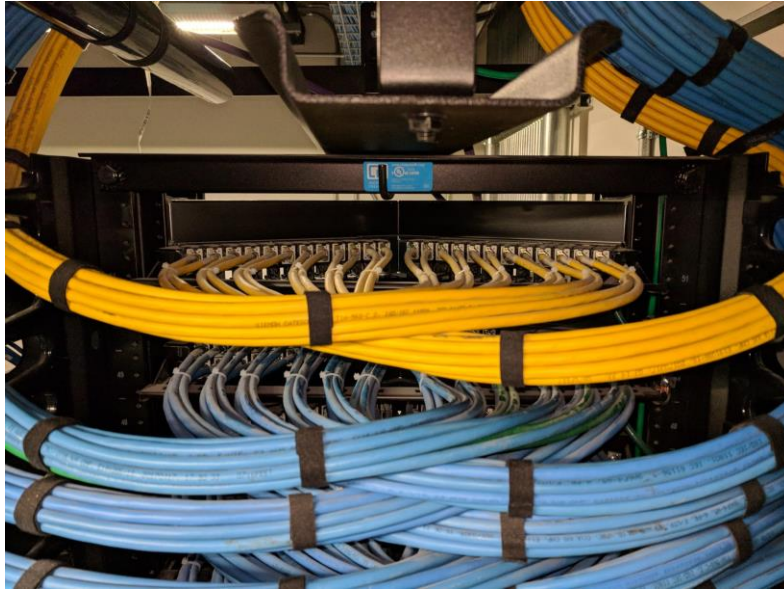
- A. PATCH PANELS – COPPER
 - 1. 48 Port CAT 6A Shielded, 1RU Angled Patch Panel with Outlets – Siemon Z6AS-PA-48A
 - 2. 48 Port CAT 6A Shielded, 1RU Flat Patch Panel with Outlets – Siemon Z6AS-PNL-U48K
 - 3. 24 Port CAT 6A Shielded, 1RU Flat Patch Panel with Outlets – Siemon Z6AS-PNL-U24K
 - 4. 48 Port 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 27 15 00

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



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 27 15 13

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



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SECTION 27 15 43

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 should include and 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 27 16 19

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 27 52 23
NURSE CALL/CODE BLUE 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.
- B. Specification Section 27 00 00 "Intermountain Healthcare Structured Cabling Standards".

1.2 SUMMARY

- A. Section includes raceways, back boxes and cabling for a Hill-Rom Navicare Nurse Call (NNC) system.
- B. All active components and software to be provided, installed and programmed by Hill-Rom Vendor under contract with the owner.

PART 2 - PRODUCTS

2.1 NURSE-CALL SYSTEM:

- A. Nurse-Call System: Hill-Rom Navicare Nurse Call (NNC) System. All electronic components

2.2 CONDUCTORS AND CABLES

- A. Data Cable and Hardware: Category 6, Orange, UTP and UTP hardware. Comply with requirements in Section 27 00 00.
- B. Power Conductors and Cables: Copper, solid, No. 20 AWG. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."
- C. Grounding Conductors and Cables: Copper, stranded, No. 16 AWG. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."



PART 3 - EXECUTION

3.1 INSTALLATION

- A. Wiring Method:
 - 1. Install cables in raceways and J-Hooks except within consoles, cabinets, desks, and counters
 - a. Conceal raceway and cables except in unfinished spaces.
 - 2. Conduit and Boxes: Comply with requirements in Section 26 05 33 "Raceway and Boxes for Electrical Systems." Flexible metal conduit shall not be used.
 - a. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.
 - b. Coordinate each outlet box type with Hill-Rom.
- B. Install cables without damaging conductors, shield, or jacket.
- C. Do not bend cables, while handling or installing, to radii smaller than as recommended by manufacturer.
- D. Pull cables without exceeding cable manufacturer's recommended pulling tensions.
 - 1. Pull cables simultaneously if more than one is being installed in same raceway.
 - 2. Use pulling compound or lubricant if necessary. Use compounds that will not damage conductor or insulation.
 - 3. Use pulling means, including fish tape, cable, rope, and basket-weave wire or cable grips, that will not damage media or raceway.
- E. Install exposed raceways and cables parallel and perpendicular to surfaces or exposed structural members, and follow surface contours. Secure and support cables by straps, staples, or similar fittings designed and installed so as not to damage cables. Secure cable at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, or fittings.
- F. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.
- G. Separation of Wires: Separate speaker/microphone, line-level, speaker-level, and power-wiring runs. Run in separate raceways or, if exposed or in same enclosure, provide 12-inch (300-mm) minimum separation between conductors to speaker/microphones and adjacent parallel power and telephone wiring. Provide separation as recommended by equipment manufacturer for other conductors.
- H. Splices, Taps, and Terminations: Make splices, taps, and terminations on numbered terminal strips in junction, pull, and outlet boxes; terminal



cabinets; and equipment enclosures. Install terminal cabinets where there are splices, taps, or terminations for eight or more conductors.

- I. Impedance and Level Matching: Carefully match input and output impedances and signal levels at signal interfaces. Provide matching networks if required.
- J. Identification of Conductors and Cables: Comply with requirements in Section 27 15 00 "Communications Horizontal Cabling" for cable administration, cable schedule, and cable and wire identification.
- K. Equipment Identification:
 - 1. Comply with requirements in Section 26 05 53 "Identification for Electrical Systems" for equipment labels and signs and labeling installation requirements.
 - 2. Label stations, controls, and indications using approved consistent nomenclature.

3.2 EXISTING SYSTEMS

- A. Examine existing systems for proper operation, compatibility with new equipment, and deficiencies. If discrepancies or impairments to successful connection and operation of interconnected equipment are found, report them and do not proceed with installation until directed. Schedule existing systems' examination so there is reasonable time to resolve problems without delaying construction.

3.3 GROUNDING

- A. Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other signal impairments.
- B. Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding except at connection to main building ground bus.
- C. Grounding Provisions: Comply with requirements in Section 27 05 26 "Grounding and Bonding for Communications Systems."

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. 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.

END OF SECTION

SECTION 27 60 01

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 27 60 02

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



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SECTION 27 60 03

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 27 60 04

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 27 60 05

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 27 60 06

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
3775 W. California Ave. Ste 400
Salt Lake City, UT 84104 US

Main Phone: (801) 973-2121
Fax: (801) 973-4472
Email: randi.whittaker@anixter.com

Karl Bartlam
End User/Outside Sales
3775 W. California Ave. Ste 400
Salt Lake City, UT 84104 US

Main Phone: (801) 973-2121
Fax: (801) 973-4472
Email: karl.bartlam@anixter.com

Graybar Electric

Elizabeth Vaughn
Inside Sales
2841 South 900 West
Salt Lake City, UT 84119 US

Main Phone: (801) 656-3016
Fax: (801) 973-4314
Email: Elizabeth.Vaughn@graybar.com

Erika Morrison
Contractor Outside Sales
2841 South 900 West
Salt Lake City, UT 84119 US

Main Phone: (801) 656-3014
Fax: (801) 973-4314
Email: Erika.Morrison@graybar.com

WESCO / CSC

Brian Walters
Inside Sales
3210 South 900 West
Salt Lake City, UT 84119 US

Main Phone: (801) 975-0600
Fax: (801) 907-4450
Email: Bwalters@gocsc.com

Adam Tueller
Contractor Outside Sales
3210 South 900 West
Salt Lake City, UT 84119 US

Main Phone: (801) 975-0600
Direct: (801) 618-6665
Email: Atueller@wesco.com

- B. The Siemon Company is represented locally by: Marc.Lovestrand@Siemon.com



END OF SECTION

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SECTION 27 60 07

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 2018-12-01.
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@hunteletric.com / www.hunteletric.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 27 60 08

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)		

PART 1 -

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



HDR Project No. 10394230

Intermountain Healthcare
Logan Regional Hospital Reconfiguration
LRH PET/CT
APPENDIX 08 – LEAD WALL PENETRATIONS
27 60 08 - 1

June 28, 2024
100% Construction Documents

- 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"

PART 2 - 1.8 EXCEPTIONS

- A. None.

PART 3 -

PART 4 - 1.9 PRIMARY SOURCES

- A. List the regulatory references upon which the procedure is based (cite the code, the title, and the statute).

PART 5 - 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

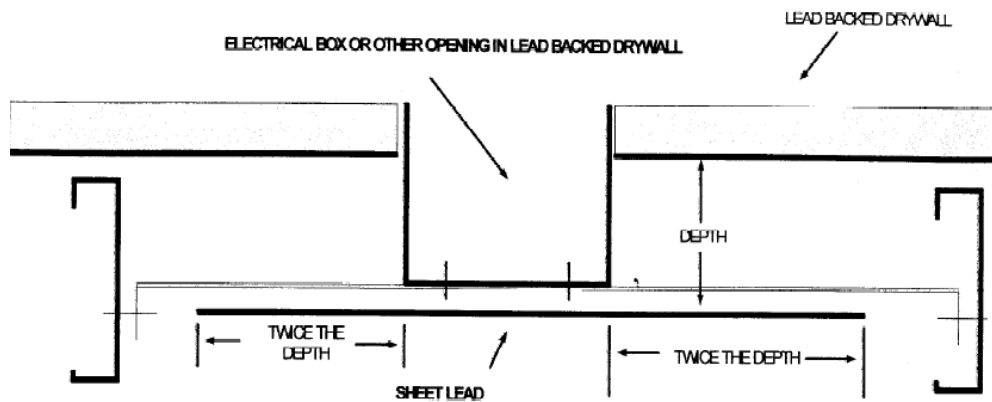


Option 2: worker to install new power utility wall box – box is lead Lined by manufacturer



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

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.

RELATED SECTIONS

- C. 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

1.2 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.

SUBMITTALS

- D. Product data shall be supplied for any parts/equipment that does not match the specified part number.
- E. Shop drawings
 - 1. Labeling schedules and layouts in owner designated electronic format
 - 2. Cabling administrative drawings

CONDITIONS



F. 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 considered a part of this section. The contractor shall read all sections in their

entirety and apply them as appropriate for work in this section.

G. 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.

H. 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.

I. 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.

J. 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.

SCOPE OF WORK:

K. 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.

REFERENCE STANDARDS:

- L. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
- M. All reference amendments adopted prior to the effective date of the Contract shall be applicable to this Project.
- N. The publications listed below form a part of this specification. The publications are referred to in the text by basic designation only.
- O. 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.
- P. 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**.

DEFINITIONS:

- Q. Definitions and Abbreviations are listed in **Appendix 05**:

PART 2 - PRODUCTS

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

MEASUREMENT PROCEDURES:

The Contractor shall

3. Coordinate supports, adjacent construction, and fixture locations to ensure actual dimensions correspond to established dimensions.
4. Verify dimensions in areas of installation by field measurements before fabrication and indicate measurements and scale on shop drawings.
5. Coordinate fabrication schedule with construction progress to avoid delaying the work.
6. Where field measurements cannot be made without delaying the work, establish dimensions and coordinate with the General Contractor.

When approved, proceed with fabricating units without field measurements.



CHANGES

ALTERNATES:

7. 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.
8. 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.

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.
9. 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.
 10. 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.

SUBSTITUTION PROCEDURES

11. Substitution may be considered when a product becomes unavailable through no fault of the Contractor.
12. 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.
13. 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.
14. The Owner will be the final judge of acceptability, with review by Owner's Representative and the distribution of the acceptance by the Architect.
15. 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

QUALITY ASSURANCE



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.

Certifications:

4. 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.
 5. Contractor shall have a complete working knowledge of low voltage cabling applications such as, but not limited to data, voice and video network systems.
 6. 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.
 7. Contractor shall provide certificates for the appropriate insurance coverage as defined in contract documents.
 8. 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.
9. 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.
 10. Refer also to General Conditions.

Administrative Requirements and Coordination:

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.

Contract Administration:

- 11. Change orders shall be submitted to the Owner/Project Manager complete with price breakdown and description for approval before any work is done.
- 12. 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.

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.

Pre-Installation Meetings - Contractor shall:

- 13. 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.

B. 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.

Post-Installation Meetings:

2. Schedule Div. 27 Final Inspection
3. 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.
4. 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.

DELIVERY, STORAGE, AND HANDLING:

- C. Coordination with delivery companies, drivers, site address, and contact person(s) will be the responsibility of the Contractor.

Contractor Shall:

Be responsible for prompt material deliveries to meet contracted completion date.

1. Coordinate deliveries and submittals with the General Contractor to ensure a timely installation.
 2. No equipment materials shall be delivered to the job site more than three weeks prior to the commencement of its installation.
 3. Equipment shall be delivered in original packages with labels intact and identification clearly marked.
 4. Materials shall not be damaged in any way and shall comply with manufacturer's operating specifications.
 5. 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.
 6. Material Contractor shall be responsible for all handling and control of equipment.
 7. Material Contractor is liable for any material loss due to delivery and storage problems.
- D. Owner/General Contractor shall supply a list of security requirements for Contractor to follow.

PROJECT/SITE CONDITIONS

For all environmental recommendations, refer to master Architectural section.

For all security recommendations, refer to related Division 01.

- E. 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.

F. Contractor shall provide daily a clean work environment, free from trash/rubbish accumulated during and after cabling installation.

G. Food and drink are not permitted in work areas. They shall be stored, prepared, and consumed only in designated break or cafeteria areas.

H. 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.

CLEANING

I. Work areas will be kept in a broom clean condition throughout the duration of the installation process.

J. 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.

K. The Contractor will damp clean all surfaces prior to final acceptance by Owner.

END OF SECTION





DIVISION 28

ELECTRONIC SAFETY AND SECURITY



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SECTION 28 05 00

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.

1.4 SUBMITTALS

- A. Product Data: For sleeve seals.

1.5 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. 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).
- C. Fire-Rated Assemblies for Low Voltage Penetrations: Engineered prefabricated fire stop system. The acceptable manufacturers of firestop systems are:
 - 1. STI Firestop (EZ-Path)

2.2 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 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 cable or conduit. Include type and number required for material and size of raceway or cable.
 - 3. Pressure Plates: Carbon steel. Include two for each sealing element.
 - 4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating 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 listed firestop system from one of the acceptable manufacturer products listed below during construction of floor or wall at each point where communications cabling, cable tray, conduit, sleeves, etc., penetrate a fire-rated assembly. The acceptable manufacturers of firestop systems are:
 - 1. STI EZ-Path
 - 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 engineered prefabricated fire rated assemblies.
 - 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.

END OF SECTION 28 05 00



SECTION 28 05 13

CONDUCTORS AND CABLES 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. UTP cabling.
 - 2. 8.3/125 – 9/125 micrometer, singlemode optical fiber cabling.
 - 3. Coaxial cabling.
 - 4. RS-232 cabling.
 - 5. RS-485 cabling.
 - 6. Control-voltage cabling.
 - 7. Control-circuit conductors.
 - 8. Fire alarm wire and cable.
 - 9. Identification products.

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. IDC: Insulation displacement connector.
- C. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.
- D. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).
- E. RCDD: Registered Communications Distribution Designer.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate layout and installation of electronic safety and security cabling with Owner's telecommunications and LAN equipment and service suppliers.
- B. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.



1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Installation data for UTP and optical-fiber cables as specified in TIA 569-C-1.
 - 2. For coaxial cable, include the following installation data for each type used:
 - a. Nominal OD.
 - b. Minimum bending radius.
 - c. Maximum pulling tension.
- B. Shop Drawings:
 - 1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
 - 2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
 - 3. Cabling administration drawings and printouts.
 - 4. Wiring diagrams to show typical wiring schematics, including the following:
 - a. Cross-connects.
 - b. Patch panels.
 - c. Patch cords.
 - 5. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.
- B. Source quality-control reports.
- C. Field quality-control reports.

1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An NRTL.
 - 1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site.
 - 1. Test optical-fiber cable to determine the continuity of the strand, end to end. Use optical loss test set.
 - 2. Test optical-fiber cable on reels. Use an optical time domain reflectometer to verify the cable length, and locate cable defects, splices, and connector; include the loss value of each. Retain test data and include the record in maintenance data.
 - 3. Test each pair of UTP cable for open and short circuits.



PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 50 or less.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 BACKBOARDS

- A. Backboards: Plywood, fire-retardant treated, **3/4 by 48 by 96 inches**. Comply with requirements for plywood backing panels in Section 06 10 00 "Rough Carpentry."

2.3 UTP CABLE

- A. Manufacturer: Siemon
- B. Description: 100-ohm, four-pair UTP, covered with a blue thermoplastic jacket.
 - 1. Comply with ICEA S-90-661 for mechanical properties.
 - 2. Comply with TIA-568-C.1 for performance specifications.
 - 3. Comply with TIA-568-C.2, Category 6A F\UTP.
 - 4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
 - a. Communications, Plenum Rated: Type CMP complying with NFPA 262.
 - b.

2.4 UTP CABLE HARDWARE

- A. Manufacturer: Siemon
- B. UTP Cable Connecting Hardware: IDC type, using modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of the same category or higher.
- C. Connecting Panels: 110-style for Category 6A F\UTP. Provide panel connectors for the number of cables terminated on the panel, plus 20 percent spare. Integral with connector bodies, including plugs and jacks where indicated.

2.5 OPTICAL-FIBER CABLE

- A. Manufacturer: Siemon
- B. Description: Singlemode, 8.3/125 – 9/125 micrometer fiber, strands as noted, tight buffer, optical-fiber cable with interlocked armor jacket.



1. Comply with ICEA S-83-596 for mechanical properties.
 2. Comply with TIA-568-C.3 for performance specifications.
 3. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:
 - a. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
 - 4.
- C. Jacket:
1. Jacket Color: Yellow.
 2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA-598-C.
 3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals.

2.6 OPTICAL-FIBER CABLE HARDWARE

- A. Manufacturer: Siemon
- B. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.
1. Number of Connectors per Field: One for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit specified expansion criteria.
- C. Patch Cords: Factory-made, dual-fiber cables in **36-inch** lengths.
- D. Cable Connecting Hardware: Comply with the Fiber Optic Connector Intermateability Standard (FOCIS) specifications of TIA-604-2-B, TIA-604-3-B, and TIA-604-12. Comply with TIA-568-C.3.
1. Quick-connect, simplex and duplex, Type LC connectors. Insertion loss not more than 0.75 db.

2.7 COAXIAL CABLE

- A. Manufacturers: CommScope, Belden, Coleman, West Penn CDT
- B. General Coaxial-Cable Requirements: Broadband type, recommended by cable manufacturer specifically for broadband data-transmission applications. Coaxial cable and accessories shall have 75-ohm nominal impedance with a return loss of 20 db maximum from 7 to 806 MHz.
- C. RG-11/U (Plenum Rated): NFPA 70, Type CMP.
1. No. 14 AWG, solid, copper-covered steel conductor.
 2. Gas-injected, foam-PE insulation.
 3. Double shielded with 100 percent aluminum polyester tape and 60 percent aluminum braid.
 - 4.
 5. Suitable for outdoor installations in ambient temperatures ranging from minus 40 to plus 85 deg C.
- D. RG-6/U (Plenum Rated): NFPA 70, Type CMP.
1. No. 18 AWG, solid, copper-covered steel conductor; foam fluorinated ethylene propylene insulation.
 2. Double shielded with 100 percent aluminum-foil shield and 60 percent aluminum braid.



3. Jacketed with PE.
- E. NFPA and UL Compliance: Coaxial cables shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1655 and with NFPA 70, Article 820 "Radio and Television Equipment" and Article 830 "Community Antenna Television and Radio Distribution Systems." Types are as follows:
 1. CATV Plenum Rated: Type CATVP, complying with NFPA 262.

2.8 COAXIAL-CABLE HARDWARE

- A. Coaxial-Cable Connectors:
 1. Type BNC, 75 ohms, crimp on style.
 2. Type F compression style for RG-6/U and RG-11/U cables.

2.9 RS-232 CABLE

- A. RS-232 communications require three to nine conductors with an overall shield. Circuit is limited to a distance of not more than 50 feet (15 m). Add other conductor count cables as needed for the project.
- B. Plenum-Rated Cable: NFPA 70, Type CMP.
 1. No. 22 AWG, stranded (7x30) tinned copper conductors.
 2. PE insulation.
 3. Aluminum foil-polyester tape shield with 100 percent shield coverage.
 4. Fluorinated ethylene propylene jacket.
 5. Conductors are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
 6. Flame Resistance: Comply with NFPA 262.

2.10 RS-485 CABLE

- A. Plenum-Rated Cable: NFPA 70, Type CMP.
 1. Paired, two pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
 2. Fluorinated ethylene propylene insulation.
 3. Unshielded.
 4. Fluorinated ethylene propylene jacket.
 5. Flame Resistance: NFPA 262, Flame Test.

2.11 CONTROL-VOLTAGE CABLE

- A. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.
 1. One pair, twisted, No. 16 AWG, stranded (19x29) and No. 18 AWG, stranded (19x30)] tinned copper conductors.
 2. PVC insulation.
 3. Unshielded.
 4. PVC jacket.
 5. Flame Resistance: Comply with NFPA 262.



2.12 CONTROL-CIRCUIT CONDUCTORS

- A. Class 1 Control Circuits: Stranded copper, Type THHN-THWN, complying with UL 83, in pathway.
- B. Class 2 Control Circuits: Stranded copper, Type THHN-THWN, complying with UL 83, in pathway.
- C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or TF in pathway.

2.13 FIRE ALARM WIRE AND CABLE

- A. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.

2.14 CONSOLIDATION POINTS

- A. Description: Consolidation points shall comply with requirements for cable connecting hardware.
 - 1. Number of Terminals per Field: One for each conductor in assigned cables.
 - 2. Number of Connectors per Field:
 - a. One for each four-pair conductor group of indicated cables, plus 20 percent spare positions.
 - b.
 - 4. NRTL listed as complying with UL 50 and UL 1863.
 - 5. When installed in plenums used for environmental air, NRTL listed as complying with UL 2043.

2.15 IDENTIFICATION PRODUCTS

- A. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.16 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate cables.
- B. Factory test UTP and optical-fiber cables on reels according to TIA-568-C.1.
- C. Factory test UTP cables according to TIA-568-C.2.
- D. Factory test optical fiber cables according to TIA-526.14-B and TIA-568-C.3.
- E. Factory sweep test coaxial cables at frequencies from 5 MHz to 1 GHz. Sweep test shall test the frequency response, or attenuation over frequency, of a cable by generating a voltage whose frequency is varied through the specified frequency range and graphing the results. Structural Return Loss shall be less than 20 db.



- F. Cable will be considered defective if it does not pass tests and inspections.
- G. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for installation of supports for cables.

3.2 WIRING METHOD

- A. Install wiring in metal pathways and wireways.
 - 1. Minimum conduit size shall be 1 **inch**. Control and data-transmission wiring shall not share conduits with other building wiring systems.
 - 2. Comply with requirements in Section 28 05 28 "Pathways for Electronic Safety and Security."
 - 3. Comply with requirements in Section 26 05 36 "Cable Trays for Electrical Systems."
 - 4. Comply with requirements in Section 27 05 36 "Cable Trays for Communications Systems."
- B. Install cable, concealed in accessible ceilings, walls, and floors when possible.
- C. Wiring on Racks and within Enclosures:
 - 1. Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM's "Cabling Termination Practices" chapter. Cable ties shall not be excessively tightened such that the transmission characteristics of the cable are altered.
 - 2. Install lacing bars and distribution spools.
 - 3. Separate power-limited and non-power-limited conductors as recommended in writing by manufacturer.
 - 4. Install conductors parallel with or at right angles to sides and back of enclosure.
 - 5. Connect conductors associated with intrusion system that are terminated, spliced, or interrupted in any enclosure onto terminal blocks.
 - 6. Mark each terminal according to system's wiring diagrams.
 - 7. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Comply with NECA 1 and NFPA 70.
- B. Conductors: Size according to system manufacturer's written instructions unless otherwise indicated.
- C. Do not install conductors and cables that are wet, moisture damaged, or mold damaged.



- D. Install UTP, optical-fiber, and coaxial cables and connecting materials after spaces are 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.
- E. General Requirements for Cabling:
1. Comply with TIA-568-C.1.
 2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
 3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
 4. Cables may not be spliced. Secure and support cables at intervals not exceeding **30 inches** and not more than **6 inches** from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 5. Maintain minimum cable bending radius during installation and termination of cables.
 6. Do not install bruised, kinked, scored, deformed, or abraded 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.
 7. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
 8. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions. Do not exceed manufacturer's rated cable-pulling tension.
 9. Riser Cable: Riser cable support intervals shall be in accordance with manufacturer's recommendations.
 10. Comply with Section 28 05 44 "Sleeves and Sleeve Seals for Electronic Safety and Security Pathways and Cabling."
- F. UTP Cable Installation: Install using techniques, practices, and methods that are consistent with **Category 6A** rating of components and that ensure **Category 6A** performance of completed and linked signal paths, end to end.
1. Comply with TIA-568-C.2.
 2. Install 110-style IDC termination hardware unless otherwise indicated.
 3. Do not untwist UTP cables more than **1/2 inch** from point of termination to maintain cable geometry.
- G. Optical-Fiber Cable Installation:
1. Comply with TIA-568-C.3.
 2. Cable shall be terminated on connecting hardware that is rack or cabinet mounted.
- H. Coaxial-Cable Installation:
1. Install outdoor connections in enclosures complying with NEMA 250, Type 4X. Install corrosion-resistant connectors with properly designed O-rings to keep out moisture.
 2. Attach antenna lead-in cable to support structure at intervals not exceeding **36 inches**.
 3. Install indoor cables in pathway.
- I. Open-Cable Installation:
1. Install cabling with horizontal and vertical cable guides in telecommunication spaces with terminating hardware and interconnection equipment.
 2. Suspend copper cable not in a wireway or pathway a minimum of **8 inches** above ceilings by cable supports not more than **60 inches** apart. Cable supports shall be fastened to structural members or floor slabs in accordance with Section 26 05 29 "Hangers and Supports for Electrical Systems."



3. Cable shall not be run in contact with pipes, ducts, or other potentially damaging items. Cables shall not be run through structural members or use structural members, pipes, ducts, or equipment as a support.
- J. Installation of Cable Routed Exposed under Raised Floors:
1. Install plenum-rated cable only.
 2. Install cabling after the flooring system has been installed in raised floor areas.
 3. Cable **72 inches** long shall be neatly coiled not less than **12 inches** in diameter below each feed point.
- K. Separation from EMI Sources:
1. Comply with BICSI TDMM and TIA-569-C recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
 2. Separation between open communication cables or cables in nonmetallic pathways and unshielded power conductors and electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of **5 inches (127 mm)**.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of **12 inches (300 mm)**.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of **24 inches (600 mm)**.
 3. Separation between communication cables in grounded metallic pathways and unshielded power lines or electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of **2-1/2 inches (64 mm)**.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of **6 inches (150 mm)**.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of **12 inches (300 mm)**.
 4. Separation between cables in grounded metallic pathways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of **3 inches (75 mm)**.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of **6 inches (150 mm)**.
 5. Separation between Cables and Electrical Motors and Transformers, 5 kVA or hp and Larger: A minimum of **48 inches (1200 mm)**.
 6. Separation between Cables and Fluorescent Fixtures: A minimum of **5 inches (127 mm)**.

3.4 FIRE ALARM WIRING INSTALLATION

- A. Comply with NECA 1 and NFPA 72.
- B. Wiring Method: Install wiring in metal pathway according to Section 28 05 28 "Pathways for Electronic Safety and Security."
1. Install plenum cable in environmental air spaces, including plenum ceilings.
 2. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated pathway system. This system shall not be used for any other wire or cable.



- C. **Wiring Method:**
 - 1. Cables and pathways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable.
 - 2. Fire-Rated Cables: Use of two-hour, fire-rated fire alarm cables, NFPA 70, Types MI and CI, is permitted.
 - 3. Signaling Line Circuits: Power-limited fire alarm cables shall not be installed in the same cable or pathway as signaling line circuits.
- D. **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.
- E. **Cable Taps:** Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.
- F. **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.
- G. **Risers:** Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signals from other floors or zones.
- H. **Wiring to Remote Alarm Transmitting Device:** 1-inch conduit between the fire alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.5 POWER AND CONTROL-CIRCUIT CONDUCTORS

- A. **120-V Power Wiring:** Install according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables" unless otherwise indicated.
- B. **Minimum Conductor Sizes:**
 - 1. Class 1 remote-control and signal circuits, No. 14 AWG.
 - 2. Class 2 low-energy, remote-control and signal circuits, No. 16 AWG.
 - 3. Class 3 low-energy, remote-control, alarm and signal circuits, No. 12 AWG.

3.6 CONNECTIONS

- A. Comply with requirements in Section 28 16 00 "Intrusion Detection" for connecting, terminating, and identifying wires and cables.
- B. Comply with requirements in Section 28 13 00 "Access Control" for connecting, terminating, and identifying wires and cables.



- C. Comply with requirements in Section 28 23 00 "Video Surveillance" for connecting, terminating, and identifying wires and cables.
- D. Comply with requirements in Section 28 31 11 "Digital, Addressable Fire-Alarm System" for connecting, terminating, and identifying wires and cables.

3.7 FIRESTOPPING

- A. Comply with requirements in Section 07 84 13 "Penetration Firestopping."
- B. Comply with TIA-569-C, "Firestopping" Annex A.
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.8 GROUNDING

- A. For communication wiring, comply with J-STD-607-A and with BICSI TDMM's "Grounding, Bonding, and Electrical Protection" chapter.
- B. For low-voltage wiring and cabling, comply with requirements in Section 28 05 26 "Grounding and Bonding for Electronic Safety and Security."

3.9 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA-606-B. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.10 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. Visually inspect UTP and optical-fiber cable jacket materials for NRTL certification markings. Inspect cabling terminations to confirm color coding for pin assignments, and inspect cabling connections to confirm compliance with TIA-568-C.1.
 - 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
 - 3. Test UTP 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.
 - a. Test instruments shall comply with or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords



- and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
4. Optical-Fiber Cable Tests:
 - a. Test instruments shall comply with or exceed applicable requirements in TIA-568-C.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
 - b. Link End-to-End Attenuation Tests:
 - 1) Attenuation test results for links shall be less than 2.0 db. Attenuation test results shall be less than that calculated according to equation in TIA-568-C.1.
 5. Coaxial-Cable Tests:
 - a. Align and adjust system and pretest components, wiring, and functions to verify that they comply with specified requirements.
 - b. Replace malfunctioning or damaged items.
 - c. Retest until satisfactory performance and conditions are achieved.
 - d. Use an agile receiver and signal strength meter or spectrum analyzer for testing.
 - e. Test Schedule: Schedule tests after pretesting has successfully been completed and system has been in normal functional operation for at least 14 days. Provide a minimum of 10 days' notice of test schedule.
 - f. Operational Tests: Perform tests of operational system to verify that system complies with Specifications. Include all modes of system operation. Test equipment for proper operation in all functional modes.
 - g. Distribution System Acceptance Tests:
 - 1) Field-Strength Instrument: Rated for minus 40-db mV measuring sensitivity and a frequency range of 54 to 812 MHz, minimum. Provide documentation of recent calibration against recognized standards.
 - 2) Signal Level and Picture Quality: Use a field-strength meter or spectrum analyzer, as well as a standard television receiver, to measure signal levels and check picture quality at 25 percent of user-interface outlets.
 - a) Test the signal strength in db mV at 55 and 750 MHz.
 - b) Minimum acceptable signal level is zero db mV (1000 mV).
 - c) Maximum acceptable signal level over the entire bandwidth is 12 db mV.
 - d) Television receiver shall show no evidence of cross-channel intermodulation, ghost images, or beat interference.
 - h. Signal-to-Noise-Ratio Test: Use a field-strength meter to make a sequence of measurements at the output of the last distribution amplifier or of another agreed-on location in system. With system operating at normal levels, tune meter to the picture carrier frequency of each of the designated channels in turn, and record the level. With signal removed and input to corresponding headend amplifier terminated at 75 ohms, measure the level of noise at same tuning settings. With meter correction factor added to last readings, differences from first set shall not be less than 45 db.
 - i. Qualitative and Quantitative Performance Tests: Demonstrate reception quality of color-television program transmissions at each user interface from each designated channel and source. Quality shall be equal or superior to that obtained with performance checks specified below, using a standard, commercial, cable-ready, color-television receiver. Level and quality of signal at each outlet and from each service and source shall comply with the following Specifications when tested according to 47 604-12 76:
 - 1) RF video-carrier level.
 - 2) Relative video-carrier level.
 - 3) Carrier-level stability, during 60-minute and 24-hour periods.



- 4) Broadband frequency response.
 - 5) Channel frequency response.
 - 6) Carrier-to-noise ratio.
 - 7) RF visual signal-to-noise ratio.
 - 8) Antenna combiner insertion loss.
 - 9) Signal power splitter loss.
 - 10) Cable connector attenuation.
 - 11) Cross modulation.
 - 12) Carrier-to-echo ratio.
 - 13) Composite triple beat.
 - 14) Second order beat.
 - 15) Terminal isolation.
 - 16) Terminal isolation between television and FM.
 - 17) Hum modulation.
 - 18) RF FM carrier level.
 - 19) FM frequency response.
 - 20) FM carrier-to-noise ratio.
- D. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.
- E. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

END OF SECTION



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SECTION 28 05 44

SLEEVES AND SLEEVE SEALS FOR ELECTRONIC SAFETY AND SECURITY PATHWAYS AND 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.

1.2 SUMMARY

- A. Section Includes:
 - 1. Sleeves for pathway and cable penetration of non-fire-rated construction walls and floors.
 - 2. Sleeve-seal systems.
 - 3. Sleeve-seal fittings.
 - 4. Grout.
 - 5. Silicone sealants.
- B. Related Requirements:
 - 1. Division 26 Section "Common Work Results for Electrical" and "Sleeves and Sleeve Seals for Electronic Safety and Security Pathways and Cabling" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.
 - 2. Penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. LEED Submittals:
 - 1. Product Data for Credit EQ 4.1: For sealants, documentation including printed statement of VOC content.
 - 2. Laboratory Test Reports for Credit EQ 4: For sealants, documentation indicating that products 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."

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Wall Sleeves:
 - 1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.



- B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.
- C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- D. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
- E. Sleeves for Rectangular Openings:
 - 1. Material: Galvanized-steel sheet.
 - 2. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and with no side larger than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
 - b. For sleeve cross-section rectangle perimeter 50 inches (1270 mm) or more and one or more sides larger than 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE-SEAL SYSTEMS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and pathway or cable.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Advance Products & Systems, Inc.
 - b. CALPICO, Inc.
 - c. Metraflex Company (The).
 - d. Pipeline Seal and Insulator, Inc.
 - e. Proco Products, Inc.
 - 2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 3. Pressure Plates: Carbon steel.
 - 4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

- A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Presealed Systems.

2.4 GROUT

- A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.



- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

- A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
 - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
 - 2. Sealant shall have VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Silicone Foams: Multicomponent, silicone-based, liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Comply with NEMA VE 2 for cable tray and cable penetrations.
- C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
 - 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
 - a. Seal annular space between sleeve and pathway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."
 - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
 - 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 3. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pathway or cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.
 - 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
 - 5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level. Install sleeves during erection of floors.
- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
 - 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.



3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at pathway entries into building.
- B. Install type and number of sealing elements recommended by manufacturer for pathway or cable material and size. Position pathway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pathway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 28 05 44



SECTION 28 13 00

ACCESS CONTROL

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 a complete installation of a PC based and managed access control and security system (Lenel) and specifies sensors, signal equipment, and system controls. The Lenel system shall be capable of functioning with both standard wired locks and card readers as well as with network connected integrated hardware.
- B. The electrified locking and access hardware for this project is specified using ASSA ABLOY products that will require the security contractor to provide integrated access control connection locking devices and wire harnesses. Locking devices are specified to use either POE or standard wiring connections. Cabling for the POE locking devices shall be provided by Div 27 contractors with the security contractor providing the cabling for non POE locking hardware.
- C. The system shall also interface with wireless access control for medical cabinets and refrigerators via wired hubs. Aperio IP hubs shall be provided for the wireless communication and wired connections back to the network patch panels. Provide optional external antenna with each hub.

1.3 DEFINITIONS

- A. Hard-Wired System: Alarm, supervisory, and detection devices are directly connected, through individual dedicated conductors, to central control panels.

1.4 SYSTEM DESCRIPTION

- A. The system shall have both access controlled doors and alarm inputs for panic buttons and intrusion detection.
- B. The system shall support automatic responses to alarms entering the system. Each alarm condition shall be capable of initiating numerous events including but not limited to: Activation of remote devices, door control, remote annunciation LED's, and card validation.
- C. Access control functions shall include but not be limited to: Validation based on time of day and day of week, holiday scheduling with card validation override, and access validation based on positive verification of card.



- D. The system shall interface with the fire alarm system and in the event of an alarm, shall release all controlled doors designated for emergency egress, and put them in fail-safe mode allowing free egress.

1.5 FUNCTIONAL PERFORMANCE

- A. The system shall consist of a network controller and network nodes using a standard TCP/IP network. Each controller shall retain all data necessary for system operation in its own RAM. Each controller will contain an integrated real time clock that continues to govern events even if communication with the main network controller is interrupted.
- B. The network controller shall act as an interface point with the node network, a data base management tool, and a transaction storage device.

1.6 ACTION SUBMITTALS

- A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections
- B. Product data for system components, including "Nationally Recognized Testing Laboratory" (NRTL) listing data and list of materials, dimensioned plans, sections, and elevations showing minimum clearances, mounting arrangements, and installed features and devices.
- C. Wiring Diagrams and Door Elevations: Provide the following for each opening having electric hardware, except doors with only magnetic holder/release units.
 - 1. Wiring diagrams for scheduled items requiring power. Identify manufacturer-installed and field-installed wiring.
 - 2. Provide load calculations and requirements for each electro-mechanical locking device within +/-5% of 24 VDC. Size the conductors for each device appropriately to maintain this requirement.
 - 3. Provide cable type (as indicated on the Shop Drawings Wire Legend) that is used for each electro-mechanical locking device, the conductor size, the estimated total length of cable, the estimated line loss (voltage drop), and the percentage of estimated line loss (voltage drop).
- D. System operation description, including method of operation and supervision of each component and each type of circuit, and sequence of operations for all manually and automatically initiated system inputs. Description must cover this specific Project; manufacturer's standard descriptions for generic systems are not acceptable.

1.7 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data for inclusion in "Operating and Maintenance Manual" specified in Division 01. Include data for each type product, including all features and operating sequences, both automatic and manual. Include user's software data and recommendations for spare parts to be stocked at the site. Provide names, addresses, and telephone numbers of service organizations that stock repair parts for the system.



- B. Product certifications signed by the manufacturers of system components certifying that their products comply with the referenced standards.
- C. Separate Qualification Data for Manufacturers and Installers: Demonstrate their capabilities and experience as specified in Quality Assurance Article. Include lists of completed projects with project names and addresses, names of Contracting Officer and Government representatives, plus other information specified.
- D. Record of field tests of system.

1.8 QUALITY ASSURANCE

- A. Converjint and Security 101 are Intermountain Healthcare's approved installers.
- B. Comply with NFPA 70, "National Electrical Code."
- C. Listing and Labeling: Provide system and components that are listed and labeled for their indicated use and location on the Project.
 - 1. The Terms "Listed" and "Labeled": As defined in the "National Electrical Code," Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
- D. Comply with UL Standard 609, 1023, and 1076.
- E. FM Compliance: Provide FM approved card access system and components.
- F. Single Source Responsibility: Obtain system components from a single source (the prime system manufacturer) that assumes responsibility for system components and for their compatibility.
- G. The successful bidding contractor shall be required to have training and accreditation with both ASSA ABLOY and Lenel.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of card readers, sensors, equipment related to access control operation, etc., that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: One year from date of Substantial Completion.

1.10 COORDINATION

- A. Access Control System Electrical Coordination: Coordinate with the layout and installation of scheduled electrified door hardware, and related access control equipment, with required connections to source power junction boxes, power supplies, detection and monitoring hardware and fire alarm system.



1. Door Hardware Interface: The card access control system shall be connected to electronic door control hardware (electromechanical locks, electric strikes, magnetic locks, door position switches, other monitoring contacts, and related auxiliary control devices) as described under Division 8 "Door Hardware". Coordinate with the installation and configuration of specified door hardware being monitored or controlled with the controls, software and access control hardware specified in this Section.
2. Access Control Hardware Sets: The hardware sets listed 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. **Refer to Section 08 71 00 Door Hardware Schedule for hardware set information.**
3. Fire Alarm Interface: Review Door Hardware Schedule for sequence of operation requiring an interface with the fire alarm system, such as release upon fire alarm. Coordinate with the fire alarm installer to provide all fire alarm system components to accomplish the specified sequence of operation. Provide fire alarm release at all delayed egress doors and any other doors in the path of egress that are allowed to be locked.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Lenel

2.2 ACCESS CONTROL SYSTEM EQUIPMENT, GENERAL

- A. Surge Protection: Comply with minimum requirements of UL Standard 1449, "Transient Voltage Surge Suppressors," for each component using solid state devices and having a line voltage power source connection or an exterior underground signal connection.
- B. Provide at the locations identified, a complete and operational Access Control and Security System including but not limited to the following equipment:
 1. Card Readers
 2. Door Logic Panels
 3. Relay output contacts
 4. All power supplies and/or transformers
 5. All equipment, security devices, components, wire, cable, and mounting hardware as required to meet specification requirements and manufacturers documented installation procedures.
- C. Provide the quantity of new door licenses to the existing Lenel building package to accommodate the increased number of readers being added as part of this project.



2.3 PHYSICAL SECURITY APPLIANCE

- A. Physical Security Appliance (PSA): Stand-alone, modular multi-reader access controller shall be provided for standard door opening access control. The appliances shall communicate to the main system server using Ethernet TCP/IP, and shall serve as the data collection and communications interface between the system server and the various field devices such as card readers, alarm inputs and control outputs.
- B. Power Requirements: Each Physical Security Appliance (PSA) shall accept a power input voltage of 120 VAC, 60Hz. Maximum power draw shall be no more than 300W. The PSA shall generate appropriate DC voltage levels for on-board use as required. External lock power supplies shall be required and sized for the appropriate number of locks (plus 20%) associated with each distributed controller. All power outputs to external devices shall be current limited in accordance with class 2 power limited wiring standards
- C. Battery Backup: The power supplies inherent in the PSA shall have the capability of charging standard gel-cell batteries, and shall be capable of operating on direct battery backup. The PSA shall be capable of providing at least four hours of full operation backup time, and shall be capable of recharging its batteries in less than 48 hours. Batteries shall be mounted in a separate, dedicated battery shelf sized to contain the amount of batteries required.

2.4 ELECTRICAL POWER

- A. Normal System Power Supply: 120 V 60 Hz from locked disconnect device. System components are supplied with power through separate power supplies. Provide all required power supplies and associated transformers as specified by the manufacturer.
- B. Power Source Transfer: When normal power is interrupted, system is automatically switched to backup supply without degradation of critical system function or loss of signals or status data.
 - 1. Backup Source: Batteries in power supplies of individual system components. Such batteries are an integral part of power supplies of the components.
 - 2. Annunciation: Switching of the system or any system component to backup power is indicated as a change in system condition.

2.5 CARD ACCESS SYSTEM HARDWARE, GENERAL

- A. Types, features, accessories, and mounting conditions of individual devices are as indicated.
- B. Battery Backup: The access control panel shall be provided with back up battery power for up to four hours operation upon loss of AC power.
- C. Suppression: The access control panel shall have provisions for relay suppressor kits for each relay used, to protect the access control panel from collapsing electrical fields.
- D. Card Readers: Card readers shall be HID multi-class SE readers.
 - 1. Proximity Readers: The system shall be provided with uni directional proximity card readers. The standard multi-class SE readers shall have a read range of five to eight inches. The reader shall be able to be mounted with its sides against metal door or window frames, and masonry walls. Long range readers mounted at vehicle gates shall have a minimum 10 inch read range.



- a. Standard readers: HID RP40
- b. Keypad/Pinpad: HID RPK40
- c. Mullion Installation: HID RP10

2.6 POWER SUPPLIES

- A. Provide power supplies as per manufacturers written recommendations with total number of powered devices for each power supply restricted to only consuming 75 percent of the power supplies rated amperage. Provide separate power supplies for system controllers (As per manufacturer), card readers (12VDC, 5 A), and locks (24 VDC, 7 A).

2.7 CONTACT INDICATOR SWITCHES

- A. Contact indicators on overhead doors that are not supplied by the door manufacturer shall be Sentrol series 2300 type surface mounted magnetic reed type switches with opposing magnet, and shall be per manufacturer's recommendations for the type of door.

2.8 WIRE AND CABLE

- A. Cables: Bundled, shielded and unshielded, twisted-pair cable, shielded where manufacturer recommends shielded cable for standard readers and locking hardware. Cat 6A cable shall be provided by Div 27 to all network connected locking hardware.
 - 1. Specified Manufacturer: Provide the specified product or prior approved equal.
 - a. Coleman Cable Inc. (CCI) Part Number 73101 consisting the following cables bundled plenum rated within a yellow Low Smoke PVC, CMP/CL3P/FPLP jacket:
 - 1) PN 72321: 22 AWG 2/Conductor CMP. Typical use, Door Contact
 - 2) PN 72344: 22 AWG 4/Conductor CMP. Typical use, Request to Exit/Spare
 - 3) PN 75366: 22 AWG 6/Conductor shielded CMP. Typical use, Card Reader.
 - 4) PN 71944: 18 AWG 4/Conductor CMP. Typical use, Lock Power
 - b. Any of the above cables may be used individually where cables in addition to those included in the bundle are required.
- B. Comply with Division 26 Section "Wires and Cables" except as indicated.
- C. Cable for Low Voltage Control and Signal Circuits: Shielded twisted pair cable with drain. Comply with Division 26 Section "Wires and Cables."

2.9 RACEWAY

- A. Comply with Division 26 Section "Raceways."

2.10 DOOR HARDWARE SCHEDULE

- A. Refer to Section 08 71 00 Door Hardware Schedule for hardware set information and assignment of required components to be provided by the Division 28 contractor.



PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine pathway elements intended for cables. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation.
- B. Examine roughing-in for card readers, and other cable-connected devices to verify actual locations of conduit and back boxes before device installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Comply with recommendations in SIA CP-01.
- B. Comply with TIA/EIA 606-A, "Administration Standard for Commercial Telecommunications Infrastructure."
- C. Obtain detailed Project planning forms from manufacturer of access-control system; develop custom forms to suit Project. Fill in all data available from Project plans and specifications and publish as Project planning documents for review and approval.
 - 1. For each Location, record setup of controller features and access requirements.
 - 2. Prepare a specific plan for system testing, startup, and demonstration.
 - 3. Develop acceptance test concept and, on approval, develop specifics of the test.
 - 4. Develop cable and asset-management system details; input data from construction documents.

3.3 INSTALLATION

- A. General: Install system according to NFPA 70, applicable codes, and manufacturer's printed instructions.
- B. Intermountain Healthcare Approved Installers:
 - 1. Convergent
 - 2. Security 101
- C. Wiring Method:
 - 1. Concealed in walls or above inaccessible ceilings: Install all cabling in raceways, 1 inch minimum. Conduit fill shall not exceed 40%.
 - 2. Above Accessible Ceilings: Provide J-Hooks at not more than 5 feet on center. Fasten J-Hooks to walls with solid anchoring to studs. Where wall are unavailable suspend from structure using not less than 3/8" diameter threaded rod and provide tie to ceiling grid to prevent sway.
 - 3. Exposed: Install exposed cables in minimum 3/4" galvanized rigid metal conduit with straps at not more than 3 feet on center and minimum 1/4" gap between conduit and building surface. Use boxes that are specified for surface mounting.



- D. Wiring within Panels and Enclosures: Bundle, wrap, and train the conductors to terminal points with 6-inches of slack minimum, 12-inches of slack maximum. Provide and use cable management hardware and distribution spools.
- E. Number of Conductors: As recommended by system manufacturer for functions indicated. As a minimum install one bundled, shielded and unshielded, twisted pair cable for every access controlled door.
- F. Splices, Taps, and Terminations: Make splices, taps, and terminations on numbered terminal strips in junction, pull and outlet boxes, terminal cabinets, and equipment enclosures.
- G. Tighten connections to comply with tightening torques specified in UL Standard 486A.
- H. Identification of Conductors and Cables: Color code conductors and apply wire and cable marking tape to designate wires and cables so media are identified and coordinated with system wiring diagrams.
- I. Install power supplies and other auxiliary components for detection devices at the door controller panel or at a data gathering panel except as otherwise indicated. Do not install such items in the vicinity of the devices they serve.
- J. Provide spare capacity within access control system to accommodate 2 additional future access control doors in each access panel location (i.e., in each electrical or telecommunications room with access control panels).

3.4 GROUNDING

- A. Comply with Section 28 05 26 "Grounding and Bonding for Electronic Safety and Security."
- B. Comply with IEEE 1100, "Recommended Practice for Power and Grounding Electronic Equipment."
- C. Ground cable shields, drain conductors, and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
- D. Bond shields and drain conductors to ground at only one point in each circuit.

3.5 DOOR RELEASE BUTTON INSTALLATION

- A. Push Buttons: Push-button switches shall be connected to the controller associated with the portal to which they are applied, and shall operate the appropriate electric strike, electric lock, or other facility release device. The system shall also use card readers in place of push-buttons at designated locations for remote operation of access controlled doors.

3.6 IDENTIFICATION

- A. In addition to requirements in this article, comply with applicable requirements in Section 26 05 53 "Identification for Electrical Systems" and with TIA/EIA 606-A.



- B. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
 - 1. All wiring conductors connected to terminal strips shall be individually numbered, and each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with the name and number of the particular device as shown.
 - 2. Each wire connected to building-mounted devices is not required to be numbered at the device if the color of the wire is consistent with the associated wire connected and numbered within the panel or cabinet.

3.7 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 system pre-testing, testing, adjustment, and programming.
- B. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.
- C. Pre-testing: Align and adjust the system and perform pre-testing of all components, wiring, and functions to verify conformance with specified requirements. Correct deficiencies by replacing malfunctioning or damaged items with new items. Retest until satisfactory performance and conditions are achieved.
- D. Testing: Provide at least 10 days' notice of acceptance test performance schedule.
- E. Operational Tests: Perform operational system tests to verify conformance with specifications. Test all modes of system operation and intrusion detection. Methodically test for false alarms in each zone of space intrusion detection devices by simulating activities outside indicated detection patterns.
- F. Installer Start-up Responsibility: The Installer shall initiate system operation. The Installer shall provide competent start up personnel on each consecutive working day until the system is fully functional. Upon reoccurring technical problems, the Installer shall supply factory direct Manufacturer's support in the form of factory technical representation and/or diagnostic equipment until the resolution of those defined problems.

3.8 ADJUSTMENT

- A. Occupancy Adjustments: When requested within 1 year of date of substantial completion, provide on site assistance in adjusting and reprogramming to suit actual occupied conditions. Provide up to 3 visits to the site for this purpose without additional cost.

3.9 DEMONSTRATION

- A. Train Owner's operating personnel in the programming and operation of the system. Train Owner's maintenance personnel in the procedures and schedules involved in preventive maintenance and in programming, operating, adjusting, troubleshooting, and servicing of the system. Provide a minimum of 4 hours training.
- B. Schedule training with advance notice of at least 7 days.



END OF SECTION

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SECTION 28 23 00

VIDEO SURVEILLANCE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes a video surveillance system consisting of cameras, software installation, configuration, and licensing. Network electronics shall be provided by the Owner. Cabling and terminations shall be provided by Section 27 10 00. Owner approved installers:
 - 1. CONVERGINT TECHNOLOGIES.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated. Include dimensions and data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For video surveillance. 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. Functional Block Diagram: Show single-line interconnections between components for signal transmission and control. Show cable types and sizes.
 - 3. Dimensioned plan and elevations of equipment racks, control panels, and consoles. Show access and workspace requirements.
 - 4. Wiring Diagrams: For power, signal, and control wiring.
- C. Equipment List: Include every piece of equipment by model number, manufacturer, location, and date of original installation.
- D. Field quality-control reports.
- E. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Convergent is Intermountain Healthcare's approved installer.
- B. 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.
- C. Comply with NECA 1.
- D. Comply with NFPA 70.



- E. Electronic data exchange between video surveillance system with an access-control system shall comply with SIA TVAC.

1.4 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of cameras, equipment related to camera operation, and control-station equipment that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SYSTEM REQUIREMENTS

- A. Video-signal format shall comply with IP based digital transmission.
- B. Surge Protection: Protect components from voltage surges entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor's entry connection to components.
 - 1. Minimum Protection for Power Connections 120 V and More: Auxiliary panel suppressors complying with requirements in Division 26 Section "Transient-Voltage Suppression for Low-Voltage Electrical Power Circuits."
 - 2. Minimum Protection for Communication, Signal, Control, and Low-Voltage Power Connections: Comply with requirements in Division 26 Section "Transient-Voltage Suppression for Low-Voltage Electrical Power Circuits." as recommended by manufacturer for type of line being protected.
- C. Tamper Protection: Tamper protection capability shall be provided as part of the camera manufacture and design.

2.2 CAMERAS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AXIS
- B. Description: Camera shall be an all-in-one solution with integrated megapixel camera, varifocal lens, and dome enclosure. Refer to camera type schedule in the drawings.

2.3 CAMERA-SUPPORTING EQUIPMENT

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:



1. AXIS
- B. Minimum Load Rating: Rated for load in excess of the total weight supported times a minimum safety factor of two.
- C. Mounting Brackets for Fixed Cameras: Type matched to items supported and mounting conditions. Include manual pan-and-tilt adjustment.
- D. Protective Housings for Fixed Cameras: Dome type enclosures with internal camera mounting and connecting provisions that are matched to camera/lens combination and mounting and installing arrangement of camera to be housed. Dome enclosures mounted outside shall be manufactured with environmental features for sustained function in all expected temperatures.

2.4 IP VIDEO MANAGEMENT SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Genetec
- B. Description:
 1. System shall provide high-quality delivery and processing of IP-based video, audio, and control data using standard Ethernet-based networks.
 2. System shall have seamless integration of all video surveillance and control functions.
 3. System design shall include all necessary compression software for high-performance, dual-stream, MPEG-2/MPEG-4/h.264 video. Unit shall provide connections for all video cameras, camera PTZ control data, bidirectional audio, discreet sensor inputs, and control system outputs.
 4. All camera signals shall be compressed, encoded, and delivered onto the network for processing and control by the IP video-management software.
 5. All system interconnect cables, camera licenses, workstation programming, and other system intermediate devices shall be provided for full performance of specified system.

2.5 SIGNAL AND POWER TRANSMISSION COMPONENTS

- A. Cable: Four pair, 100 ohm, Category 6A compliant UTP. (By Section 27 15 00)
- B. Video Surveillance Cable Connectors: Category 6A compliant. (By Section 27 15 00)
- C. Camera Power: POE enabled network switches. (By Owner)
- D. **Media Converter (Camera Fiber Connections): 10/100/1000 Media converter with Power over Ethernet. Provide OmniConverter GPoE+ by Omnitron systems or approved equal. (BA2)**



PART 3 - EXECUTION

3.1 VIDEO SURVEILLANCE SYSTEM INSTALLATION

- A. Intermountain Healthcare Approved Installers:
 - 1. Convergent
- B. Install cameras at heights noted in drawings.
- C. Set pan-and-tilt unit stops to suit final camera position and to obtain the field of view required for camera. Connect all controls and alarms, and adjust.
- D. Identify system components, wiring, cabling, and terminals according to Division 26 Section "Identification for Electrical Systems."

3.2 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.
- B. Tests and Inspections:
 - 1. Inspection: Verify that units and controls are properly installed, connected, and labeled, and that interconnecting wires and terminals are identified.
 - 2. Pretesting: Align and adjust system and pretest components, wiring, and functions to verify that they comply with specified requirements. Conduct tests at varying lighting levels, including day and night scenes as applicable. Prepare video-surveillance equipment for acceptance and operational testing as follows:
 - a. Verify operation of auto-iris lenses.
 - b. Set back-focus of fixed focal length lenses. At focus set to infinity, simulate nighttime lighting conditions by using a dark glass filter of a density that produces a clear image. Adjust until image is in focus with and without the filter.
 - c. Set back-focus of zoom lenses. At focus set to infinity, simulate nighttime lighting conditions by using a dark glass filter of a density that produces a clear image. Additionally, set zoom to full wide angle and aim camera at an object **50 to 75 feet** away. Adjust until image is in focus from full wide angle to full telephoto, with the filter in place.
 - d. Set sensitivity of motion detection.
 - e. Connect and verify responses to alarms.
 - f. Verify operation of control-station equipment.
 - 3. Test Schedule: Schedule tests after pretesting has been successfully completed and system has been in normal functional operation for at least 14 days. Provide a minimum of 10 days' notice of test schedule.
 - 4. Operational Tests: Perform operational system tests to verify that system complies with Specifications. Include all modes of system operation.



- C. Video surveillance system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.3 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain video-surveillance equipment.

END OF SECTION

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SECTION 28 31 11
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. Nonsystem smoke detectors.
 - 5. Heat detectors.
 - 6. Notification appliances.
 - 7. Firefighters' two-way telephone communication service.
 - 8. Magnetic door holders.
 - 9. Remote annunciator.
 - 10. Addressable interface device.
 - 11. Digital alarm communicator transmitter.
 - 12. Radio alarm transmitter.
 - 13. System printer.

1.3 DEFINITIONS

- A. LED: Light-emitting diode.
- B. NICET: National Institute for Certification in Engineering Technologies.

1.4 SYSTEM DESCRIPTION

- A. Noncoded, UL-certified FMG-placarded addressable system, with automatic sensitivity control of smoke detectors and multiplexed signal transmission, dedicated to fire-alarm service only.

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."

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. 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. Provide remote test switches (RTS) as required by NFPA 72.
 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.
- C. 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.
- 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.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. 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.
- C. Field quality-control reports.



1.8 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 23 "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.
- B. 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.

1.9 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 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.
 - 7. Fuses: Two of each type installed in the system.

1.10 QUALITY ASSURANCE

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level II technician.



- C. 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.
- D. 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.
- E. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL.
- F. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.
- G. NFPA Certification: Obtain certification according to NFPA 72 in the form of a placard by an FMG-approved alarm company.
- H. NFPA Certification: Obtain certification according to NFPA 72 by the Authority Having Jurisdiction.

1.11 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 Construction Manager no fewer than 7 days in advance of proposed interruption of fire-alarm service.
 - 2. Do not proceed with interruption of fire-alarm service without Construction Manager's written permission.

1.12 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.

1.13 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.



PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide product by the following:
1. Notifier
 2. Siemens

2.2 SYSTEMS OPERATIONAL DESCRIPTION

- A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:
1. Manual stations.
 2. Smoke detectors.
 3. Duct smoke detectors.
 4. Verified automatic alarm operation of smoke detectors.
 5. Automatic sprinkler system water flow.
 6. Heat detectors in elevator shaft and pit.
 7. Fire-extinguishing system operation.
 8. Fire standpipe system.
- B. Fire-alarm signal shall initiate the following actions:
1. In the Clinic and Central Utility Plant (CUP), continuously operate alarm notification appliances.
 2. In the hospital, continuously operate chime/strobe appliances in smoke zone where alarm is initiated. Continuously operate strobe appliances throughout the hospital
 3. Identify alarm at fire-alarm control unit and remote annunciators.
 4. Transmit an alarm signal to the remote alarm receiving station.
 5. Unlock electric door locks in designated egress paths.
 6. Release fire and smoke doors held open by magnetic door holders.
 7. Activate voice/alarm communication system.
 8. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
 9. Activate smoke-control system (smoke management) at firefighter smoke-control system panel.
 10. Activate stairwell and elevator-shaft pressurization systems.
 11. Close smoke dampers in air ducts of designated air-conditioning duct systems.
 12. Recall elevators to primary or alternate recall floors.
 13. Activate emergency lighting control.
 14. Activate emergency shutoffs for gas and fuel supplies.
 15. Record events in the system memory.
 16. Record events by the system printer.
- C. Supervisory signal initiation shall be by one or more of the following devices and actions:
1. Valve supervisory switch.
 2. Low-air-pressure switch of a dry-pipe sprinkler system.
 3. Elevator shunt-trip supervision.
- 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.
 9. Fire-pump power failure, including a dead-phase or phase-reversal condition.
 10. Low-air-pressure switch operation on a dry-pipe or preaction sprinkler system.
- 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. General Requirements for Fire-Alarm Control Unit:
1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL.
 - a. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
 - b. Include a real-time clock for time annotation of events on the event recorder
 - c. Must be able to operate and monitor Pre-action systems throughout hospital
 2. Addressable initiation devices that communicate device identity and status.
 - a. Smoke sensors shall additionally communicate sensitivity setting and allow for adjustment of sensitivity at fire-alarm control unit.
 - b. Temperature sensors shall additionally test for and communicate the sensitivity range of the device.
 3. Addressable control circuits for operation of mechanical equipment.
- B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
1. Annunciator and Display: Liquid-crystal type, 3 line(s) of 80 characters, minimum.
 2. Keypad: Arranged to permit entry and execution of programming, display, and control commands and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.
- C. Circuits:
1. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class A.
 - a. Initiating Device Circuits: Style D.



- 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.
- 2. Serial Interfaces: Two RS-232 ports for printers.
- D. Stairwell Pressurization: Provide an output signal using an addressable relay to start the stairwell pressurization system. Signal shall remain on until alarm conditions are cleared and fire-alarm system is reset. Signal shall not stop in response to alarm acknowledge or signal silence commands.
 - 1. Pressurization starts when any alarm is received at fire-alarm control unit.
 - 2. Alarm signals from smoke detectors at pressurization air supplies have a higher priority than other alarm signals that start the system.
- E. Smoke-Alarm Verification:
 - 1. Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.
 - 2. Activate an NRTL-listed and -approved "alarm-verification" sequence at fire-alarm control unit and detector.
 - 3. Record events by the system printer.
 - 4. Sound general alarm if the alarm is verified.
 - 5. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.
- F. Notification Appliance Circuit: Operation shall sound in a temporal.
- G. Elevator Recall:
 - 1. Smoke detectors at the following locations shall initiate automatic elevator recall. Alarm-initiating devices, except those listed, shall not start elevator recall.
 - a. Elevator lobby detectors except the lobby detector on the designated floor.
 - b. Smoke detector in elevator machine room.
 - c. Smoke detectors in elevator hoistway.
 - 2. Elevator lobby detectors located on the designated recall floors shall be programmed to move the cars to the alternate recall floor.
 - 3. Water-flow alarm connected to sprinkler in an elevator shaft and elevator machine room shall shut down elevators associated with the location without time delay.
 - a. Water-flow switch associated with the sprinkler in the elevator pit may have a delay to allow elevators to move to the designated floor.
 - 1. 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. Review Door Hardware Schedule for sequence of operation requiring an interface with the fire alarm system, such as release upon fire alarm. Provide all fire alarm system components to accomplish the specified sequence of operation which may require components beyond those that are indicated on drawings. Provide fire alarm release at all delayed egress doors and any other doors in the path of egress that are allowed to be locked.
- H.
- I. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups.



Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and print out the final adjusted values on system printer.

- J. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.
- K. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also print system reset event, including same information for device, location, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.
- L. 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.
- M. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
 - 1. Batteries: Sealed, valve-regulated, recombinant lead acid.
- N. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.4 MANUAL FIRE-ALARM BOXES

- A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
 - 1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
 - 2. Station Reset: Key- or wrench-operated switch.
 - 3. Indoor Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.
 - 4. Weatherproof Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.

2.5 SYSTEM SMOKE DETECTORS

- A. General Requirements for System Smoke Detectors:
 - 1. Comply with UL 268; operating at 24-V dc, nominal.
 - 2. Detectors shall be four-wire type.
 - 3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
 - 4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.



5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
 6. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status.
 7. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.
 - a. Rate-of-rise temperature characteristic shall be selectable at fire-alarm control unit for **15 or 20 deg F (8 or 11 deg C)** per minute.
 - b. Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at **135 or 155 deg F (57 or 68 deg C)**.
 - c. Provide multiple levels of detection sensitivity for each sensor.
- B. Photoelectric Smoke Detectors:
1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
 2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).
- C. Ionization Smoke Detector:
1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
 2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).
- D. Duct Smoke Detectors: Photoelectric type complying with UL 268A.
1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
 2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).
 3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.
 4. Each sensor shall have multiple levels of detection sensitivity.



5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
6. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.
7. Remote Test Station (RTS): Provide keyed type RTS. Comply with NFPA 72, owner, AHJ, architect, and EOR locations.

2.6 HEAT DETECTORS

- A. General Requirements for Heat Detectors: Comply with UL 521.
- B. Heat Detector, Combination Type: Actuated by either a fixed temperature of **135 deg F (57 deg C)** or a rate of rise that exceeds **15 deg F (8 deg C)** per minute unless otherwise indicated.
 1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.7 NOTIFICATION APPLIANCES

- A. General Requirements for Notification Appliances: Individually addressed, connected to a signaling line circuit, equipped for mounting as indicated and with screw terminals for system connections.
- B. 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.
- C. Chimes, Low-Level Output: Vibrating type, 75-dBA minimum rated output.
- D. Chimes, High-Level Output: Vibrating type, 81-dBA minimum rated output.
- E. 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.
- F. 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.

2.8 MAGNETIC DOOR HOLDERS

- A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.



1. Electromagnet: Requires no more than 3 W to develop 25-lbf (111-N) holding force.
 2. Wall-Mounted Units: Flush mounted unless otherwise indicated.
 3. Rating: 24-V ac or dc.
 4. Rating: 120-V ac.
- B. Material and Finish: Match door hardware.

2.9 REMOTE ANNUNCIATOR

- A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.
1. Mounting: Flush cabinet, NEMA 250, Type 1.
- B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.10 ADDRESSABLE INTERFACE DEVICE

- A. Description: Microelectronic monitor module, NRTL listed for use in providing a system address for alarm-initiating devices for wired applications with normally open contacts.
- B. Integral Relay: Capable of providing a direct signal to elevator controller to initiate elevator recall to circuit-breaker shunt trip for power shutdown.

2.11 DIGITAL ALARM COMMUNICATOR TRANSMITTER

- A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.
- B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture two telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.
- C. Local functions and display at the digital alarm communicator transmitter shall include the following:
1. Verification that both telephone lines are available.
 2. Programming device.
 3. LED display.
 4. Manual test report function and manual transmission clear indication.
 5. Communications failure with the central station or fire-alarm control unit.
- D. Digital data transmission shall include the following:
1. Address of the alarm-initiating device.
 2. Address of the supervisory signal.
 3. Address of the trouble-initiating device.



4. Loss of ac supply or loss of power.
 5. Low battery.
 6. Abnormal test signal.
 7. Communication bus failure.
- E. Secondary Power: Integral rechargeable battery and automatic charger.
- F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.12 SYSTEM PRINTER

- A. Printer shall be listed and labeled by an NRTL as an integral part of fire-alarm system.

2.13 DEVICE GUARDS

- A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.
1. Factory fabricated and furnished by manufacturer of device.
 2. Finish: Paint of color to match the protected device.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72 for installation of fire-alarm equipment.
- B. Install wall-mounted equipment, 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 Section 26 05 48 "Vibration and Seismic Controls for Electrical Systems."
- C. 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. HVAC: Locate detectors not closer than **3 feet (1 m)** from air-supply diffuser or return-air opening.
 5. Lighting Fixtures: Locate detectors not closer than **12 inches (300 mm)** from any part of a lighting fixture.
- D. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct. Install keyed remote test stations in acceptable locations.
- E. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.
- F. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.
- G. 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.



- H. Remote Test Station (RTS): Install keyed test station in wall near each duct smoke detector that is not readily visible from normal viewing position. Provide in locations acceptable to owner, AHJ, Architect, & EOR.
- I. 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.
- J. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least **6 inches (150 mm)** below the ceiling.
- K. Device Location-Indicating Lights: Locate in public space near the device they monitor.
- L. Fire-Alarm Control Unit: Surface mounted, with tops of cabinets not more than **72 inches (1830 mm)** above the finished floor.
- M. Annunciator: Install with top of panel not more than **72 inches (1830 mm)** above the finished floor.

3.2 WIRING INSTALLATION

- A. Wiring Method: **Install wiring free air with suitable support per Division 26 specifications. Install wiring in the middle j-hook of the triple tier j-hooks along cable trays, etc., reflected in telecommunications pathway plans.**
- B. Wiring for Grid Ceiling Mounted Devices: Install junction box at accessible location above ceiling.
- C. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by the manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- 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 a different color-code for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.
- F. Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signal from other floors or zones.



- G. Wiring to Remote Alarm Transmitting Device: 1-inch (25-mm) conduit between the FACP and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.3 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 Section 08 71 00 "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. Alarm-initiating connection to smoke-control system (smoke management) at firefighter smoke-control system panel.
 - 2. Alarm-initiating connection to stairwell and elevator-shaft pressurization systems.
 - 3. Smoke dampers in air ducts of designated air-conditioning duct systems. Provide end switches at each smoke and fire/smoke damper
 - 4. Alarm-initiating connection to elevator recall system and components.
 - 5. Alarm-initiating connection to activate emergency lighting control.
 - 6. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
 - 7. Supervisory connections at valve supervisory switches.
 - 8. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
 - 9. Supervisory connections at elevator shunt trip breaker.
 - 10. Supervisory connections at fire-pump power failure including a dead-phase or phase-reversal condition.
 - 11. Supervisory connections at fire-pump engine control panel.

3.4 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "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 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.

END OF SECTION



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APPENDIX 01

PHYSICIST'S SHIELDING REPORT



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April 11, 2024

Intermountain Health Logan Regional Hospital
500 E 1400 N
Logan, UT 84341

ATTN: Danee Cooper
Manager, Imaging Services

Patrick Monson
Nuclear Medicine/PET CT Coordinator

Dear Ms. Cooper and Mr. Monson:

Enclosed, please find the calculations for the amount of shielding required in the **PET/CT room (Rm 1618)** at your facility. Installing the specified **required** shielding will reduce the exposure to less than the required levels, i.e. 0.02 mGy/week (2 mrem/week) or 1 mGy/year (100 mrem/year) to members of the general public, and 0.1 mGy/week (10 mrem/week) or 5 mGy/year (500 mrem/year) to occupationally exposed employees. For each barrier, I have **recommended** the appropriate use of "standard" shielding materials. ***Often times it is beneficial from a cost and ease of construction aspect to overshield. In those situations, feel free to install more than the recommended amount of shielding.*** A narrative description of the shielding requirements and recommendations follows.

General Comments:

- Walls are to be constructed with leaded (Pb) drywall of specified thickness with the lead (Pb) extending **from the floor to the ceiling** to form a lead box.. The screws/nails do NOT need to be capped with lead (Pb). All electrical outlets, switches, and other penetrations of all shielded walls are to be backed with the same thickness of lead (Pb) as the wall that they penetrate.
- The door and jamb are to be lined with the same thickness of lead (Pb) as the wall that they penetrate, unless specified otherwise which is often the case. Be sure that the leaded doorframe overlaps the lead (Pb) in the gypsum drywall.
- As part of the control booth wall the patient viewing window and windowsill must have the same lead (Pb) equivalency as the wall that they penetrate. Be sure that the leaded windowsill overlaps the lead (Pb) in the gypsum drywall.

Corporate: 214 E. Huron Street, Ann Arbor, MI 48104 (734) 662-3197 Fax: (734) 662-9224

Regional: 50 E. 91st Street, Suite 211, Indianapolis, IN 46240 (317) 581-1911 Fax: (317) 581-1931

Salt Lake City, UT  Sussex, WI  Springfield, IL

www.mpcphysics.com  mpc@mpcphysics.com

WORKLOAD

The estimated workload for this scanner is 45 PET cardiac studies per week. The cardiac patients will be imaged twice for a total of 90 cardiac scans per week. The activity for these exams will be 10 to 40 mCi of Rb-82. The imaging time for cardiac patients will be 10 minutes for both the stress and rest portions of the study.

This PET scanner will also be used for approximately 20 PET oncology studies per week. The activity for the oncology patients will be 10 mCi of F-18 FDG. The uptake time for oncology patients will be 45 to 90 minutes. The imaging time for oncology patients will be from 10 to 40 minutes.

You are installing the GE Discovery MI Gen2 three ring system at this facility.

I have assumed that the top of the architectural drawings is North.

PET/CT ROOM 1618 Shielding Specifications

PET/CT Control Room:

Required shielding: 0.8 mm (1/32 inch) lead (Pb) in wall, window, and window frame extended to the ceiling

Recommended shielding: 1.6 mm (1/16 inch) lead (Pb) in wall, window, and window frame extended to the ceiling

COMMENT: Installation of the recommended amount of shielding will reduce the annual exposure to approximately 0.6 mSv/year, which is much less than the 2.5 mSv/year limit for this controlled area (two sources of radiation).

NOTE: Control room windows are not available in 1/32 inch lead equivalent. The entire barrier should be shielded to the same standard, therefore, 1/16 inch lead is preferred.

PET/CT Control Room Door:

Required shielding: 0.8 mm (1/32 inch) lead (Pb)

Recommended shielding: 1.6 mm (1/16 inch) lead (Pb) extended to the ceiling

COMMENT: Installation of the recommended amount of shielding will reduce the annual exposure to approximately 0.6 mSv/year, which is much less than the 2.5 mSv/year limit for this controlled area (two sources of radiation).

Lighting Conditions:

While this is not a radiation safety issue per se, with the advent of digital imaging it has become important that the lighting in the control booth be either subdued or dimmable such that the ambient lighting can be optimized for viewing images on computer monitors.

PET/CT ROOM 1618 Shielding Specifications, continued**North Wall – SPECT/CT Room :**

Required shielding: 0.8 mm (1/32 inch) lead (Pb)

Recommended shielding: 1.6 mm (1/16 inch) lead (Pb) on the PET side of this barrier to prevent count rate increases on the SPECT camera heads. Extend the shielding to the ceiling.

COMMENT: Installation of the recommended amount of shielding will reduce the annual exposure to approximately 0.57 mSv/year, which is less than the 2.5 mSv/year limit for this controlled area.

NOTE: 1/32 inch lead is already installed on the SPECT/CT side of this wall. Additional shielding is strongly recommended to protect the SPECT camera heads from increased counts.

North Wall – Adjacent SPECT/CT Camera :

The exposure rate to the camera should be limited to **1 mR/hour**.

F-18

Exposure rate from the patient: 0.092 uSv/MBq-hr = 0.388 mR/mCi-hr @ 1 meter

Distance to closest SPECT camera head: 4.4 meters

Activity administered: 10 mCi*0.753 (decay factor)*0.85(urine reduction factor) = 6.4 mCi

Exposure rate at camera head: $0.388/(4.4)^2 = 0.02$ mR/mCi-hr *6.4 mCi = 0.13 mR/hr

Rb-82

Exposure rate from the patient: 0.102 uSv/MBq-hr = 0.430 mR/mCi-hr @ 1 meter

Distance to closest SPECT camera head: 4.4 meters

Activity administered: 40 mCi*0.004 (decay factor) = 0.16 mCi

Exposure rate at camera head: $0.430/(4.4)^2 = 0.02$ mR/mCi-hr *0.16 mCi = 0.004 mR/hr

The projected exposure rate to the camera heads is below the target value of 1 mR/hour but without additional shielding, camera quality control and maintenance may be very difficult while patients are being imaged in the adjacent room.

PET/CT ROOM 1618 Shielding Specifications, continued**North Wall – SPECT/CT Control Room :**

Required shielding: 0.8 mm (1/32 inch) lead (Pb)

Recommended shielding: 1.6 mm (1/16 inch) lead (Pb) extended to the ceiling

COMMENT: Installation of the recommended amount of shielding will reduce the annual exposure to approximately 0.5 mSv/year, which is less than the 2.5 mSv/year limit for this controlled area.

NOTE: The verified lead shielding in this wall is 1/8 inch.**South Wall – Electrical Room :**

Required shielding: 0.8 mm (1/32 inch) lead (Pb)

Recommended shielding: 1.6 mm (1/16 inch) lead (Pb) extended to the ceiling

COMMENT: Installation of the recommended amount of shielding will reduce the annual exposure to approximately 0.07 mSv/year, which is much less than the 1 mSv/year limit for an uncontrolled public area.

West Wall – Corridor :

Required shielding: 0.8 mm (1/32 inch) lead (Pb)

Recommended shielding: 1.6 mm (1/16 inch) lead (Pb) extended to the ceiling

COMMENT: Installation of the recommended amount of shielding will reduce the annual exposure to approximately 0.24 mSv/year, which is much less than the 1 mSv/year limit for an uncontrolled public area.

West Wall Door – Corridor :

Required shielding: 0.8 mm (1/32 inch) lead (Pb)

Recommended shielding: 1.6 mm (1/16 inch) lead (Pb)

COMMENT: Installation of the recommended amount of shielding will reduce the annual exposure to approximately 0.15 mSv/year, which is much less than the 1 mSv/year limit for an uncontrolled public area.

Floor:**Required shielding: None**

COMMENT: This room is constructed on grade, with no occupiable area below it. Therefore, no radiation shielding is required, nor is any recommended.

PET/CT ROOM 1618 Shielding Specifications, continued**Ceiling (Patient Rooms):**

Required shielding: **3.5 inches of standard weight concrete or 1.6 mm Lead (1/16 inch).** The existing 3.5 inches of lightweight concrete is equivalent to 2.63 inches of standard weight concrete. **An additional 0.2 mm of lead (1/32 inches commercially available) is needed.**

Recommended shielding: 1.6 mm (1/16 inch) lead (Pb)

This value was determined as follows (the shielding requirement is almost entirely due to the CT contribution to scatter radiation):

Deficit: 3.5-2.63 inches concrete = 0.87 inches (2.21 cm)

2.21 cm standard weight concrete= 2.21cm/6.6 cm per TVL @ 125 kVp = 0.33 TVL
0.33 TVL*0.5mm/TVL lead @ 125 kVp=**0.2 mm lead**

COMMENT: Installation of the recommended amount of shielding will reduce the annual exposure to approximately 0.7 mSv/year, which is the limit for an uncontrolled public area.

GENERAL COMMENTS

- Once the rooms are constructed, MPC can perform radiation transmission measurements to verify that the lead shielding has been installed satisfactorily. Please contact our office to arrange this testing.
- ***Shielding verification is required prior to clinical use of CT scanners, nuclear medicine gamma cameras, and PET/CT scanners to meet TJC standards.***
- Proper installation can also be verified via visual evidence such as digital photographs taken during construction which can be submitted to our office. Please contact me for more information on the details of photo verification.

All of the assumptions used in these calculations were conservative. However, if the use of the room, the use of the areas around the room, or the position of the machine within the room change the calculations will no longer be valid.

- **As required by the Utah Division of Waste Management and Radiation Control R313-28-32 Plan Review, you must submit a copy of this report to the UDWMRC executive secretary within 14 days. The address is:**

UTAH WASTE MANAGEMENT AND RADIATION CONTROL BOARD
Doug Hansen, Executive Secretary
195 North 1950 West
P.O. Box 144880
Salt Lake City, UT 84114-4880

INTERMOUNTAIN HEALTH LOGAN REGIONAL HOSPITAL
April 11, 2024

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- **Please maintain a copy of this shielding design report for your records as required by the UDMRC for as long as this x-ray room is in use.**

If you have any questions regarding this report, or if I may be of any further assistance, please contact me at either ksilverstrim@mpcphysics.com or on my cell (719-352-6421).

Sincerely,

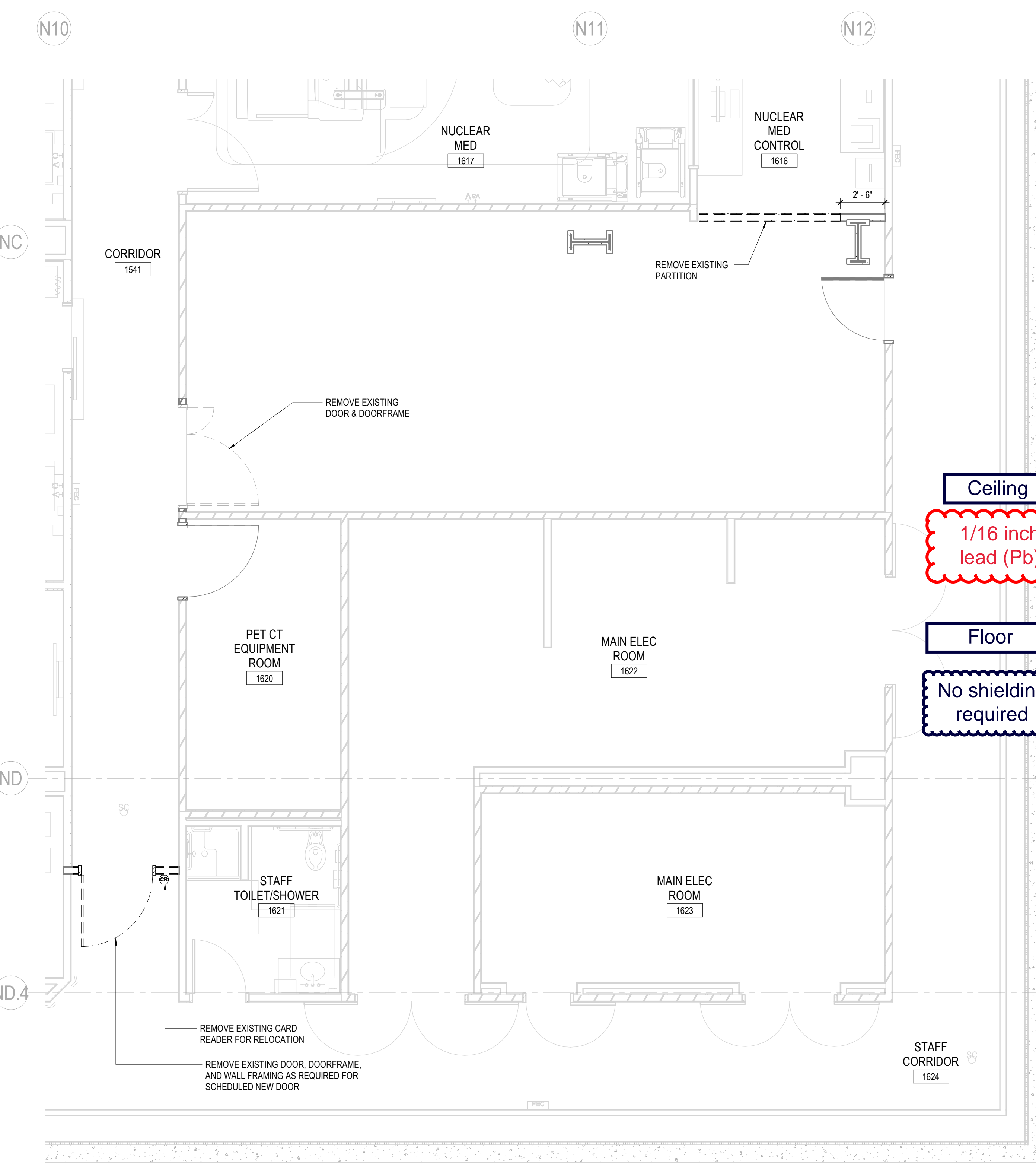
A handwritten signature in black ink, appearing to read "Kelli J. Silverstrim".

Kelli J. Silverstrim, PhD, DABR
Diagnostic Medical Physicist

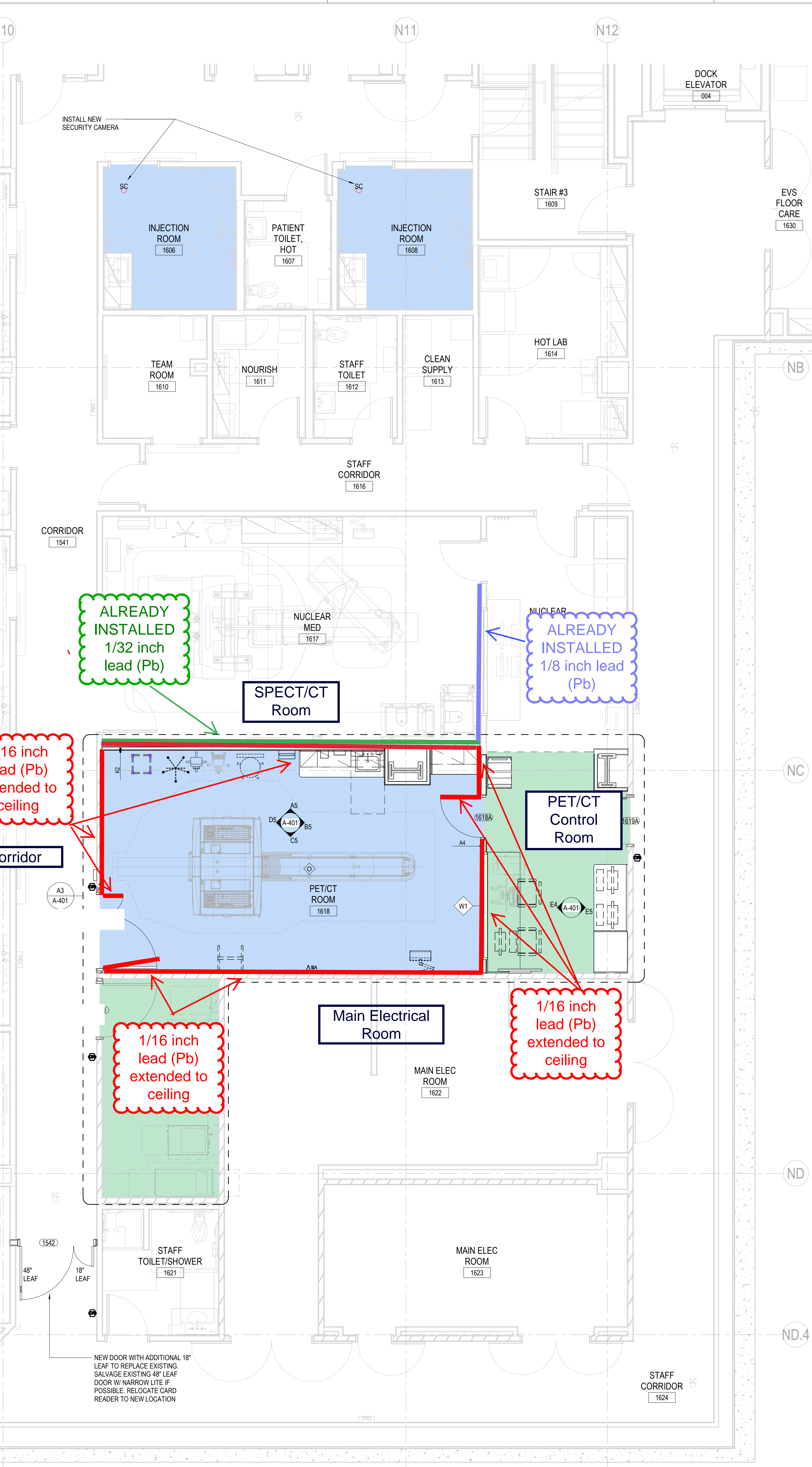
Enclosures

3/12/2024 10:08:04 AM Autodesk Docs://10394230_LHJ_PET/10394230_LHJ_PET/CT.ctb
08.101 Plans

A5 DEMOLITION PLAN - LEVEL 01 - SECTOR J
1/4" = 1'-0"



A3 FLOOR PLAN - LEVEL 01 - SECTOR H/J
1/4" = 1'-0"



FLOOR PLAN LEGEND

	NOT IN SCOPE
	NEW GRID
	EXISTING GRID
	KEYNOTE TAG
	WALL TYPE - SEE A-520
	DOOR TAG - SEE A-600'S FOR DOOR SCHEDULE
	WINDOW TAG - SEE A-600
	CARD READER
	AUTOMATIC DOOR OPERATOR
	MATCHLINE

PARTITION RATINGS

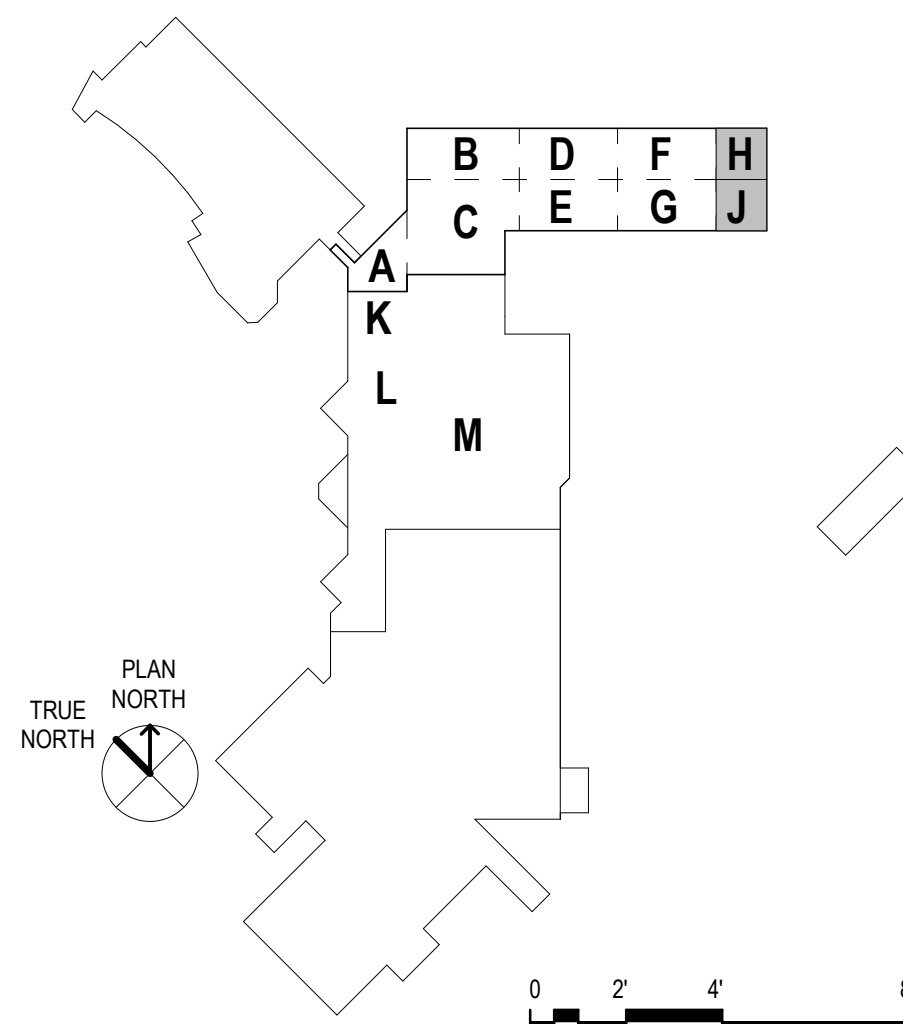
PARTITION RATING GRAPHIC DESIGNATION	PRIORITY
2 HR RATED FIRE BARRIER (SEE G-SHEETS FOR DISTINCTION)	1 HIGHEST
1 HR RATED SMOKE BARRIER	2
1 HR RATED FIRE BARRIER	
1 HR RATED FIRE PARTITION (SEE G-SHEETS FOR DISTINCTION)	3
NON-RATED SMOKE PARTITION	
NON-RATED PARTITION	4 LOWEST

FLOOR PLAN GENERAL NOTES

- DRAWINGS & SPECIFICATIONS ARE COMPLEMENTARY COMPONENTS OF THE CONTRACT DOCUMENTS. REVIEW ALL DRAWINGS AND SPECIFICATIONS FOR THE COMPLETE SCOPE OF WORK. NOTIFY ARCHITECT IMMEDIATELY FOR CLARIFICATION IF INCONSISTENCIES, CONTRADICTIONS OR OMISSIONS ARE DISCOVERED.
- DO NOT SCALE DRAWINGS. IF DIMENSIONAL INFORMATION IS REQUIRED & NOT FOUND, NOTIFY ARCHITECT IMMEDIATELY FOR CLARIFICATION.
- ALL DIMENSIONS ARE TO COLUMN CENTERLINES OR FACE OF FINISHED WALLS OR SURFACES UNLESS NOTED OTHERWISE.
- REFER TO DEMOLITION DRAWINGS, IF ANY, FOR WORK REQUIRED IN ADVANCE OF CONSTRUCTION AND COORDINATE ACCORDINGLY.
- ALL DOOR FRAMES ARE TO BE INSTALLED 4" AWAY OF ADJACENT PERPENDICULAR WALLS UNLESS NOTED OTHERWISE.
- REFER TO LIFE SAFETY DRAWINGS FOR ADDITIONAL FIRE / SMOKE RATING REQUIREMENTS.
- REFER TO EQUIPMENT DRAWINGS FOR ADDITIONAL EQUIPMENT SPECIFIC INFORMATION.
- REFER TO INTERIOR FINISH DRAWINGS FOR ADDITIONAL INTERIOR FINISH SPECIFIC INFORMATION.
- REFER TO STRUCTURAL DRAWINGS FOR ADDITIONAL STRUCTURAL SPECIFIC INFORMATION.
- REFER TO MEP DRAWINGS FOR ADDITIONAL MEP SPECIFIC INFORMATION.
- ALL NON-LOAD BEARING INTERIOR WALLS ARE TYPE "A" UNLESS NOTED OTHERWISE.
- HIGHER RATED FIRE WALLS TAKE PRECEDENCE OVER LOWER RATED WALLS & ARE TO CONTINUE THROUGH ALL SUCH INTERSECTIONS.
- ALL SMOKE BARRIER WALLS ARE TO BE EXTENDED FROM BACK SIDE OF EXTERIOR WALL SHEATHING TO BACK SIDE OF EXTERIOR WALL SHEATHING OR ANOTHER SMOKE BARRIER WALL.

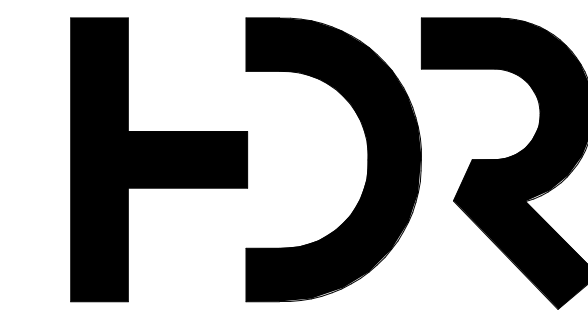
SHEET KEYNOTES

KEY PLAN



FUNCTION LEGEND

	CLINICAL SUPPORT
	PATIENT CARE



HDR ARCHITECTURE P.C.
SUITE 1500
201 CALIFORNIA ST.
SAN FRANCISCO, CA
94111

INTERMOUNTAIN
HEALTHCARE
LRH PET/CT

500E 1400N
LOGAN, UT 84341



Project Manager	BEN HICKMAN
Project Health Planner	ANNETTE HIMELICK
Project Architect	BEN HICKMAN
Landscape Architect	N/A
Civil Engineer	N/A
Structural Engineer	REAVELEY
Mechanical Engineer	VAN BOERUM & FRANK
Electrical Engineer	SPECTRUM
Plumbing Engineer	VAN BOERUM & FRANK
Interior Designer	RUBY THORP
Equipment Planner	STEVE HOOPER
Wayfinding	N/A

MARK	DATE	DESCRIPTION
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Project Number	10394230
Original Issue	02/29/2024

Sheet Name
**DEMOLITION & FLOOR
PLANS - LEVEL 01
AREAS H&J**

Sheet Number
A-101HJ

Project Status
DESIGN DEVELOPMENT



PET-CT IMAGING ROOM
PET SHIELDING CALCULATIONS

Facility: **Intermountain Health Logan Regional Hospital**

Date: **4/2/2024**

Physicist: **Kelli J. Silverstrim, PhD, DABR**

Room Number: **1618**

Dose equivalent Rate Constants and Barrier Transmission Data from "AAPM Task Group 108 PET and PET-CT Shielding Requirements" Medical Physics, 2005

Administered Activity (Ao)
(mCi)

Enter **40.0**

Imaging Time (ti)
(min)

Enter **10**

Uptake Time (Tu)
(min)

Enter **0**

Patients per Week (Nw)
Enter **90**

Radionuclide
Enter **Rb-82**

Scanner Reduction Factor (Sf)
0.850

Urine Void Reduction Factor (Uf)
1.000

Decay Reduction Factor (Rti)
1.000

Imaging Room Decay Factor (Fu)
0.004

Patient Dose Rate uSv-m2/MBq-h
0.102

Half-Life (Minutes)
1.27

Equation #9 AAPM TG 108

Weekly Dose = ((0.092 uSv m2 /MBq h) x Nw x Ao(MBq) x Sf x Uf x Fu x ti(h) x Rti / d(m)2) x T

Equation #10 AAPM TG 108

Transmission Factor (B) = 10.9 x P x d(m)2 / (T x Nw x Ao(MBq) x Sf x Fu x ti(h) x Rti)

Barrier:	North Wall	North Wall	East Wall	East Wall Door	South Wall	West Wall	West Wall Door	Ceiling
Description:	SPECT/CT Room	SPECT/CT Control Room	PET/CT Control Room	PET/CT Control Room	Electrical Room	Corridor	Corridor	Inpatient Rooms
Occupancy Factor (T)	0.500	1.000	1.000	1.000	0.050	0.200	0.125	1.000
Annual Limit (mSv) (P) (100 mRem = 1 mSv)	2.5	2.5	2.5	2.5	1.0	1.0	1.0	1.0
Distance (inches)	120.36	186.96	165.24	164.40	113.64	116.88	115.20	172.00
uSv per week Equation #9 AAPM TG 108	0.44	0.36	0.47	0.47	0.05	0.19	0.12	0.43
B* Transmission Factor Equation #10 AAPM TG 108	126.50	152.62	119.22	118.01	451.08	119.29	185.42	51.67
Pb Thickness (mm)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Concrete Thickness (cm)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pb Thickness (in)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Concrete Thickness (in)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00



Facility: Intermountain Health Logan Regional Hospital

Date: 4/2/2024

Physicist: Kelli J. Silverstrim, PhD, DABR

Room Number: 1618

Barrier:	North Wall	North Wall	East Wall	East Wall Door	South Wall	West Wall	West Wall Door	Ceiling
Description:	SPECT/CT Room	CT/CT Control Room	CT Control Room	CT Control Room	Electrical Room	Corridor	Corridor	Inpatient Rooms
Pb Thickness (mm)	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year
0	0.02	0.02	0.02	0.02	0.00	0.01	0.01	0.02
1	0.02	0.02	0.02	0.02	0.00	0.01	0.01	0.02
2	0.02	0.01	0.02	0.02	0.00	0.01	0.00	0.02
3	0.02	0.01	0.02	0.02	0.00	0.01	0.00	0.01
4	0.01	0.01	0.01	0.01	0.00	0.01	0.00	0.01
5	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.01
6	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.01
7	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.01
8	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.01
9	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.01
10	0.01	0.00	0.01	0.01	0.00	0.00	0.00	0.01
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Concrete Thickness (cm)	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year
0	0.02	0.02	0.02	0.02	0.00	0.01	0.01	0.02
1	0.02	0.02	0.02	0.02	0.00	0.01	0.01	0.02
2	0.02	0.02	0.02	0.02	0.00	0.01	0.01	0.02
3	0.02	0.02	0.02	0.02	0.00	0.01	0.01	0.02
4	0.02	0.01	0.02	0.02	0.00	0.01	0.00	0.02
5	0.02	0.01	0.02	0.02	0.00	0.01	0.00	0.02
6	0.01	0.01	0.02	0.02	0.00	0.01	0.00	0.01
7	0.01	0.01	0.01	0.01	0.00	0.01	0.00	0.01
8	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.01
9	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.01
10	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.01
12	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.01
14	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00



Facility: Intermountain Health Logan Regional Hospital

Date: 4/2/2024

Physicist: Kelli J. Silverstrim, PhD, DABR

Room Number: 1618

Barrier:	North Wall	North Wall	East Wall	East Wall Door	South Wall	West Wall	West Wall Door	Ceiling
Description:	SPECT/CT Room	CT/CT Control Room	CT/CT Control Room	CT/CT Control Room	Electrical Room	Corridor	Corridor	Inpatient Rooms
Pb Thickness (inches)	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year
1/32	0.02	0.02	0.02	0.02	0.00	0.01	0.01	0.02
1/16	0.02	0.02	0.02	0.02	0.00	0.01	0.00	0.02
3/32	0.02	0.01	0.02	0.02	0.00	0.01	0.00	0.02
1/8	0.01	0.01	0.02	0.02	0.00	0.01	0.00	0.01
3/16	0.01	0.01	0.01	0.01	0.00	0.01	0.00	0.01
1/4	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.01
5/16	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.01
3/8	0.01	0.00	0.01	0.01	0.00	0.00	0.00	0.01
7/16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3/4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 1/32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 1/16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 3/32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 1/8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 3/16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 1/4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Concrete Thickness (inches)	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year
0.5	0.02	0.02	0.02	0.02	0.00	0.01	0.01	0.02
1.0	0.02	0.02	0.02	0.02	0.00	0.01	0.01	0.02
1.5	0.02	0.01	0.02	0.02	0.00	0.01	0.00	0.02
2.0	0.02	0.01	0.02	0.02	0.00	0.01	0.00	0.02
2.5	0.01	0.01	0.01	0.01	0.00	0.01	0.00	0.01
3.0	0.01	0.01	0.01	0.01	0.00	0.01	0.00	0.01
3.5	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.01
4.0	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.01
4.5	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.01
5.0	0.01	0.00	0.01	0.01	0.00	0.00	0.00	0.01
5.5	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00
6.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00



PET-CT IMAGING ROOM CT SHIELDING CALCULATIONS

Facility: **Intermountain Health Logan Regional Hospital**

Date: **4/2/2024**

Physicist: **Kelli J. Silverstrim, PhD, DABR**

Room Number: **1618**

Cardiac Procedures / Week

Enter **90**

Technique (DLP) Cardiac

Enter **100**

Whole Body Procedures / Week

Enter **0**

Technique (DLP) Whole Body

Enter

% of these procedures that
are scanned twice. (Contrast)

Enter **0**

Technique (kVp)

Enter **120**

Total # Procedures / Week

90

NCRP 147 Equation A2

$$X = \frac{1}{\alpha \gamma} \ln \left(\frac{B^{-\gamma} + \frac{\beta}{\alpha}}{1 + \frac{\beta}{\alpha}} \right) \quad B = \frac{\left(\frac{P}{100} \right) T}{Sc}$$

Barrier:	North Wall SPECT/CT Room	North Wall SPECT/CT Control Room	East Wall PET/CT Control Room	East Wall Door PET/CT Control Room	South Wall Electrical Room	West Wall Corridor	West Wall Door Corridor	Ceiling Inpatient Rooms
Description:								
Occupancy Factor (T)	0.500	1.000	1.000	1.000	0.050	0.200	0.125	1.000
Annual Limit (mSv) (P)	2.500	2.500	2.500	2.500	1.000	1.000	1.000	1.000
Distance (inches)	120.360	186.960	165.240	164.400	113.640	116.880	115.200	172.000
Exposure Limit (mSv) Weekly (P)	0.05	0.05	0.05	0.05	0.02	0.02	0.02	0.02
Distance (m)	3.06	4.75	4.20	4.18	2.89	2.97	2.93	4.37
Incident Scatter (mGy/wk) (Sc)	0.35	0.14	0.18	0.19	0.39	0.37	0.38	0.17
Transmission Factor (B)	0.288	0.348	0.272	0.269	1.029	0.272	0.423	0.118
Pb Thickness (mm) (X)	0.20	0.16	0.21	0.21	0.00	0.21	0.13	0.40
Concrete Thickness (cm) (X)	2.60	2.18	2.73	2.75	-0.05	2.73	1.75	4.68
Steel Thickness (cm) (X)	0.10	0.08	0.10	0.10	0.00	0.10	0.06	0.23
Pb Thickness (in)	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.02
Concrete Thickness (in)	1.02	0.86	1.07	1.08	-0.02	1.07	0.69	1.84
Steel Thickness (in)	0.04	0.03	0.04	0.04	0.00	0.04	0.02	0.09



Facility: Intermountain Health Logan Regional Hospital

Date: 4/2/2024

Physicist: Kelli J. Silverstrim, PhD, DABR

Room Number: 1618

Imaging Room Page Two

Barrier:	North Wall	North Wall	East Wall	East Wall Door	South Wall	West Wall	West Wall Door	Ceiling
Description:	SPECT/CT Room	CT/CT Control Room	CT/CT Control Room	CT/CT Control Room	Electrical Room	Corridor	Corridor	Inpatient Rooms
Pb Thickness (inches)	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year
1/32	0.26	0.21	0.27	0.27	0.03	0.11	0.07	0.25
1/16	0.03	0.02	0.03	0.03	0.00	0.01	0.01	0.03
3/32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3/16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3/8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3/4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 1/32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 1/16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 3/32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 1/8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 3/16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 1/4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Concrete Thickness (inches)	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year
0.5	4.60	3.81	4.88	4.93	0.52	1.95	1.26	4.51
1.0	2.56	2.12	2.72	2.75	0.29	1.09	0.70	2.51
1.5	1.47	1.22	1.56	1.58	0.17	0.62	0.40	1.44
2.0	0.86	0.72	0.92	0.93	0.10	0.37	0.24	0.85
2.5	0.51	0.43	0.54	0.55	0.06	0.22	0.14	0.50
3.0	0.31	0.26	0.33	0.33	0.03	0.13	0.08	0.30
3.5	0.19	0.15	0.20	0.20	0.02	0.08	0.05	0.18
4.0	0.11	0.09	0.12	0.12	0.01	0.05	0.03	0.11
4.5	0.07	0.06	0.07	0.07	0.01	0.03	0.02	0.07
5.0	0.04	0.03	0.04	0.05	0.00	0.02	0.01	0.04
5.5	0.03	0.02	0.03	0.03	0.00	0.01	0.01	0.03
6.0	0.02	0.01	0.02	0.02	0.00	0.01	0.00	0.02
6.5	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.01
7.0	0.01	0.00	0.01	0.01	0.00	0.00	0.00	0.01
7.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00



PET-CT IMAGING ROOM
PET SHIELDING CALCULATIONS

Facility: **Intermountain Health Logan Regional Hospital**

Date: **4/2/2024**

Physicist: **Kelli J. Silverstrim, PhD, DABR**

Room Number: **1618**

Dose equivalent Rate Constants and Barrier Transmission Data from "AAPM Task Group 108 PET and PET-CT Shielding Requirements" Medical Physics, 2005

Administered Activity (Ao)
(mCi)

Enter **10.0**

Imaging Time (ti)
(min)

Enter **40**

Uptake Time (Tu)
(min)

Enter **60**

Patients per Week (Nw)
Enter **20**

Radionuclide
Enter **F-18**

Scanner Reduction Factor (Sf)
0.850

Urine Void Reduction Factor (Uf)
0.850

Decay Reduction Factor (Rti)
0.832

Imaging Room Decay Factor (Fu)
0.777

Patient Dose Rate uSv-m2/MBq-h
0.092

Half-Life (Minutes)
109.8

Equation #9 AAPM TG 108

Weekly Dose = ((0.092 uSv m2 /MBq h) x Nw x Ao(MBq) x Sf x Uf x Fu x ti(h) x Rti / d(m)2) x T

Equation #10 AAPM TG 108

Transmission Factor (B) = 10.9 x P x d(m)2 / (T x Nw x Ao(MBq) x Sf x Fu x ti(h) x Rti)

Barrier:	North Wall	North Wall	East Wall	East Wall Door	South Wall	West Wall	West Wall Door	Ceiling
Description:	SPECT/CT Room	SPECT/CT Control Room	PET/CT Control Room	PET/CT Control Room	Electrical Room	Corridor	Corridor	Inpatient Rooms
Occupancy Factor (T)	0.500	1.000	1.000	1.000	0.050	0.200	0.125	1.000
Annual Limit (mSv) (P) (100 mRem = 1 mSv)	2.5	2.5	2.5	2.5	1.0	1.0	1.0	1.0
Distance (inches)	120.36	186.96	165.24	164.40	113.64	116.88	115.20	172.00
uSv per week Equation #9 AAPM TG 108	11.29	9.36	11.98	12.10	1.27	4.79	3.08	11.05
B* Transmission Factor Equation #10 AAPM TG 108	4.42	5.33	4.16	4.12	15.76	4.17	6.48	1.81
Pb Thickness (mm)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Concrete Thickness (cm)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pb Thickness (in)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Concrete Thickness (in)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00



Facility: Intermountain Health Logan Regional Hospital

Date: 4/2/2024

Physicist: Kelli J. Silverstrim, PhD, DABR

Room Number: 1618

Barrier:	North Wall	North Wall	East Wall	East Wall Door	South Wall	West Wall	West Wall Door	Ceiling
Description:	SPECT/CT Room	CT/CT Control Room	CT Control Room	CT Control Room	Electrical Room	Corridor	Corridor	Inpatient Rooms
Pb Thickness (mm)	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year
0	0.56	0.47	0.60	0.60	0.06	0.24	0.15	0.55
1	0.50	0.42	0.53	0.54	0.06	0.21	0.14	0.49
2	0.44	0.37	0.47	0.48	0.05	0.19	0.12	0.44
3	0.39	0.32	0.41	0.42	0.04	0.17	0.11	0.38
4	0.34	0.28	0.36	0.36	0.04	0.14	0.09	0.33
5	0.29	0.24	0.31	0.32	0.03	0.13	0.08	0.29
6	0.26	0.21	0.27	0.27	0.03	0.11	0.07	0.25
7	0.22	0.18	0.23	0.24	0.02	0.09	0.06	0.22
8	0.19	0.16	0.20	0.20	0.02	0.08	0.05	0.19
9	0.16	0.14	0.17	0.17	0.02	0.07	0.04	0.16
10	0.14	0.12	0.15	0.15	0.02	0.06	0.04	0.14
12	0.10	0.09	0.11	0.11	0.01	0.04	0.03	0.10
14	0.08	0.06	0.08	0.08	0.01	0.03	0.02	0.07
16	0.06	0.05	0.06	0.06	0.01	0.02	0.02	0.05
18	0.04	0.03	0.04	0.04	0.00	0.02	0.01	0.04
20	0.03	0.03	0.03	0.03	0.00	0.01	0.01	0.03
25	0.01	0.01	0.01	0.01	0.00	0.01	0.00	0.01
30	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.01
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Concrete Thickness (cm)	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year
0	0.56	0.47	0.60	0.60	0.06	0.24	0.15	0.55
1	0.54	0.45	0.57	0.58	0.06	0.23	0.15	0.53
2	0.51	0.43	0.54	0.55	0.06	0.22	0.14	0.50
3	0.48	0.40	0.51	0.52	0.05	0.20	0.13	0.47
4	0.45	0.37	0.47	0.48	0.05	0.19	0.12	0.44
5	0.41	0.34	0.43	0.44	0.05	0.17	0.11	0.40
6	0.37	0.31	0.39	0.39	0.04	0.16	0.10	0.36
7	0.33	0.27	0.35	0.35	0.04	0.14	0.09	0.32
8	0.29	0.24	0.31	0.31	0.03	0.12	0.08	0.29
9	0.26	0.21	0.27	0.28	0.03	0.11	0.07	0.25
10	0.22	0.19	0.24	0.24	0.03	0.10	0.06	0.22
12	0.17	0.14	0.18	0.18	0.02	0.07	0.05	0.17
14	0.13	0.10	0.13	0.14	0.01	0.05	0.03	0.12
16	0.09	0.08	0.10	0.10	0.01	0.04	0.03	0.09
18	0.07	0.06	0.07	0.07	0.01	0.03	0.02	0.07
20	0.05	0.04	0.05	0.05	0.01	0.02	0.01	0.05
25	0.02	0.02	0.03	0.03	0.00	0.01	0.01	0.02
30	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.01
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00



Facility: Intermountain Health Logan Regional Hospital

Date: 4/2/2024

Physicist: Kelli J. Silverstrim, PhD, DABR

Room Number: 1618

Barrier:	North Wall	North Wall	East Wall	East Wall Door	South Wall	West Wall	West Wall Door	Ceiling
Description:	SPECT/CT Room	CT/CT Control Room	CT/CT Control Room	CT/CT Control Room	Electrical Room	Corridor	Corridor	Inpatient Rooms
Pb Thickness (inches)	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year
1/32	0.52	0.43	0.55	0.55	0.06	0.22	0.14	0.50
1/16	0.47	0.39	0.50	0.50	0.05	0.20	0.13	0.46
3/32	0.42	0.35	0.45	0.45	0.05	0.18	0.12	0.41
1/8	0.38	0.32	0.40	0.41	0.04	0.16	0.10	0.37
3/16	0.31	0.25	0.32	0.33	0.03	0.13	0.08	0.30
1/4	0.24	0.20	0.26	0.26	0.03	0.10	0.07	0.24
5/16	0.19	0.16	0.20	0.21	0.02	0.08	0.05	0.19
3/8	0.15	0.12	0.16	0.16	0.02	0.06	0.04	0.15
7/16	0.12	0.10	0.13	0.13	0.01	0.05	0.03	0.12
1/2	0.09	0.08	0.10	0.10	0.01	0.04	0.03	0.09
5/8	0.06	0.05	0.06	0.06	0.01	0.02	0.02	0.06
3/4	0.03	0.03	0.04	0.04	0.00	0.01	0.01	0.03
7/8	0.02	0.02	0.02	0.02	0.00	0.01	0.01	0.02
1	0.01	0.01	0.01	0.01	0.00	0.01	0.00	0.01
1 1/32	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.01
1 1/16	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.01
1 3/32	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.01
1 1/8	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.01
1 3/16	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.01
1 1/4	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00
Concrete Thickness (inches)	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year
0.5	0.53	0.44	0.57	0.57	0.06	0.23	0.15	0.52
1.0	0.50	0.41	0.53	0.53	0.06	0.21	0.14	0.49
1.5	0.45	0.37	0.48	0.48	0.05	0.19	0.12	0.44
2.0	0.40	0.34	0.43	0.43	0.05	0.17	0.11	0.40
2.5	0.35	0.29	0.38	0.38	0.04	0.15	0.10	0.35
3.0	0.31	0.25	0.32	0.33	0.03	0.13	0.08	0.30
3.5	0.26	0.22	0.28	0.28	0.03	0.11	0.07	0.26
4.0	0.22	0.18	0.23	0.24	0.02	0.09	0.06	0.22
4.5	0.18	0.15	0.20	0.20	0.02	0.08	0.05	0.18
5.0	0.15	0.13	0.16	0.16	0.02	0.07	0.04	0.15
5.5	0.13	0.11	0.13	0.14	0.01	0.05	0.03	0.12
6.0	0.11	0.09	0.11	0.11	0.01	0.04	0.03	0.10
6.5	0.09	0.07	0.09	0.09	0.01	0.04	0.02	0.09
7.0	0.07	0.06	0.08	0.08	0.01	0.03	0.02	0.07
7.5	0.06	0.05	0.06	0.06	0.01	0.03	0.02	0.06
8.0	0.05	0.04	0.05	0.05	0.01	0.02	0.01	0.05
8.5	0.04	0.03	0.04	0.04	0.00	0.02	0.01	0.04
9.0	0.03	0.03	0.03	0.04	0.00	0.01	0.01	0.03
9.5	0.03	0.02	0.03	0.03	0.00	0.01	0.01	0.03
10.0	0.02	0.02	0.02	0.02	0.00	0.01	0.01	0.02
10.5	0.02	0.02	0.02	0.02	0.00	0.01	0.00	0.02
11.0	0.02	0.01	0.02	0.02	0.00	0.01	0.00	0.01
11.5	0.01	0.01	0.01	0.01	0.00	0.01	0.00	0.01
12.0	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.01



PET-CT IMAGING ROOM CT SHIELDING CALCULATIONS

Facility: **Intermountain Health Logan Regional Hospital**

Date: **4/2/2024**

Physicist: **Kelli J. Silverstrim, PhD, DABR**

Room Number: **1618**

Cardiac Procedures / Week

Enter **0**

Technique (DLP) Cardiac

Enter

Whole Body Procedures / Week

Enter **20**

Technique (DLP) Whole Body

Enter **700**

% of these procedures that
are scanned twice. (Contrast)

Enter **0**

Technique (kVp)

Enter **120**

Total # Procedures / Week

20

NCRP 147 Equation A2

$$X = \frac{1}{\alpha \gamma} \ln \left(\frac{B^{-\gamma} + \frac{\beta}{\alpha}}{1 + \frac{\beta}{\alpha}} \right) \quad B = \frac{\left(\frac{P}{100} \right) T}{Sc}$$

Barrier:	North Wall SPECT/CT Room	North Wall SPECT/CT Control Room	East Wall PET/CT Control Room	East Wall Door PET/CT Control Room	South Wall Electrical Room	West Wall Corridor	West Wall Door Corridor	Ceiling Inpatient Rooms
Description:								
Occupancy Factor (T)	0.500	1.000	1.000	1.000	0.050	0.200	0.125	1.000
Annual Limit (mSv) (P)	2.500	2.500	2.500	2.500	1.000	1.000	1.000	1.000
Distance (inches)	120.360	186.960	165.240	164.400	113.640	116.880	115.200	172.000
Exposure Limit (mSv) Weekly (P)	0.05	0.05	0.05	0.05	0.02	0.02	0.02	0.02
Distance (m)	3.06	4.75	4.20	4.18	2.89	2.97	2.93	4.37
Incident Scatter (mGy/wk) (Sc)	0.54	0.22	0.29	0.29	0.60	0.57	0.59	0.26
Transmission Factor (B)	0.185	0.224	0.175	0.173	0.661	0.175	0.272	0.076
Pb Thickness (mm) (X)	0.29	0.25	0.30	0.30	0.06	0.30	0.21	0.51
Concrete Thickness (cm) (X)	3.61	3.17	3.74	3.77	0.82	3.74	2.73	5.75
Steel Thickness (cm) (X)	0.15	0.13	0.16	0.16	0.02	0.16	0.10	0.32
Pb Thickness (in)	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.02
Concrete Thickness (in)	1.42	1.25	1.47	1.48	0.32	1.47	1.07	2.26
Steel Thickness (in)	0.06	0.05	0.06	0.06	0.01	0.06	0.04	0.12



Facility: Intermountain Health Logan Regional Hospital

Date: 4/2/2024

Physicist: Kelli J. Silverstrim, PhD, DABR

Room Number: 1618

Imaging Room Page Two

Barrier:	North Wall	North Wall	East Wall	East Wall Door	South Wall	West Wall	West Wall Door	Ceiling
Description:	SPECT/CT Room	CT/CT Control Rm	CT/CT Control Rm	CT/CT Control Rm	Electrical Room	Corridor	Corridor	Inpatient Rooms
Pb Thickness (inches)	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year
1/32	0.40	0.33	0.42	0.43	0.04	0.17	0.11	0.39
1/16	0.05	0.04	0.05	0.05	0.01	0.02	0.01	0.04
3/32	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.01
1/8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3/16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3/8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3/4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 1/32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 1/16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 3/32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 1/8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 3/16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 1/4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Concrete Thickness (inches)	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year
0.5	7.16	5.93	7.59	7.67	0.80	3.04	1.95	7.01
1.0	3.99	3.30	4.23	4.27	0.45	1.69	1.09	3.90
1.5	2.29	1.90	2.43	2.46	0.26	0.97	0.63	2.24
2.0	1.34	1.11	1.43	1.44	0.15	0.57	0.37	1.32
2.5	0.80	0.66	0.85	0.86	0.09	0.34	0.22	0.78
3.0	0.48	0.40	0.51	0.51	0.05	0.20	0.13	0.47
3.5	0.29	0.24	0.31	0.31	0.03	0.12	0.08	0.28
4.0	0.18	0.15	0.19	0.19	0.02	0.07	0.05	0.17
4.5	0.11	0.09	0.11	0.11	0.01	0.05	0.03	0.11
5.0	0.07	0.05	0.07	0.07	0.01	0.03	0.02	0.06
5.5	0.04	0.03	0.04	0.04	0.00	0.02	0.01	0.04
6.0	0.02	0.02	0.03	0.03	0.00	0.01	0.01	0.02
6.5	0.02	0.01	0.02	0.02	0.00	0.01	0.00	0.01
7.0	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.01
7.5	0.01	0.00	0.01	0.01	0.00	0.00	0.00	0.01
8.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00



PET-CT IMAGING ROOM PET-CT SUMMARY

Intermountain LRH PET CT Rm 1618 Shielding F18 Version EVAL 04 02 2024.xlsm

Facility: Intermountain Health Logan Regional Hospital

Date: 4/2/2024

Physicist: Kelli J. Silverstrim, PhD, DABR

Room Number: 1618

Barrier:	North Wall	North Wall	East Wall	East Wall Door	South Wall	West Wall	West Wall Door	Ceiling
Description:	SPECT/CT Room	SPECT/CT Control Room	PET/CT Control Room	PET/CT Control Room	Electrical Room	Corridor	Corridor	Inpatient Rooms
Annual Limit (mSv) (P)	2.5	2.5	2.5	2.5	1	1	1	1
Pb Thickness (inches)	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year
1/32	0.91	0.76	0.97	0.98	0.10	0.39	0.25	0.89
1/16	0.51	0.43	0.55	0.55	0.06	0.22	0.14	0.50
3/32	0.43	0.36	0.46	0.46	0.05	0.18	0.12	0.42
1/8	0.38	0.32	0.40	0.41	0.04	0.16	0.10	0.37
3/16	0.31	0.25	0.32	0.33	0.03	0.13	0.08	0.30
1/4	0.24	0.20	0.26	0.26	0.03	0.10	0.07	0.24
5/16	0.19	0.16	0.20	0.21	0.02	0.08	0.05	0.19
3/8	0.15	0.12	0.16	0.16	0.02	0.06	0.04	0.15
7/16	0.12	0.10	0.13	0.13	0.01	0.05	0.03	0.12
1/2	0.09	0.08	0.10	0.10	0.01	0.04	0.03	0.09
5/8	0.06	0.05	0.06	0.06	0.01	0.02	0.02	0.06
3/4	0.03	0.03	0.04	0.04	0.00	0.01	0.01	0.03
7/8	0.02	0.02	0.02	0.02	0.00	0.01	0.01	0.02
1	0.01	0.01	0.01	0.01	0.00	0.01	0.00	0.01
1 1/32	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.01
1 1/16	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.01
1 3/32	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.01
1 1/8	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.01
1 3/16	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.01
1 1/4	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00
Concrete Thickness (inches)	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year	mSv / year
0.5	7.69	6.37	8.16	8.24	0.86	3.26	2.10	7.53
1.0	4.48	3.72	4.76	4.81	0.50	1.90	1.22	4.39
1.5	2.74	2.27	2.91	2.94	0.31	1.16	0.75	2.69
2.0	1.75	1.45	1.85	1.87	0.20	0.74	0.48	1.71
2.5	1.15	0.96	1.22	1.24	0.13	0.49	0.31	1.13
3.0	0.79	0.65	0.83	0.84	0.09	0.33	0.21	0.77
3.5	0.55	0.46	0.58	0.59	0.06	0.23	0.15	0.54
4.0	0.40	0.33	0.42	0.42	0.04	0.17	0.11	0.39
4.5	0.29	0.24	0.31	0.31	0.03	0.12	0.08	0.29
5.0	0.22	0.18	0.23	0.23	0.02	0.09	0.06	0.21
5.5	0.17	0.14	0.18	0.18	0.02	0.07	0.05	0.16
6.0	0.13	0.11	0.14	0.14	0.01	0.06	0.04	0.13
6.5	0.10	0.08	0.11	0.11	0.01	0.04	0.03	0.10
7.0	0.08	0.07	0.09	0.09	0.01	0.03	0.02	0.08
7.5	0.06	0.05	0.07	0.07	0.01	0.03	0.02	0.06
8.0	0.05	0.04	0.06	0.06	0.01	0.02	0.01	0.05
8.5	0.04	0.03	0.04	0.04	0.00	0.02	0.01	0.04
9.0	0.03	0.03	0.04	0.04	0.00	0.01	0.01	0.03
9.5	0.03	0.02	0.03	0.03	0.00	0.01	0.01	0.03
10.0	0.02	0.02	0.02	0.02	0.00	0.01	0.01	0.02
10.5	0.02	0.02	0.02	0.02	0.00	0.01	0.01	0.02
11.0	0.02	0.01	0.02	0.02	0.00	0.01	0.00	0.01
11.5	0.01	0.01	0.01	0.01	0.00	0.01	0.00	0.01
12.0	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.01

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APPENDIX 02

OWNER VENDOR (GE) SITE-SPECIFIC
EQUIPMENT DRAWINGS



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			<div>Logan Regional Hospital</div> <div>Logan, UT</div> <div>USA</div>																															
A	17/MAY/2024	FINAL (DC-430670)																																
REV	DATE	MODIFICATIONS																																
01 - C1 - Cover Sheet		16 - E2 - Electrical Layout			<div><div> GE Healthcare</div><div>Brian Leveille</div><div>+1 3852140181</div><div>Brian.leveille@gehealthcare.com</div></div> <div>DISCOVERY MI PET/CT</div> <div>FINAL STUDY</div> <table><tr><td colspan="2">Drawn by</td><td>Verified by</td><td>Concession</td><td>S.O. (GON)</td><td>PIM Manual</td><td>Rev</td></tr><tr><td colspan="2">DJC</td><td>CRM</td><td>-</td><td>2007792667.7</td><td>5661740-1EN</td><td>7</td></tr><tr><td>Format</td><td>Scale</td><td colspan="3">File Name</td><td>Date</td><td>Sheet</td></tr><tr><td>A3</td><td>1/4"=1'-0"</td><td colspan="3">PET-M395911-FIN-00-A.DWG</td><td>17/MAY/2024</td><td>01/19</td></tr></table>		Drawn by		Verified by	Concession	S.O. (GON)	PIM Manual	Rev	DJC		CRM	-	2007792667.7	5661740-1EN	7	Format	Scale	File Name			Date	Sheet	A3	1/4"=1'-0"	PET-M395911-FIN-00-A.DWG			17/MAY/2024	01/19
Drawn by		Verified by	Concession	S.O. (GON)			PIM Manual	Rev																										
DJC		CRM	-	2007792667.7			5661740-1EN	7																										
Format	Scale	File Name					Date	Sheet																										
A3	1/4"=1'-0"	PET-M395911-FIN-00-A.DWG					17/MAY/2024	01/19																										
02 - C2 - Disclaimer - Site Readiness		17 - E3 - Electrical Elevations																																
03 - A1 - General Notes		18 - E4 - Power Requirements																																
04 - A2 - Equipment Layout		19 - E5 - Details - Interconnections																																
05 - A3 - Radiation Protection																																		
06 - A4 - Radiation Protection Details																																		
07 - A5 - Equipment Dimensions (1)																																		
08 - A6 - Equipment Dimensions (2)																																		
09 - A6 - Equipment Dimensions (3)																																		
10 - A7 - Delivery																																		
11 - S1 - Structural Notes																																		
12 - S2 - Structural Layout																																		
13 - S3 - Structural Details (1)																																		
14 - M1 - HVAC																																		
15 - E1 - Electrical Notes																																		
A mandatory component of this drawing set is the GE Healthcare Pre Installation manual. Failure to reference the Pre Installation manual will result in incomplete documentation required for site design and preparation.																																		
Pre Installation documents for GE Healthcare products can be accessed on the web at: www.gehealthcare.com/siteplanning																																		
GE does not take responsibility for any damages resulting from changes on drawings made by others. Errors may occur by not referring to the complete set of final issue drawing. GE cannot accept responsibility for any damage due to the partial use of GE final issue drawings, however caused. All dimensions are in millimeters unless otherwise specified. Do not scale from printed pdf files. GE accepts no responsibility or liability for defective work due to scaling from these drawings.																																		

DISCLAIMER

GENERAL SPECIFICATIONS

- GE is not responsible for the installation of developers and associated equipment, lighting, cassette trays and protective screens or derivatives not mentioned in the order.
- The final study contains recommendations for the location of GE equipment and associated devices, electrical wiring and room arrangements. When preparing the study, every effort has been made to consider every aspect of the actual equipment expected to be installed.
- The layout of the equipment offered by GE, the dimensions given for the premises, the details provided for the pre-installation work and electrical power supply are given according to the information noted during on-site study and the wishes expressed by the customer.
- The room dimensions used to create the equipment layout may originate from a previous layout and may not be accurate as they may not have been verified on site. GE cannot take any responsibility for errors due to lack of information.
- Dimensions apply to finished surfaces of the room.
- Actual configuration may differ from options presented in some typical views or tables.
- If this set of final drawings has been approved by the customer, any subsequent modification of the site must be subject to further investigation by GE about the feasibility of installing the equipment. Any reservations must be noted.
- The equipment layout indicates the placement and interconnection of the indicated equipment components. There may be local requirements that could impact the placement of these components. It remains the customer's responsibility to ensure that the site and final equipment placement complies with all applicable local requirements.
- All work required to install GE equipment must be carried out in compliance with the building regulations and the safety standards of legal force in the country concerned.
- These drawings are not to be used for actual construction purposes. The company cannot take responsibility for any damage resulting therefrom.

CUSTOMER RESPONSIBILITIES

- It is the responsibility of the customer to prepare the site in accordance with the specifications stated in the final study. A detailed site readiness checklist is provided by GE. It is the responsibility of the customer to ensure all requirements are fulfilled and that the site conforms to all specifications defined in the checklist and final study. The GE Project Manager of Installation (PMI) will work in cooperation with the customer to follow up and ensure that actions in the checklist are complete, and if necessary, will aid in the rescheduling of the delivery and installation date.
- Prior to installation, a structural engineer of record must ensure that the floor and ceiling is designed in such a way that the loads of the installed system can be securely borne and transferred. The layout of additional structural elements, dimensioning and the selection of appropriate installation methods are the sole responsibility of the structural engineer. Execution of load bearing structures supporting equipment on the ceiling, floor or walls are the customer's responsibility.

RADIO-PROTECTION

- Suitable radiological protection must be determined by a qualified radiological physicist in conformation with local regulations. GE does not take responsibility for the specification or provision of radio-protection.

THE UNDERSIGNED, HEREBY CERTIFIES THAT I HAVE READ AND APPROVED THE PLANS IN THIS DOCUMENT.		
DATE	NAME	SIGNATURE

CUSTOMER SITE READINESS REQUIREMENTS

REQUIRED MANUALS FOR SYSTEM PRE-INSTALLATION	
Description	Document Number*
Product specific Pre-installation Manual	Refer to cover page
*documents can be accessed in multiple languages at https://www.gehealthcare.com/support/manuals	

- A mandatory component of this drawing set is the GE HealthCare Pre-installation manual. Failure to reference the Pre-installation manual will result in incomplete documentation required for site design and preparation.
- The items on the GE HealthCare Site Readiness Checklist **DOC2949061** and Worksheet **DOC2949068** are REQUIRED to facilitate equipment delivery to the site. Equipment will not be delivered if these requirements are not satisfied.
 - Any deviation from these drawings must be communicated in writing to and reviewed by your local GE HealthCare installation project manager prior to making changes.
 - Make arrangements for any rigging, special handling, or facility modifications that must be made to deliver the equipment to the installation site. If desired, your local GE HealthCare installation project manager can supply a reference list of rigging contractors.
 - New construction requires the following;
 1. Secure area for equipment,
 2. Power for drills and other test equipment,
 3. Restrooms.
 - Provide for refuse removal and disposal (e.g. crates, cartons, packing)
 - It is required to minimize vibrations within the scan room. It is the customer's responsibility to contract a vibration consultant/engineer to implement site design modifications to meet the GE vibration specification. Refer to the system Pre-installation manual for vibration specifications.

ENVIRONMENT

ALTITUDE

- Operating altitude: from -150 m [-492 ft] (below) to 2400 m [7875 ft] (above) sea level.

MAGNETIC FIELD SPECIFICATIONS

- Limit the magnetic interference to guarantee specified imaging performance.

GANTRY

- Ambient static magnetic fields less than 1 Gauss.
- Ambient AC magnetic fields less than 0.01 Gauss.

OPERATOR CONSOLE

- Ambient static magnetic fields less than 10 Gauss.

MAXIMUM GANTRY AUDIBLE NOISE LEVEL

- The maximum ambient noise level is produced by the gantry during a CT scan acquisition.
- It is less than 70 dBA when measured at a distance of one meter from the nearest gantry surface, in any direction.

BACKGROUND RADIATION

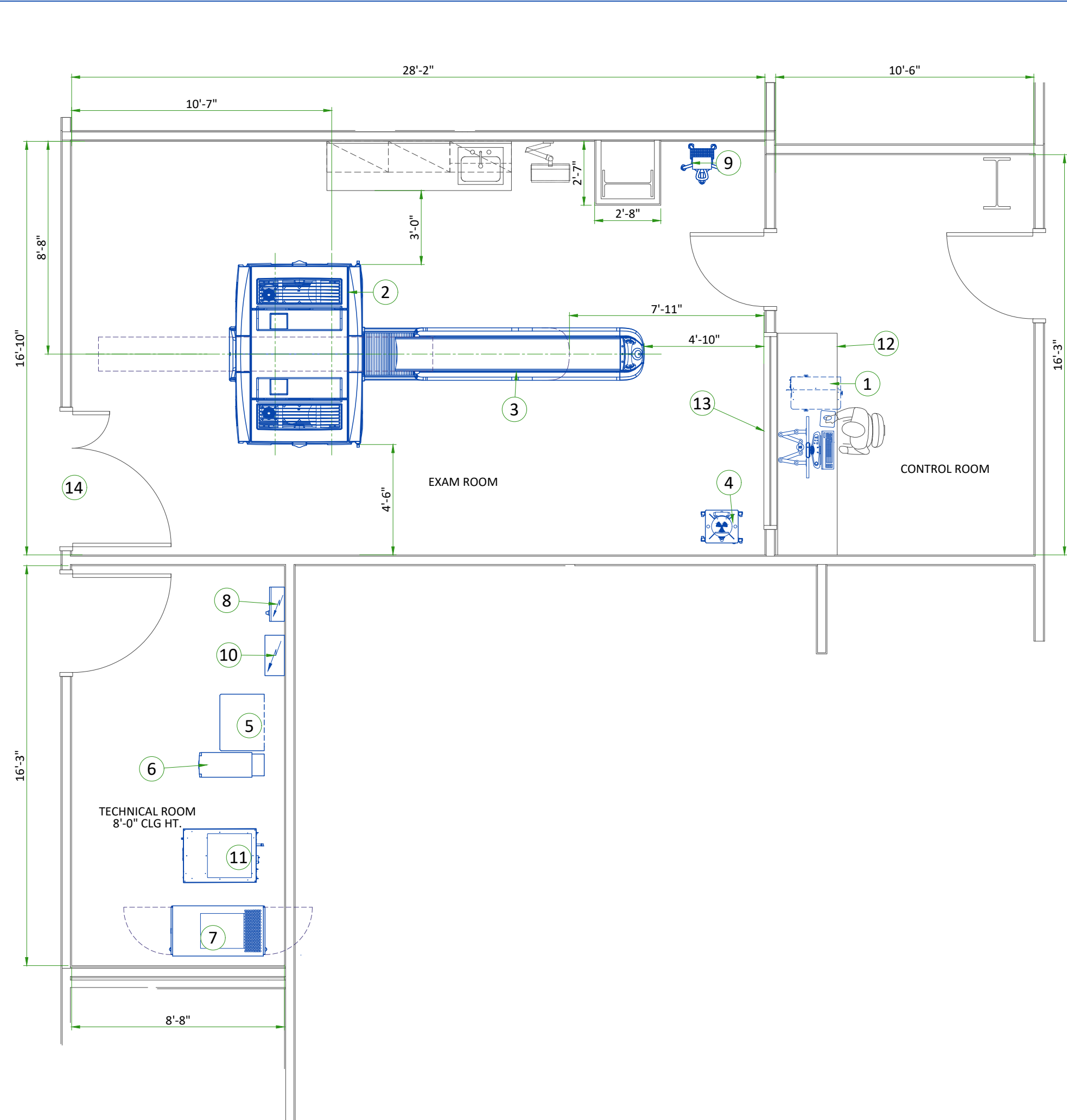
- It is important that background radiation be kept to a minimum. The coincidence detection used in a PET system allows a moderate amount of external singles events. The PET/CT system has been found to have less than 1% deadtime if the external field is below 1 mR/hr from a single source.
- Because area background can be more general than a single source, a lower limit is appropriate. If the area dose rate is maintained to less than 0.2 mR/hr (due to 511 or lower energy gamma rays) at the covers, detector deadtime should not exceed 1%.
- Radioactive sources must be stored in approved shielded containers. It is recommended that any radioactive source not specifically designed to be housed in the gantry's lead storage container be stored in a separate room (hot lab) adjacent to, and accessible from, the Scan Room. Doses should be prepared in the same area.

VIBRATION SPECIFICATIONS

- Shock Restrictions: The system cannot tolerate shock or vibration. System components cannot be tipped, dropped, or hoisted.
- The scanning facility shall be isolated from vibration such as; hospital power plants, pumps, motors, air handling equipment, air conditioning units, nearby rooms with exercise equipment or where exercise occurs, hallway foot traffic, elevators, parking lots, roads, subways, trains, and heliports; otherwise, vibration will affect the image quality of the scanner.
- CT systems are sensitive to vibration and may display limited performance if exceeding the vibration limits listed below. The band of frequencies in which systems exhibit the most sensitivity appears at or near the resonant frequencies of the gantry and the patient table, the latter of which varies depending on patient mass and location. These frequencies fall within the following ranges:
 - Patient Table: 2 – 10 Hz
 - Gantry: 8 – 14 Hz
- It is the customer’s responsibility to contract a vibration consultant or qualified engineer to verify that these specifications are met and implement an appropriate solution.
- The maximum steady state vibration transmitted through the floor should not exceed 2.5 mm/s² RMS maximum single frequency above ambient baseline from 0.5 to 80 Hz (measured in any 1 hour during a normal operating period).

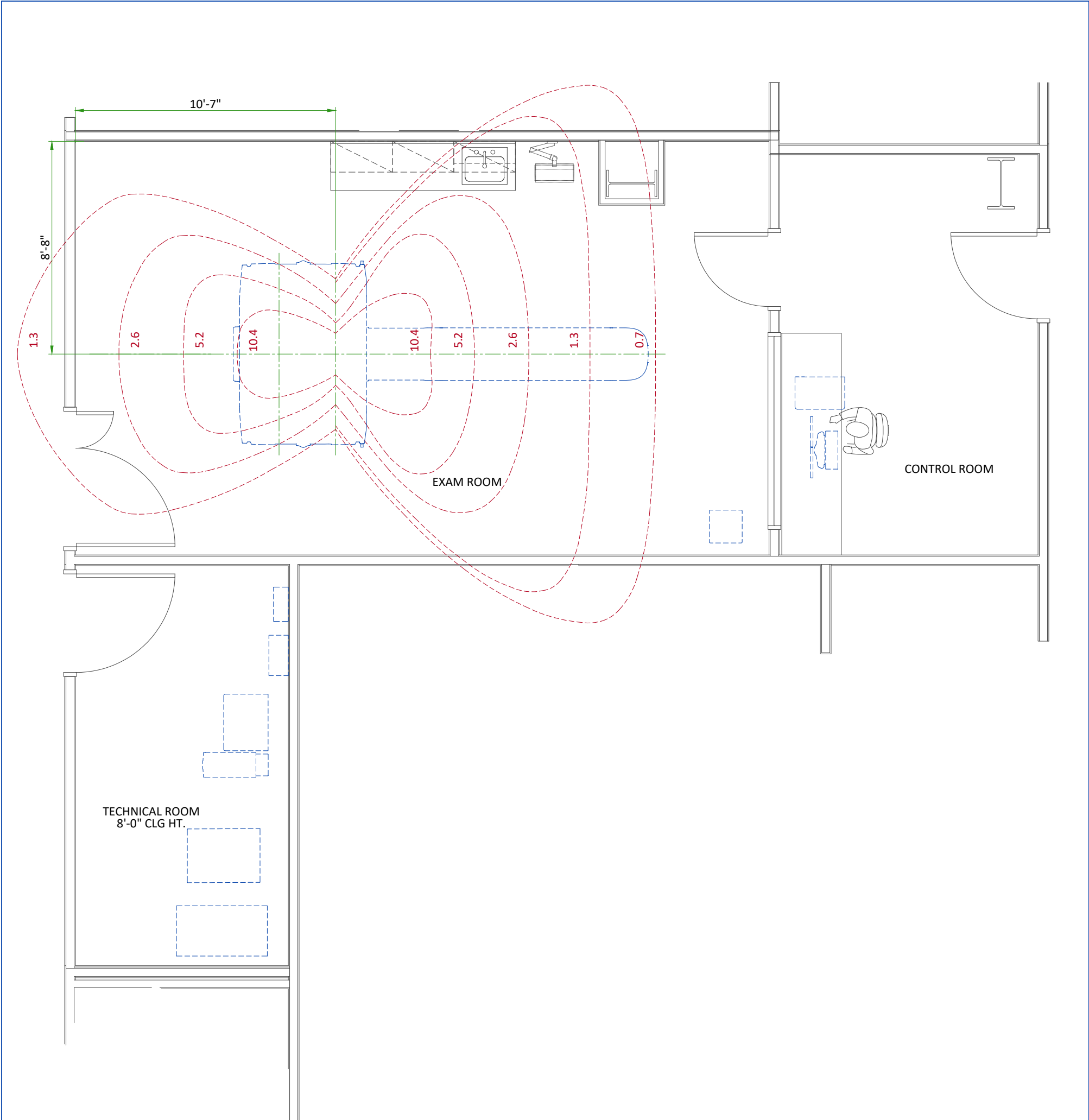
IMPORTANT CUSTOMER READINESS ALERT

- This equipment involves the use of radioactive isotopes, including those sources necessary for equipment calibration. Appropriate regulatory compliance and licensing must be arranged by the customer early in the planning process and then demonstrated/available for equipment installation.
- Note: delivery path down corridors for gantry's and table must be evaluated prior to construction, as 90 degree turns require specific corridor width.



LEGEND						
A	GE SUPPLIED			D	AVAILABLE FROM GE	
B	GE SUPPLIED/CONTRACTOR INSTALLED			E	EQUIPMENT EXISTING IN ROOM	
C	CUSTOMER/CONTRACTOR SUPPLIED AND INSTALLED			*	ITEM TO BE REINSTALLED FROM ANOTHER SITE	
BY	ITEM	DESCRIPTION	MAX HEAT OUTPUT (BTU/h)	WEIGHT (lbs)	MAX HEAT OUTPUT (W)	WEIGHT (kg)
A	1	OPEN CONSOLE	3205	144	940	65.1
A	2	GANTRY	28303	6383	8300	2895
A	3	PATIENT TABLE	1023	1813	300	822
A	4	ANNULUS PHANTOM SHIELD CONTAINER	-	329	-	149
A	5	POWER DISTRIBUTION UNIT (PDU)	3410	816	1000	370
A	6	PARTIAL UPS 14.4 KVA	3001	775	880	351.5
A	7	RECONSTRUCTION MINI CABINET (PARC4.X)	4433	474	1300	215
B	8	MAIN DISCONNECT PANEL (MDP)	-	46	-	21
A	9	IVY 7800 CARDIAC TRIGGER MONITOR	-	19	-	8.54
A	10	CHILLER PDB	-	66	-	30
A	11	AIRSYS CHILLER	9718	485	2850	220
C	12	COUNTERTOP FOR EQUIPMENT				
C	13	LEAD GLASS WINDOW				
C	14	MINIMUM OPENING FOR EQUIPMENT DELIVERY IS 1397 mm x 2032 mm [55 in x 80 in], CONTINGENT ON A 2438 mm [96 in] CORRIDOR WIDTH				

EXAM ROOM HEIGHT	
FINISHED FLOOR TO SLAB HEIGHT	14'-0"
FALSE CEILING HEIGHT	9'-0"



RADIATION PROTECTION LAYOUT

SHIELDING REQUIREMENTS SCALING	
CHANGED PARAMETER	MULTIPLICATION FACTOR
mAs	new mAs/100
80 kV	0.24
100 kV	0.45
120 kV	0.71
140 kV	1.00
1 mm aperture	0.20
3 mm aperture	0.22
5 mm aperture	0.27
10 mm aperture	0.38
15 mm aperture	0.48
20 mm aperture	0.59
30 mm aperture	0.79
40 mm aperture	1.00

SHIELDING REQUIREMENTS:

- Engage a qualified radiological health physicist to review your scan room shielding requirements, taking into consideration:
- Scatter radiation levels within the scanning room.
 - Equipment placement.
 - Weekly projected work-loads (number of patients/day technique (kvp*ma)).
 - Materials used for construction of walls, floors, ceiling, doors, and windows.
 - Activities in surrounding scan room areas.
 - Equipment in surrounding scan room areas (e.g., film developer, film storage).
 - For small and medium filter survey, the 20 cm water phantom should be placed on the phantom headholder inserted into the end of the patient table.

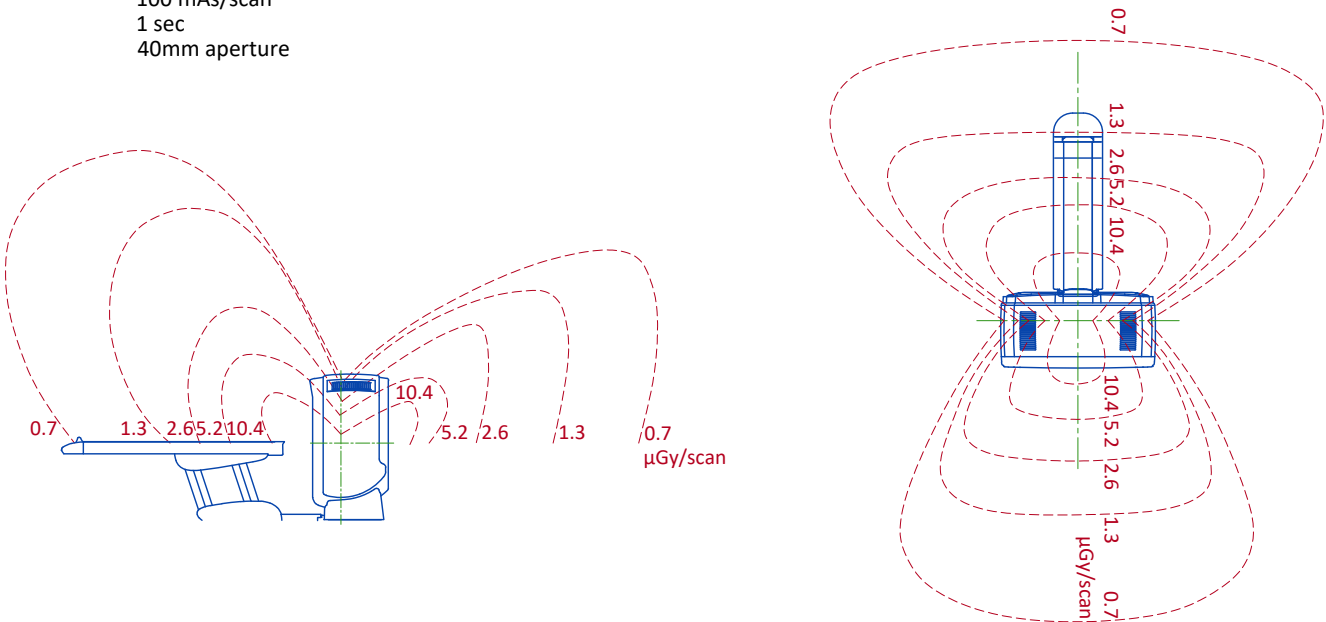
The four scatter surveys depict measured radiation levels within the scanning room at the indicated distanced, while scanning a 16 cm CTDI phantom for the Head Scan mode and 32 cm CTDI phantom for the Body Scan Mode. Use the mAs, kV and aperture scaling factors in the table shown here to adjust exposure levels to the scan technique used at the site.

For example: The exposure level for a 120 kV, 800 mA, 1 sec scan at 50" (127 cm) away from the scan plane is: $10.4 \mu\text{Gy} \times 0.71 \times 800/100 = 59.1 \mu\text{Gy}$

NOTE: Actual measurements can vary. Expected deviations equals $\pm 15\%$, expect for the 5 mA and 1.25mm techniques, where variations may be greater (up to a factor of 2), due to the inherent deviation in small values. The maximum deviation anticipated for tube output equals $\pm 40\%$.

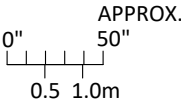
RADIATION SCATTER - HEAD PHANTOM

NOTE: 140 kV
100 mAs/scan
1 sec
40mm aperture



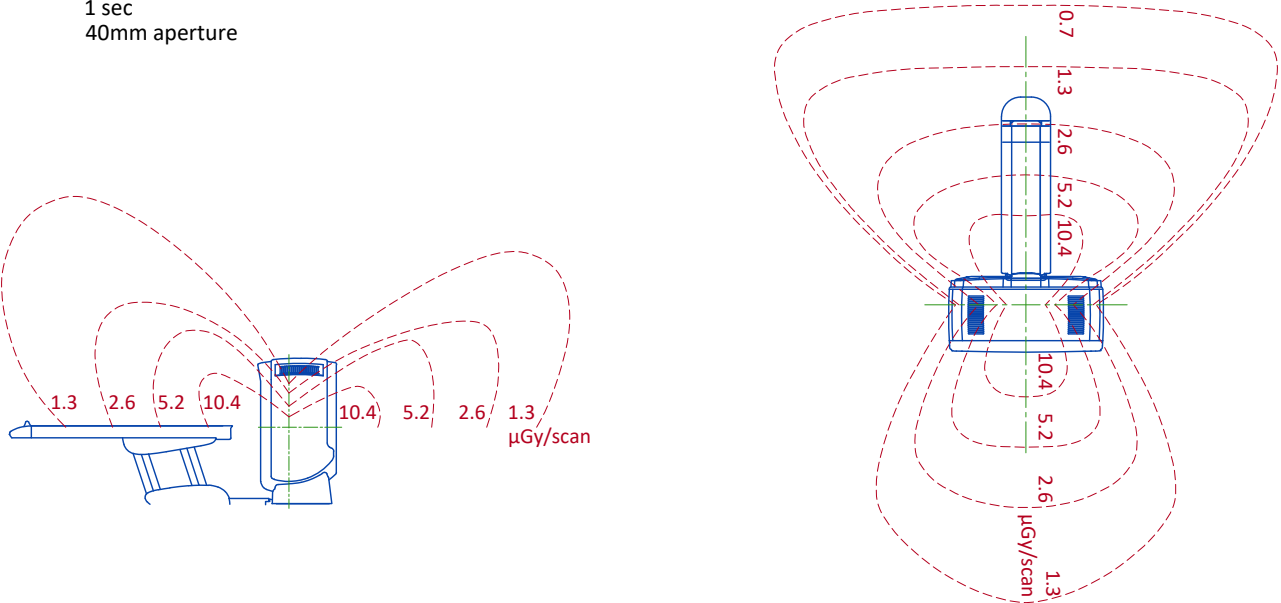
Elevation

Plan View



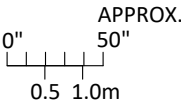
RADIATION SCATTER - BODY PHANTOM

NOTE: 140 kV
100 mAs/scan
1 sec
40mm aperture



Elevation

Plan View



RADIOACTIVE ISOTOPES

RADIOACTIVE ISOTOPES AND RADIOPROTECTION

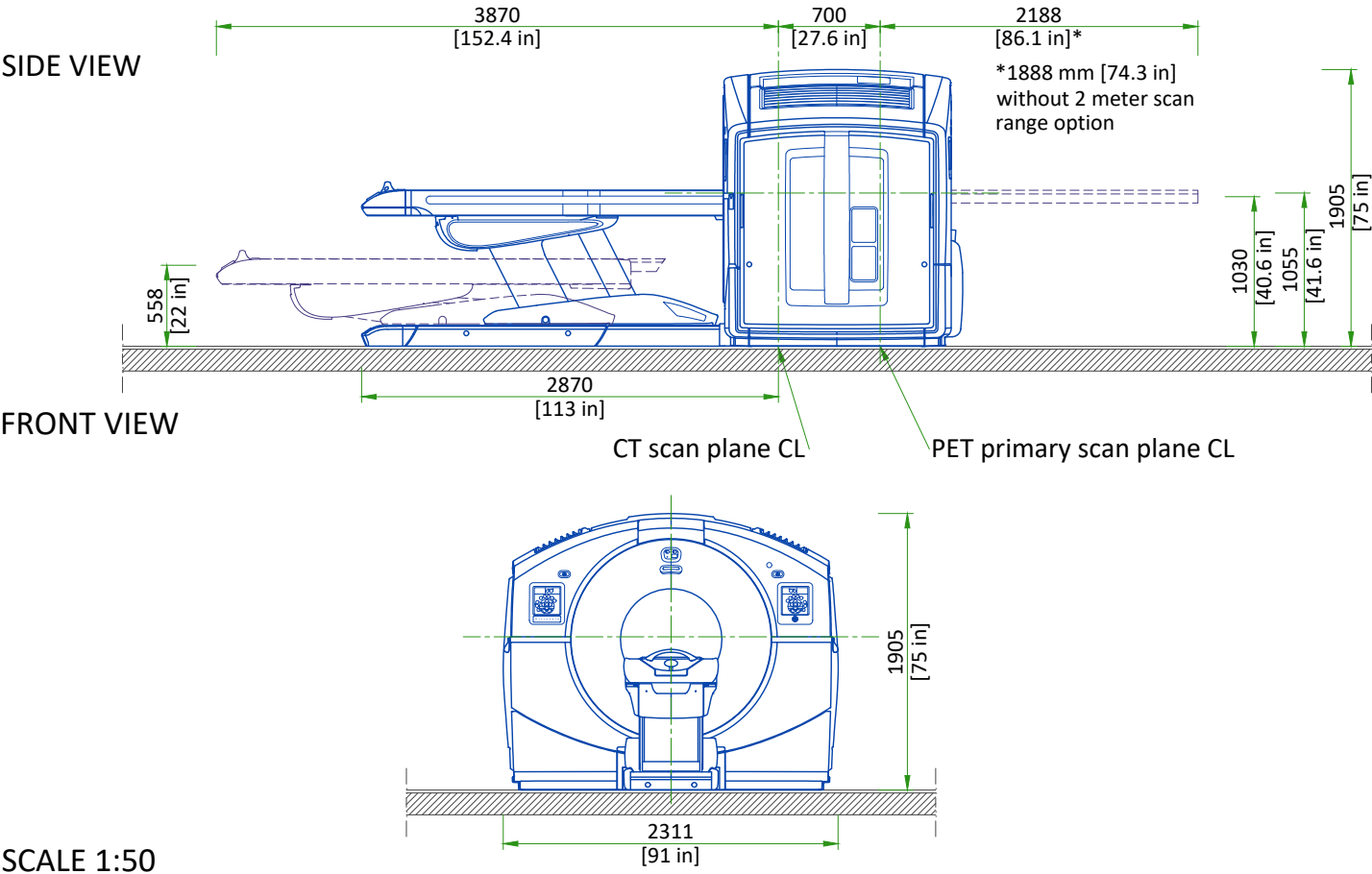
Since the system produces X-ray radiation and involves the use of radioactive isotopes, compliance with Nuclear Regulatory Commission regulations (or country similar regulatory requirements), must be adhered to and all permissions obtained well in advance.

It is Customer's responsibility consult a qualified radiological health physicist for radiation protection requirements for the walls, floor, ceiling, doors, window glass, etc.(lead content and thickness) and warning lights and signs, in accordance with local requirements.

It is essential that regulatory compliance and preparations are completed early so that required source materials can be obtained prior to installation, including calibration sources and isotopes. These sources and isotopes may have fairly long delivery lead times and a short half-life, so that it may not be advisable to store them over long periods of time.

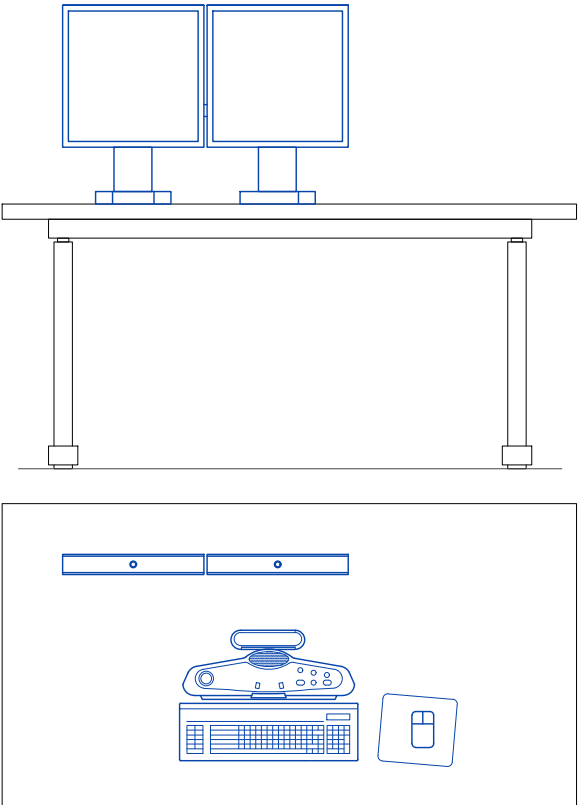
RADIOACTIVE SOURCE - ISOTOPE	
The PET/CT system uses one radioactive source during calibration and the Daily QA Check.	
Isotope	Ge-68
Activity level	55 MBq ± 20%
Typical Positron Emitting Isotopes include	Fluorine 18
	Carbon 11
	Nitrogen 13
	Oxygen 15
It is customer's responsibility provide isotopes for system calibration and prepare the required doses.	

GANTRY WITH PATIENT TABLE

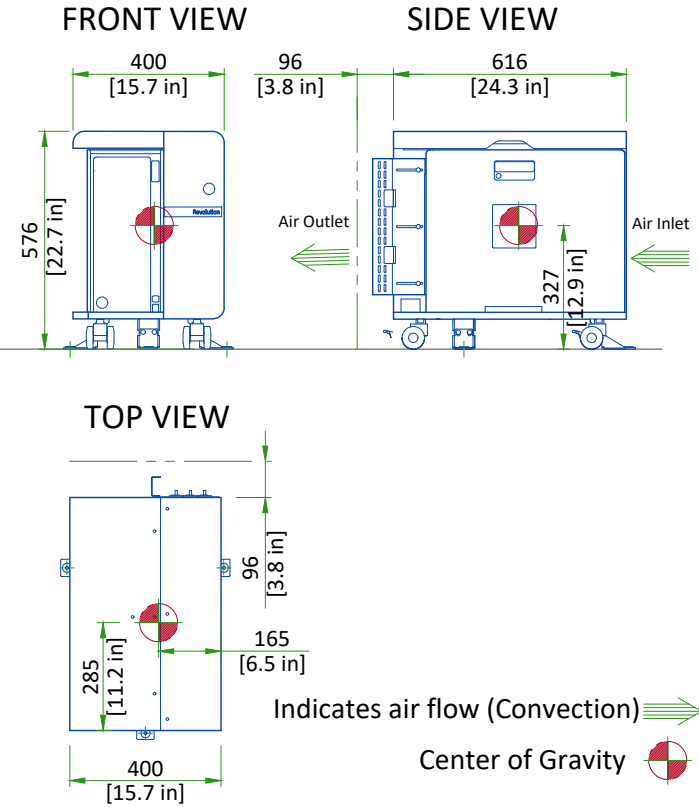


CT CONSOLE

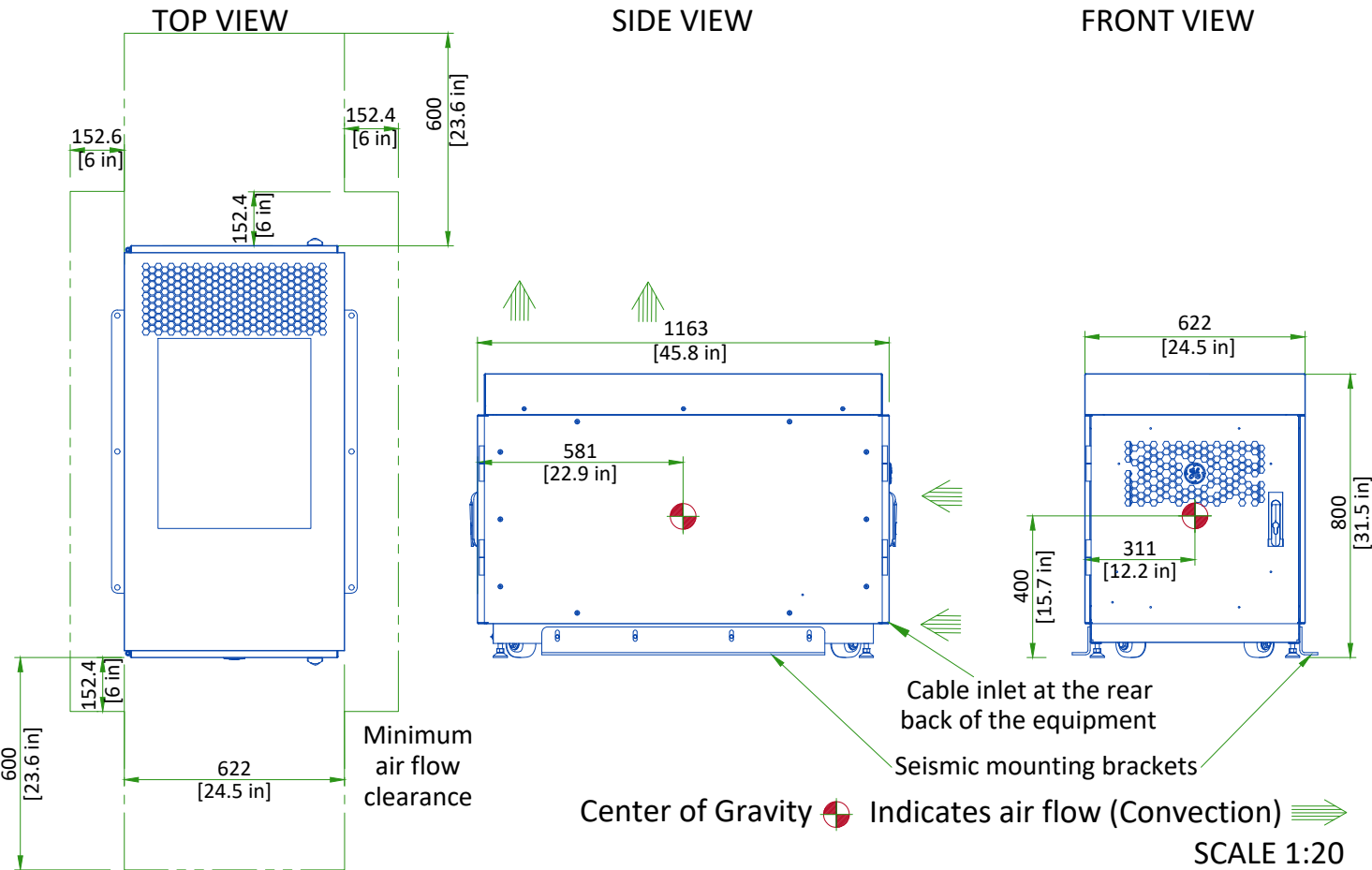
CUSTOMER SUPPLIED TABLE



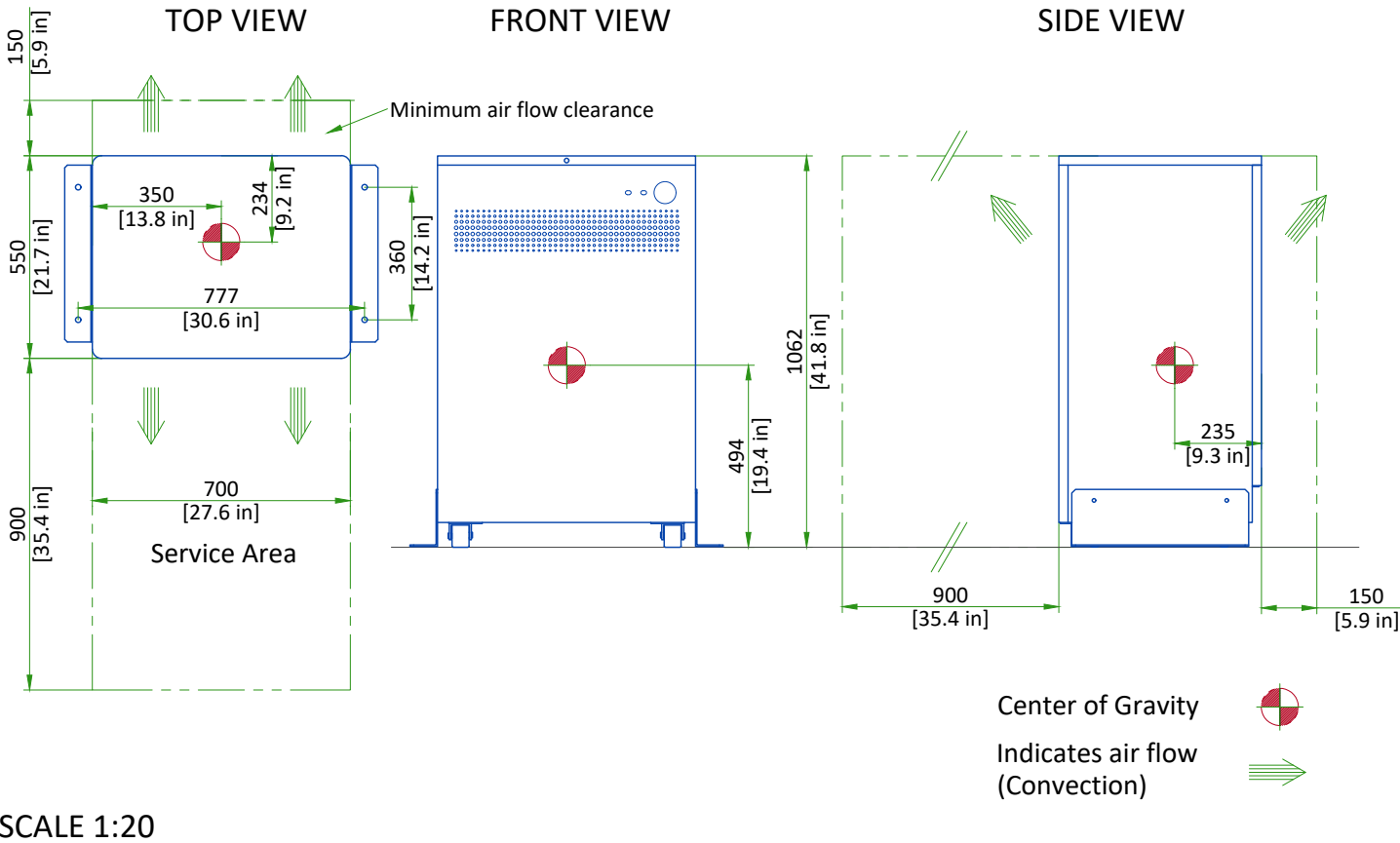
CONSOLE DIMENSIONS



PARC4 RECONSTRUCTION CABINET

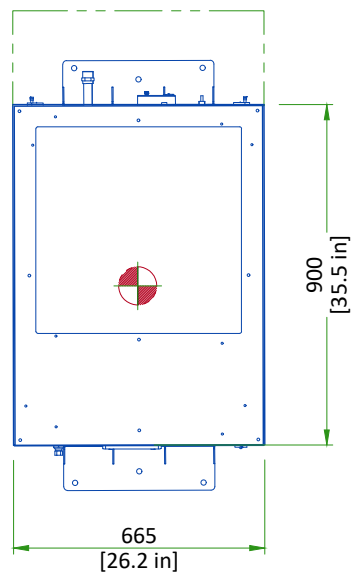


POWER DISTRIBUTION UNIT (PDU)

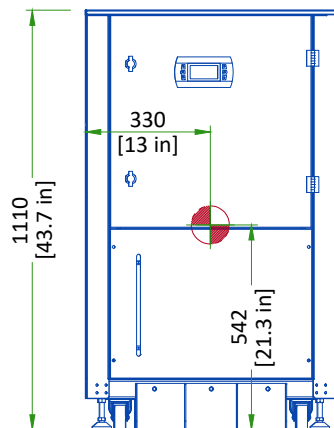


CHILLER (AIRSYS MODEL)

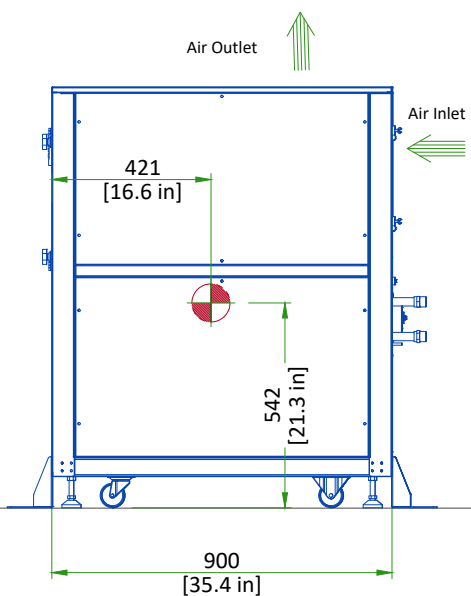
TOP VIEW





SIDE VIEW



FRONT VIEW

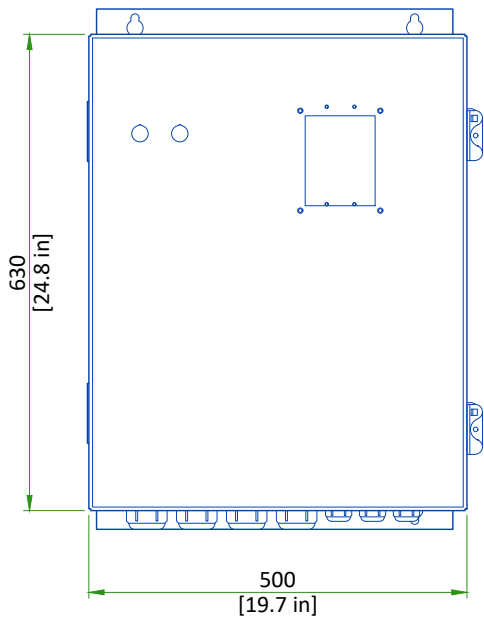


Center of Gravity 
Indicates air flow (Convection) 

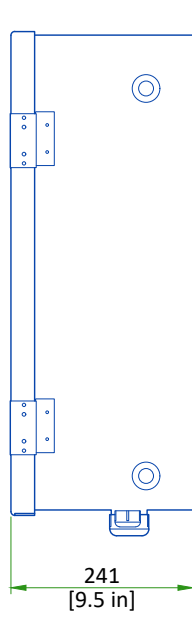
SCALE 1:20

CHILLER PDB

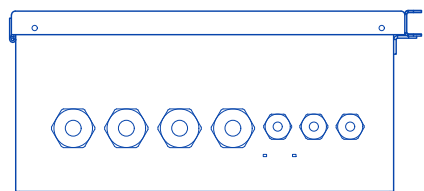
FRONT VIEW



SIDE VIEW



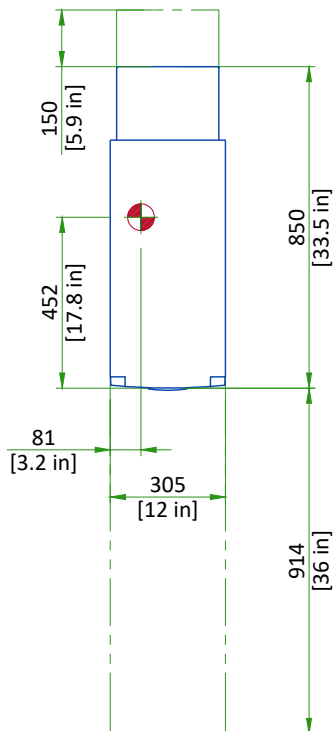
BOTTOM VIEW



SCALE 1:10

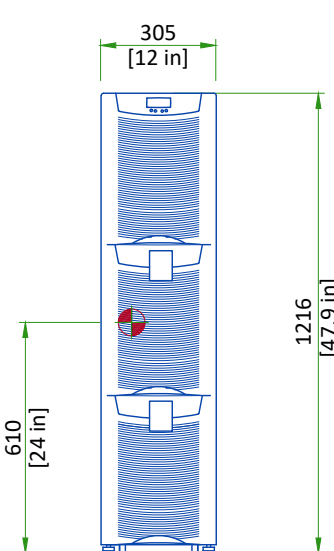
UNINTERRUPTIBLE POWER SUPPLY

TOP VIEW

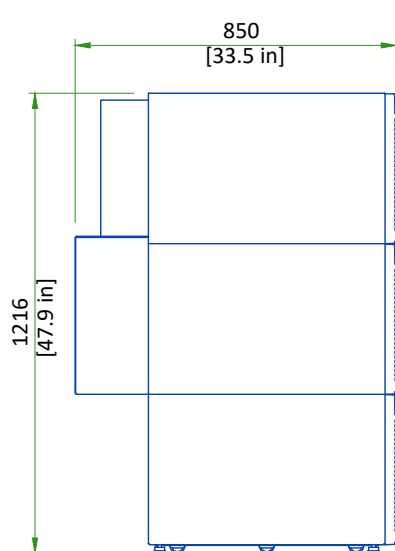


SCALE 1:20

FRONT VIEW



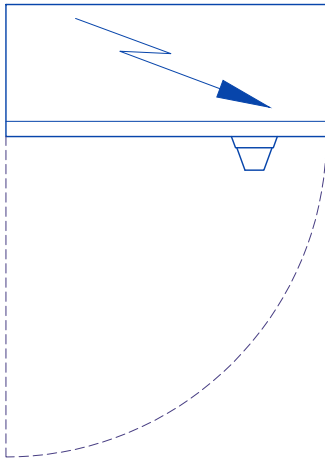
SIDE VIEW



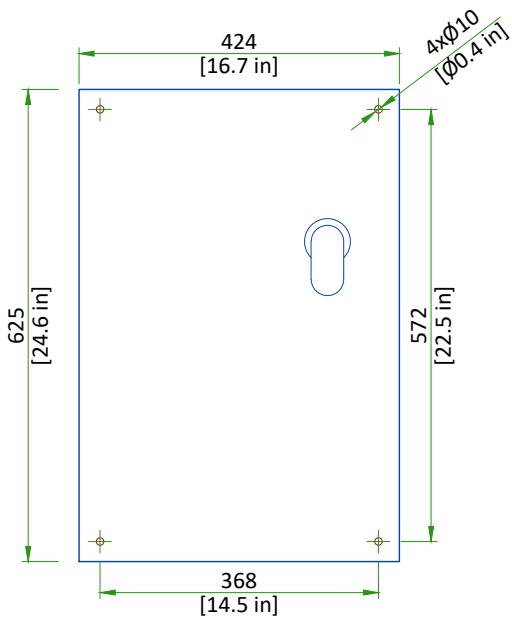
Center of Gravity 

MAIN DISCONNECT PANEL

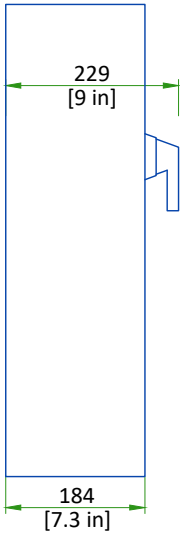
TOP VIEW



FRONT VIEW



SIDE VIEW

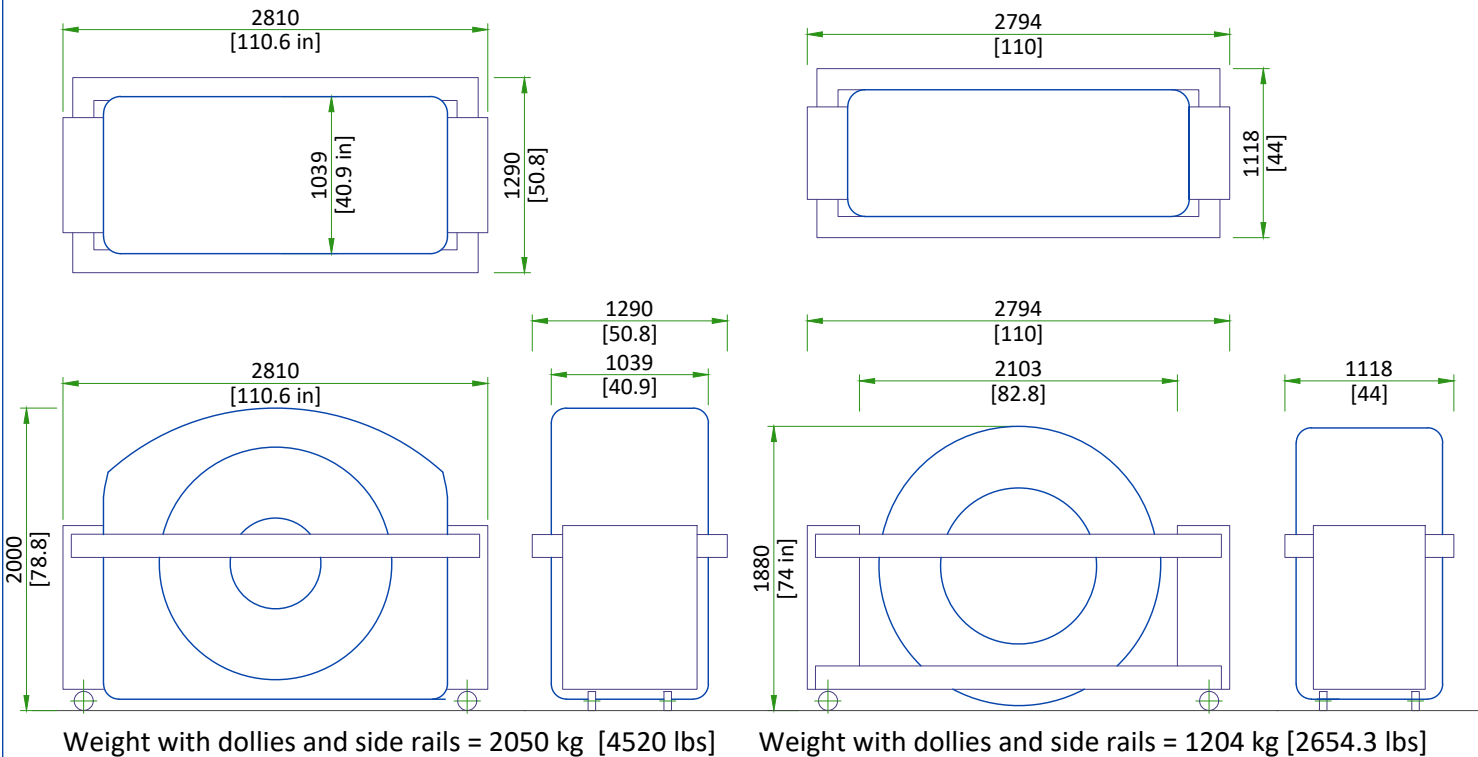


SCALE 1:10

SHIPPING DOLLY DIMENSIONS FOR GANTRY

CT GANTRY

PET IMAGE RING FOR WELDMENT GANTRY



DELIVERY

- THE CUSTOMER/CONTRACTOR SHOULD:
- Provide an area adjacent to the installation site for delivery and unloading of the GE equipment.
- Ensure that the dimensions of all doors, corridors, ceiling heights are sufficient to accommodate the movement of GE equipment from the delivery area into the definitive installation room.
- Ensure that access routes for equipment will accommodate the weights of the equipment and any transportation, lifting and rigging equipment.
- Ensure that all necessary arrangements for stopping and unloading on public or private property not belonging to the customer have been made.

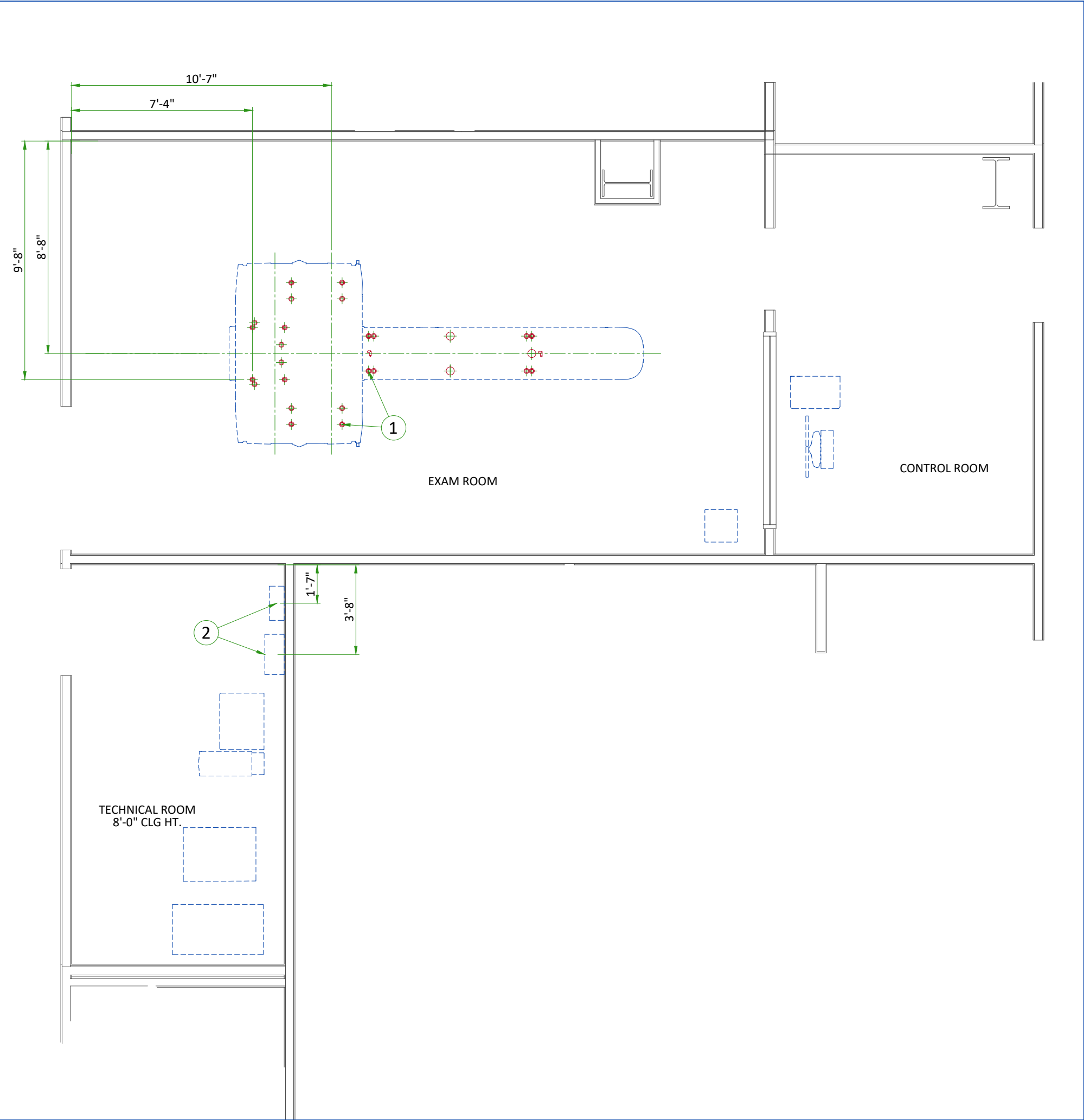
DIMENSIONS OF DELIVERY WITH DOLLY TRANSPORT EQUIPMENT

		mm	in	kg	lbs
CT GANTRY	LENGTH	2810	111	2050	4520
	WIDTH	1290	51		
	HEIGHT	2000	79		
PET WELDMENT GANTRY	LENGTH	2794	110	1204	2654.3
	WIDTH	1118	44		
	HEIGHT	1880	74		
PATIENT TABLE	LENGTH	3836	151	1241	2736
	WIDTH	864	34		
	HEIGHT	1410	55.5		

Above dimensions shown with side rails on. The minimum unobstructed hallway width is 1803 mm, the minimum clear doorway openings is 1067 mm to accommodate delivery of the system.

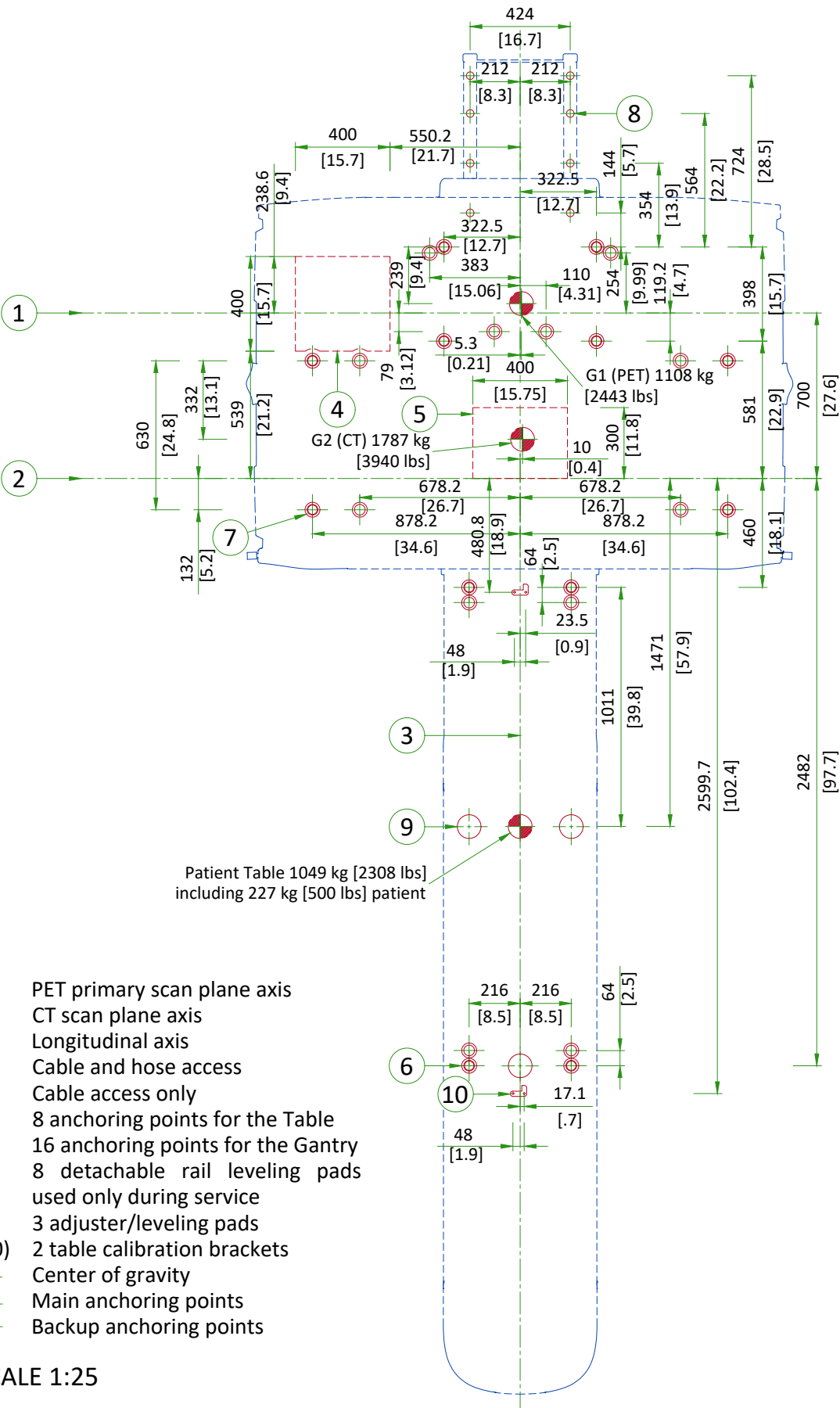
STRUCTURAL NOTES

- Methods of support for the steelwork that will permit attachment to structural steel or through bolts in concrete construction should be favored. Do not use concrete or masonry anchors in direct tension.
- All units that are wall mounted or wall supported are to be provided with supports where necessary. Wall supports are to be supplied and installed by the customer or his contractors. See plan and detail sheets for suggested locations and mounting hole locations.
- All ceiling mounted fixtures, air vents, sprinklers, etc. To be flush mounted, or shall not extend more than 6,35mm (1/4") below the finished ceiling.
- Floor slabs on which equipment is to be installed must be level to 6.00mm (1/4") in 3050mm (10'-0")
- Dimensions are to finished surfaces of room.
- Customers contractor must provide all penetrations in post tension floors.
- Customers contractor must provide and install any non-standard anchoring. Documents for standard anchoring methods are included with GE equipment drawings for geographic areas that require such documentation.
- Customers contractor must provide and install hardware for "through the floor" anchoring and/or any bracing under access floors. This contractor must also provide floor drilling that cannot be completed because of an obstruction encountered while drilling by the GE installer such as rebar etc.
- It is the customer's responsibility to perform any floor or wall penetrations that may be required. The customer is also responsible for ensuring that no subsurface utilities (e.g., electrical or any other form of wiring, conduits, piping, duct work or structural supports (i.e. post tension cables or rebar)) will interfere or come in contact with subsurface penetration operations (e.g. drilling and installation of anchors/screws) performed during the installation process. To ensure worker safety, GE installers will perform surface penetration operations only after the customer's validation and completion of the "GE surface penetration permit"



ITEM	DESCRIPTION
(CONTRACTOR SUPPLIED & INSTALLED)	
1	Floor contact area for discovery gantry and patient table. See Structural Details.
2	Support Backing, locate as shown

ANCHORING/LOADING DISTRIBUTION TO THE FLOOR

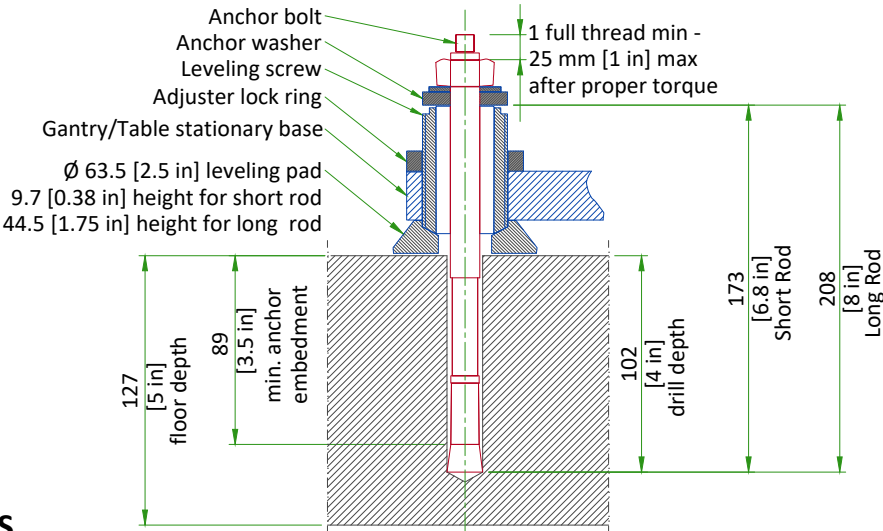


ANCHORING AND FLOOR REQUIREMENTS

GE SUPPLIED GANTRY ANCHORS (5867778)

NOTES:

If the concrete floor has a floor covering installed over it (such as floor tile), 17 or more openings 101.6 mm [4 in] in diameter will be cut into the floor covering to ensure the table and gantry rest on the concrete. (Openings are cut during installation.) Shims shall not be used to level the gantry or patient table.



FINISHED FLOOR REQUIREMENTS

- Installation requires a finish floor in the scan and control rooms.
- The floor surface in the scan room directly under the gantry and table must be level.
- The floor shall be no greater than 6 mm [0.25 in] out of level over a 3048 mm [10 ft] range, with level defined as the horizontal surface between the highest and lowest points.
- The floor shall have a minimum concrete thickness of 127 mm [5 in].
- Shims should not be used to compensate for a floor that does not meet this requirement.
- Concrete floors must have a minimum strength of $f'c = 1.7 \times 10^7$ Pa [2500 PSI] at 28 days (curing time) for mounting floor anchors. It is the responsibility of each customer to have appropriate tests performed to determine and measure concrete strength.
- These requirements apply to all installation types.

NOT TO SCALE

TEMPERATURE AND HUMIDITY SPECIFICATIONS

IN-USE CONDITIONS

Temperature	EXAM ROOM			CONTROL ROOM			TECHNICAL ROOM		
	Min	Recommended	Max	Min	Recommended	Max	Min	Recommended	Max
	18°C	22°C	26°C	18°C	22°C	26°C	18°C	22°C	26°C
Temperature gradient	64°F	72°F	79°F	64°F	72°F	79°F	64°F	72°F	79°F
	≤ 3°C/h			≤ 3°C/h			≤ 3°C/h		
Relative humidity (1)	30% to 60%			30% to 60%			30% to 60%		
Humidity gradient	≤ 5%/h			≤ 5%/h			≤ 5%/h		

STORAGE CONDITIONS

Temperature	0°C to +30°C	+32°F to +86°F
Relative humidity (1)	≤ 70% RH	
Temperature gradient	≤ 3°C/h	≤ 5.4°F/h
Humidity gradient	≤ 5%/h	

Material should not be stored for more than 6 month.

(1) Non-condensing

AIR RENEWAL

According to local standards. The HVAC system should be designed to provide 5 air changes per hour to maintain adequate air quality and temperature.

NOTE : In case of using air conditioning systems that have a risk of water leakage it is recommended not to install it above electric equipment or to take measures to protect the equipment from dropping water.

HEAT DISSIPATION

ROOM	DESCRIPTION	Max (kW)	Max (btu)
Exam Room	PET Gantry	2.8	9554
	CT Gantry	5.5	18766
	Patient table	0.3	1024
	TOTAL	9	29344
Exam room or Technical room*	Power distribution unit (CT PDU)	1.0	3400
	PARC 4 (Reconstruction Cabinet)	2.0	6824
	Partial UPS	1.5	5122
	Chiller (Airsys model)	2.85	9700
	TOTAL	5	15346
Control Room or Reporting Room	Operator console	0.84	2860
	LCD Monitor (2 units, 170 BTU/50 Watts each)	0.1	340
	TOTAL	1	3200
*Technical Room is not mandatory, the placements of these elements are recommended in the Exam Room.			
WARNING This chart contains only the principal components of the PET/CT system and does not include information about non-GE supplied equipment.			

CONNECTIVITY REQUIREMENTS

Your new GE Healthcare imaging modality will require local and remote connectivity to enable our full range of digital support:

- Local connectivity - This allows your system to connect to local devices such as PACS and modality worklist. We will require network information to configure the system(s), and a live ethernet port(s) prior to the delivery of the system(s).
- Remote connectivity - Your GE Healthcare service warranty includes InSite™ (applicable to InSite capable products), a powerful broadband-based service which enables digital tools that can help guard your hospital against equipment downtime and revenue loss by quickly connecting you to a GE Healthcare expert.

Depending on product family and software version, imaging systems can be connected in one of the following methods:

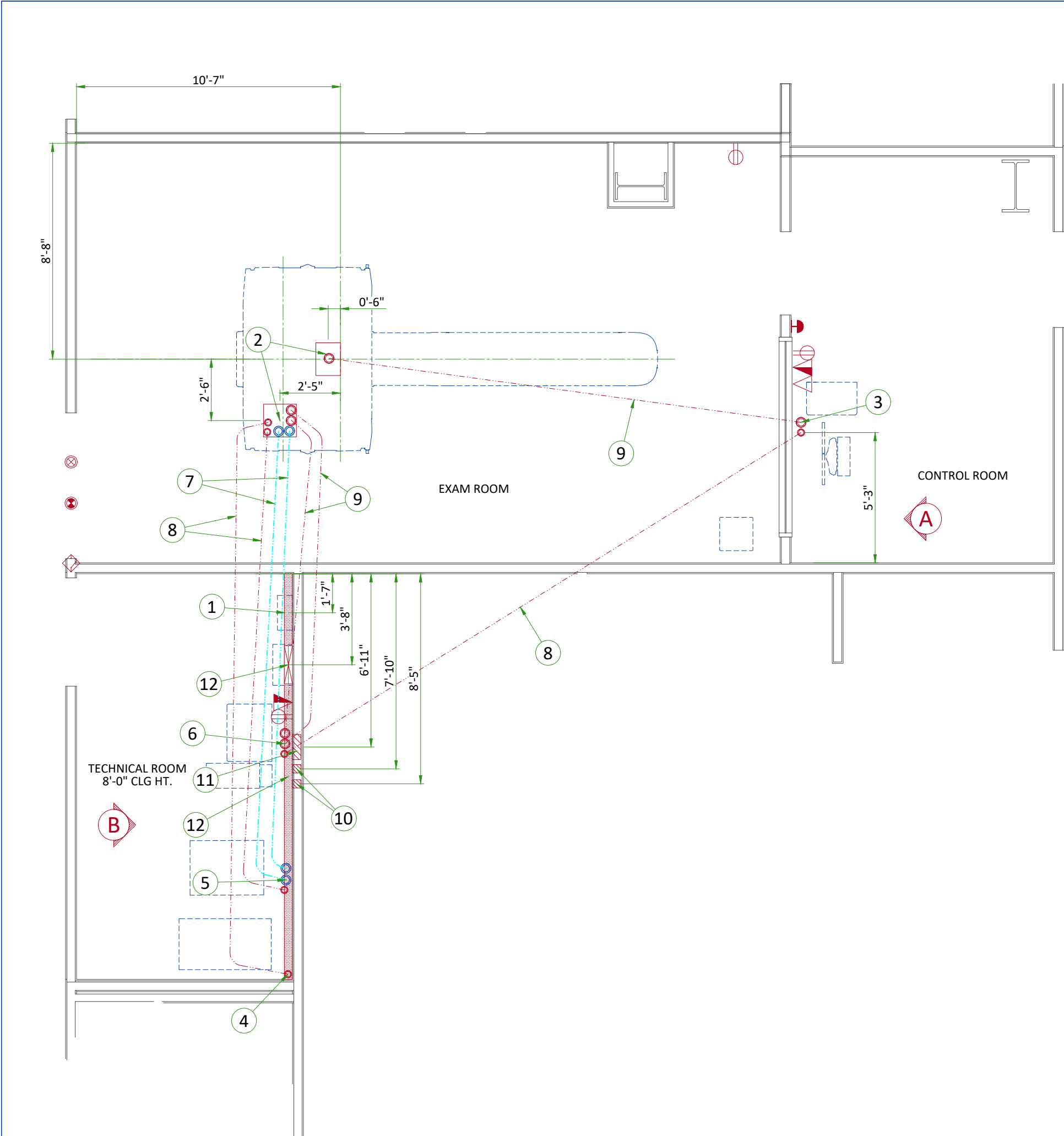
1. TLS over TCP Port 443 (Preferred method for new products) via:
 - a. DNS resolution
 - b. Customer-provided Proxy or
 - c. GE Proxy (Available in some regions)
2. Site-to-Site IPsec VPN tunnel

Please provide the GE project manager with the contact information for the resource that can provide information required to set up these connections. GEHC will send out communication to these contacts, which will include the project's Connectivity requirements, and a Connectivity form. This form will need to be completed and returned to GEHC prior to delivery of the system to ensure the system is tested and connectivity is enabled prior to the completion of the installation.

ELECTRICAL NOTES

1. All wires specified shall be copper stranded, flexible, thermo-plastic, color coded, cut 10 foot long at outlet boxes, duct termination points or stubbed conduit ends. All conductors, power, signal and ground, must be run in a conduit or duct system. Electrical contractor shall ring out and tag all wires at both ends. Wire runs must be continuous copper stranded and free from splices.
 - 1.1. Aluminum or solid wires are not allowed.
2. Wire sizes given are for use of equipment. Larger sizes may be required by local codes.
3. It is recommended that all wires be color coded, as required in accordance with national and local electrical codes.
4. Conduit sizes shall be verified by the architect, electrical engineer or contractor, in accordance with local or national codes.
5. Convenience outlets are not illustrated. Their number and location are to be specified by others. Locate at least one convenience outlet close to the system control, the power distribution unit and one on each wall of the procedure room. Use hospital approved outlet or equivalent.
6. General room illumination is not illustrated. Caution should be taken to avoid excessive heat from overhead spotlights. Damage can occur to ceiling mounting components and wiring if high wattage bulbs are used. Recommend low wattage bulbs no higher than 75 watts and use dimmer controls (except MR). Do not mount lights directly above areas where ceiling mounted accessories will be parked.
7. Routing of cable ductwork, conduits, etc., must run direct as possible otherwise may result in the need for greater than standard cable lengths (refer to the interconnection diagram for maximum usable lengths point to point).
8. Conduit turns to have large, sweeping bends with minimum radius in accordance with national and local electrical codes.
9. A special grounding system is required in all procedure rooms by some national and local codes. It is recommended in areas where patients might be examined or treated under present, future, or emergency conditions. Consult the governing electrical code and confer with appropriate customer administrative personnel to determine the areas requiring this type of grounding system.
10. The maximum point to point distances illustrated on this drawing must not be exceeded.
11. Physical connection of primary power to GE equipment is to be made by customers electrical contractor with the supervision of a GE representative. The GE representative would be required to identify the physical connection location, and insure proper handling of GE equipment.
12. GEHC conducts power audits to verify quality of power being delivered to the system. The customer's electrical contractor is required to be available to support this activity.

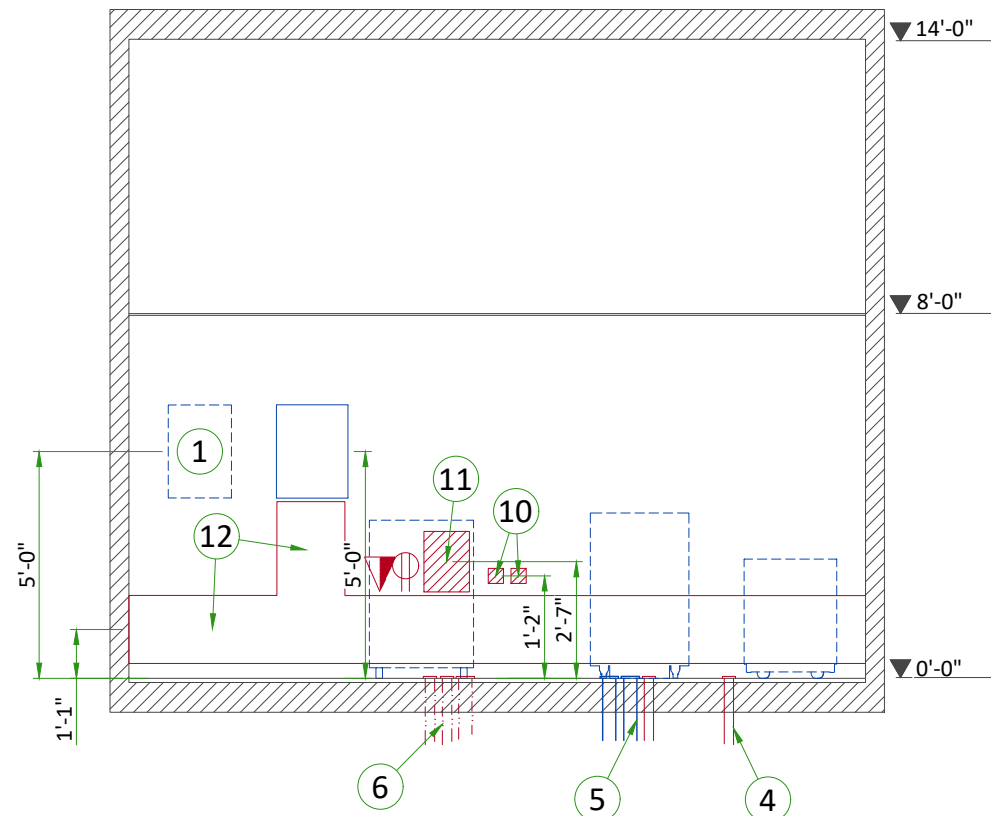
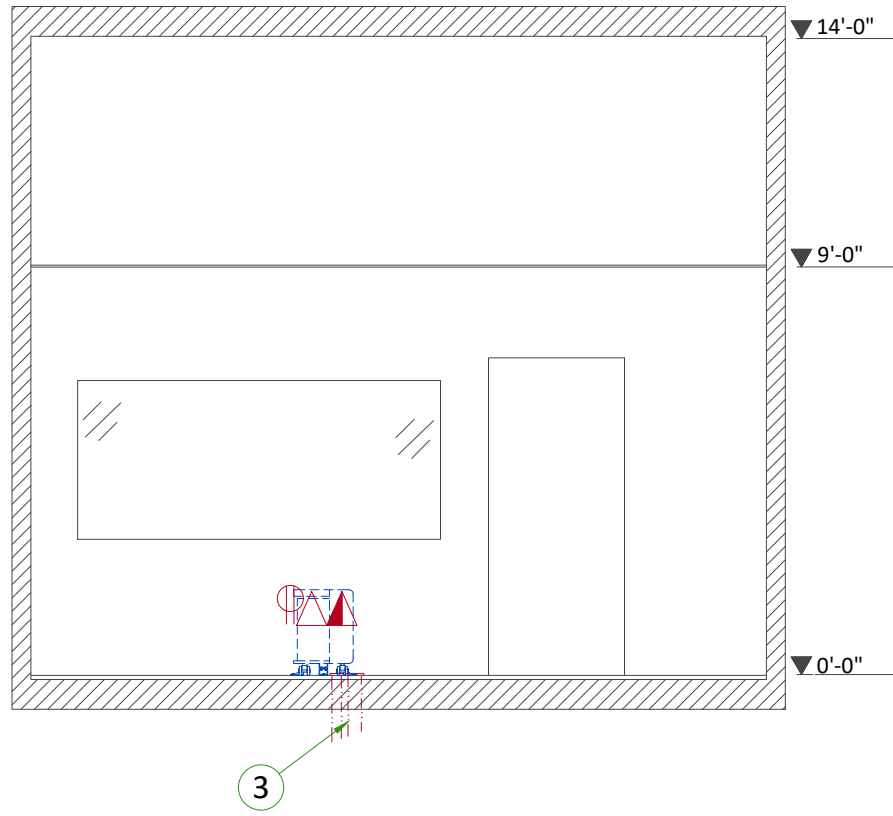
- All junction boxes, conduit, duct, duct dividers, switches, circuit breakers, cable tray, etc., are to be supplied and installed by customers electrical contractor.
- Conduit and duct runs shall have sweep radius bends
- Conduits and duct above ceiling or below finished floor must be installed as near to ceiling or floor as possible to reduce run length.
- Ceiling mounted junction boxes illustrated on this plan must be installed flush with finished ceiling.
- All ductwork must meet the following requirements:
 - 1.Ductwork shall be metal with dividers and have removable, accessible covers.
 - 2.Ductwork shall be certified/rated for electrical power purposes.
 - 3.Ductwork shall be electrically and mechanically bonded together in an approved manner.
 - 4.PVC as a substitute must be used in accordance with all local and national codes.
- All openings in raceway and access flooring are to be cut out and finished off with grommet material by the customers contractor.
- General contractor to insert pull cords for all cable run conduits between the equipment room and the operators control room.
- 10 foot pigtails at all junction points.
- Grounding is critical to equipment function and patient safety. Site must conform to wiring specifications shown on this plan.



Item	Electrical Layout Item List
1	Main disconnect panel (MDP)
2	Suitable bushings & lock nuts, refer to Anchoring/Loading Distribution to the Floor detail on sheet S3 (Gantry)
3	Suitable bushings & lock nuts (Operator's Console)
4	Suitable bushings & lock nuts (PARC)
5	Suitable bushings & lock nuts (Chiller)
6	Suitable bushings & lock nuts (PDU)
7	3" [75] conduit below floor for water lines
8	2 1/2" [64] conduit below floor
9	3 1/2" [89] conduit below floor
10	4" x 4" x 4" [100 x 100 x 100] box (Partial UPS)
11	12" x 16" x 4" [300 x 400 x 100] box (Power Distribution Unit)
12	18" x 3 1/2" [450 x 100] surface wall duct with minimum 2 dividers

ITEM	QTY	Electrical Outlet Legend
Customer/contractor supplied and installed items unless otherwise specified. Height above floor determined by local codes unless otherwise specified.		
△		Dedicated telephone line(s)
▲		Network outlet
⊕		Duplex hospital grade, dedicated wall outlet 120-v, single phase power
⏏		System emergency off (SEO), (recommended height 1.2m [48"] above floor)
⊗		X-Ray room warning light control panel
⊙		X-Ray ON lamp (L1) - 24V
◇		Door interlock switch (needed only if required by state/local codes)

Additional Conduit Runs (Contractor Supplied and Installed)					
From (Bubble # / Item)	To (Bubble # / Item)	Qty	Size		
			In.	mm	
3 Phase Power	1 Main Disconnect Panel	1	As req'd	As req'd	
1 Main Disconnect Panel	Emergency Off	1	1/2	13	
	11 Power Distribution Unit	1	As req'd	As req'd	
11 Power Distribution Unit	Door Switch	1	1/2	13	
	Warning Light Control	1	1/2	13	
Warning Light		1	1/2	13	
1 Phase Power		1	1/2	13	
1 Main Disconnect Panel	10 Partial UPS	1	1 1/4	30	



POWER REQUIREMENTS

POWER SUPPLY	3 PHASES+G 380V/400V/420V/440V/460V/480V ±10%
FREQUENCIES	50/60Hz ± 3Hz
MAXIMUM POWER DEMAND	100 kVA
AVERAGE POWER	30 kVA
POWER FACTOR	0.85

- Power supply should come into a Main Disconnect Panel (MDP) containing the protective units and controls.
- Governing electrical codes may require a neutral wire. If present, neutral must be terminated in MDP.
- The section of the supply cable should be calculated in accordance with its length and the maximum permissible voltage drops, equal to 3.4% max. of regulation for feeder size.
- There must be discrimination between supply cable protective material at the beginning of the installation (main low-voltage transformer side) and the protective devices in the MDP.
- TNC neutral point connection must not be used.

SUPPLY CHARACTERISTICS

- Power input must be separate from any others which may generate transients (elevators, air conditioning, radiology rooms equipped with high speed film changers...).
- All equipment (lighting, power outlets, etc...) installed with GE system components must be powered separately.
- Phase imbalance 2% maximum.
- Maximum voltage variation at full load 6% (Including line impedance).
- Transients must be less than 1500V peak. (on a 380V line)
- A record of power input disturbances over a continuous two-weeks period (prior to delivery) enables determination of the frequency and degree of these disturbances and can be used to ascertain the need to provide line conditioning equipment.

GROUND SYSTEM

- System of equipotential grounding.
- Equipotential: The equipotential link will be by means of an equipotential bar. This equipotential bar should be connected to the protective earth conductors in the ducts of the non GE cableways and to additional equipotential connections linking up all the conducting units in the rooms where GE system units are located.
- The impedance of the earth bar should be less than or equal to 2 Ω (ohm).

CABLES

- Power and cable installation must comply with the distribution diagram.
- All cables must be isolated and flexible of HO7RNF type, cable color codes must comply with standards for electrical installation.
- The cables from signaling and remote control (Y,SEO,L...) will go to A1 Main Disconnect with a pigtail length of 1.5m, and will be connected during installation. Each conductor will be identified and isolated (screw connector).

CABLEWAYS

The general rules for laying cableways should meet the conditions laid down in current standards and regulations, with regard to:

- Protecting cables against water (cableways should be waterproof).
- Protecting cables against abnormal temperatures (proximity to heating pipes or ducts).
- Protecting cables against temperature shocks.
- Replacing cables (cableways should be large enough for cables to be replaced).
- Metal cableways should be grounded.

POWER DISTRIBUTION

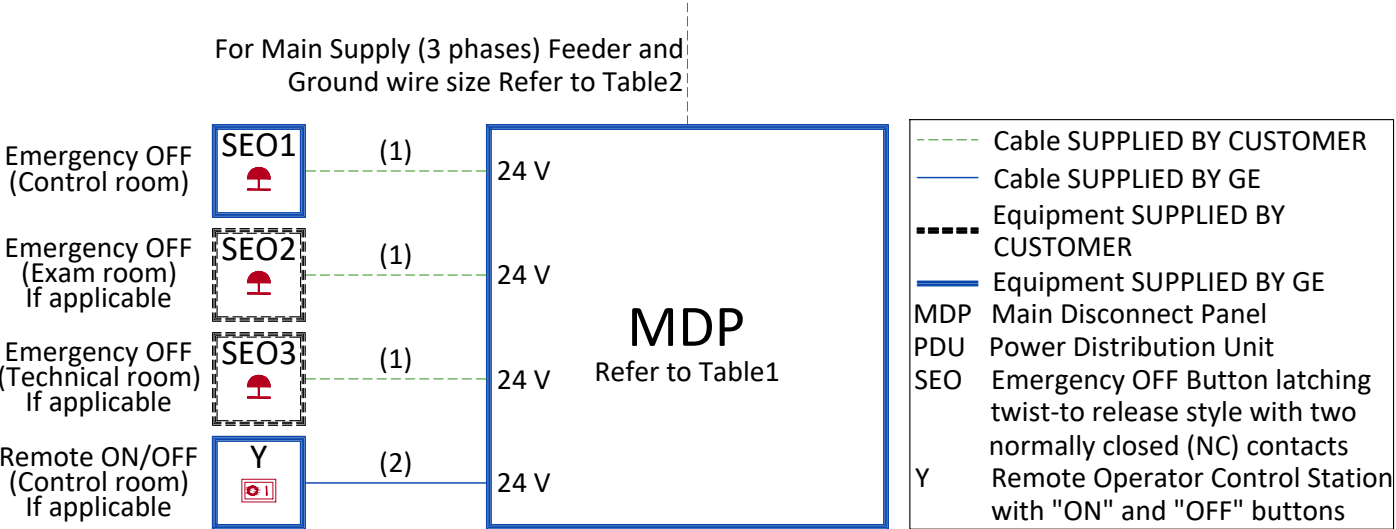


Table1:

GE Supplied Main Disconnect Panel (MDP)		
Region	CAT number	Amps
Global except EMEA(440~480 V)	E4502BB	90
Global except EMEA(380~420 V)	E4502BC	110
EMEA(380~420 V)	E45021BC (3)	160

Table2:

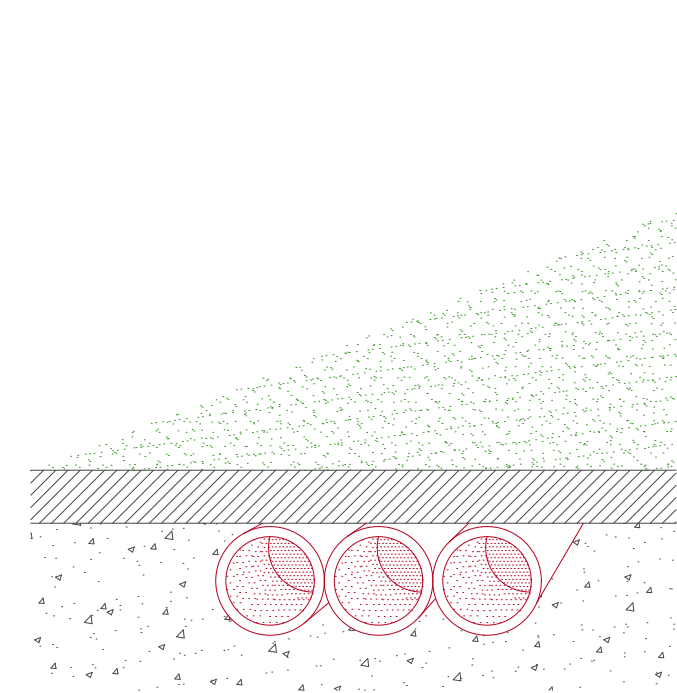
Feeder Table						
The information below assumes the use of copper wire, rated 75 C and run in steel conduit. All ampacity is determined in accordance with the National Electrical Code (NFPA 70), Table 310-16 (2002). The ampacity of the circuit protection device listed above determines the minimum feeder size, except where total source regulation limits require a larger size. If the wire size does not match the above lists, please select the nearest wire size as per to local standards.						
Feeder length from Power Substation to MDP - ft (m)	Minimum Wire Size, AWG or MCM (mm²)/VAC					
	380 VAC	400 VAC	420 VAC	440 VAC	460 VAC	480 VAC
50 (15)	2 (35)	2 (35)	3 (30)	3 (30)	3 (30)	3 (30)
100 (30)	2 (35)	2 (35)	3 (30)	3 (30)	3 (30)	3 (30)
150 (46)	2 (35)	2 (35)	3 (30)	3 (30)	3 (30)	3 (30)
200 (61)	2 (35)	2 (35)	3 (30)	3 (30)	3 (30)	3 (30)
250 (76)	1 (45)	1 (45)	2 (35)	2 (35)	2 (35)	3 (30)
300 (91)	1/0 (55)	1/0 (55)	1 (45)	1 (45)	2 (35)	2 (35)
350 (107)	2/0 (70)	1/0 (55)	1/0 (55)	1 (45)	1 (45)	1 (45)
400 (122)	2/0 (70)	2/0 (70)	1/0 (55)	1/0 (55)	1/0 (55)	1 (45)
Sub-Feeder length from MDP to PDU - ft (m)						
32 (9.7536)	2 (35)	2 (35)	3 (30)	3 (30)	3 (30)	3 (30)
Grounding						
Run a dedicated 1/0 [50 mm²] or larger insulated copper ground wire from the power source to the MDP and from MDP to the PDU. Run the ground wire in the same raceway with the three-phase wires.						

Notes :

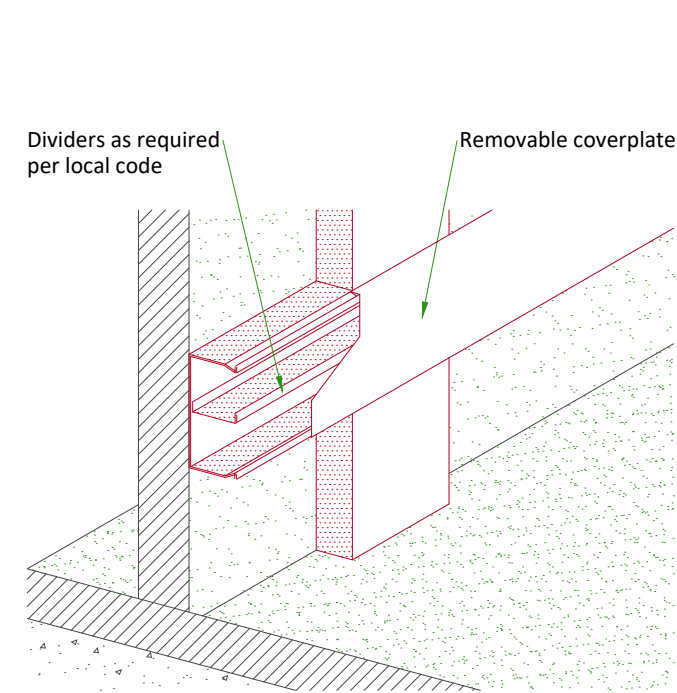
- (1) Wire size: 4x2mm² [14AWG] and 1x2mm² [14AWG] GND
- (2) Power cable: 3 Meter/10', multi-conductor, 24V DC
- (3) GE supplied MDP option E45021BC includes a 10 meter long power cable (H07RN-F) with wire size 4x50mm² and a 50 meter long control cable with wire size 2x1.5mm²

TYPICAL CABLE MANAGEMENT

CONDUIT IN THE FLOOR

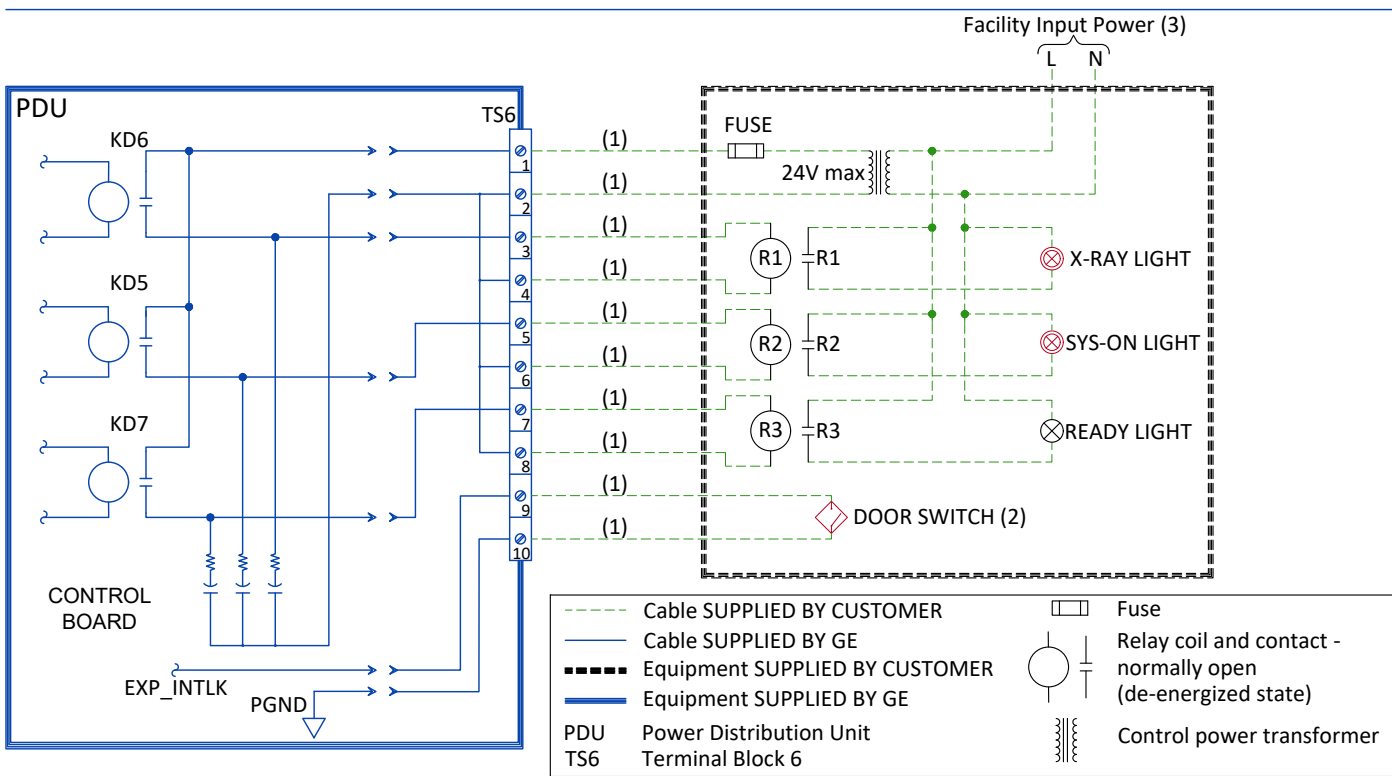


WALL DUCT



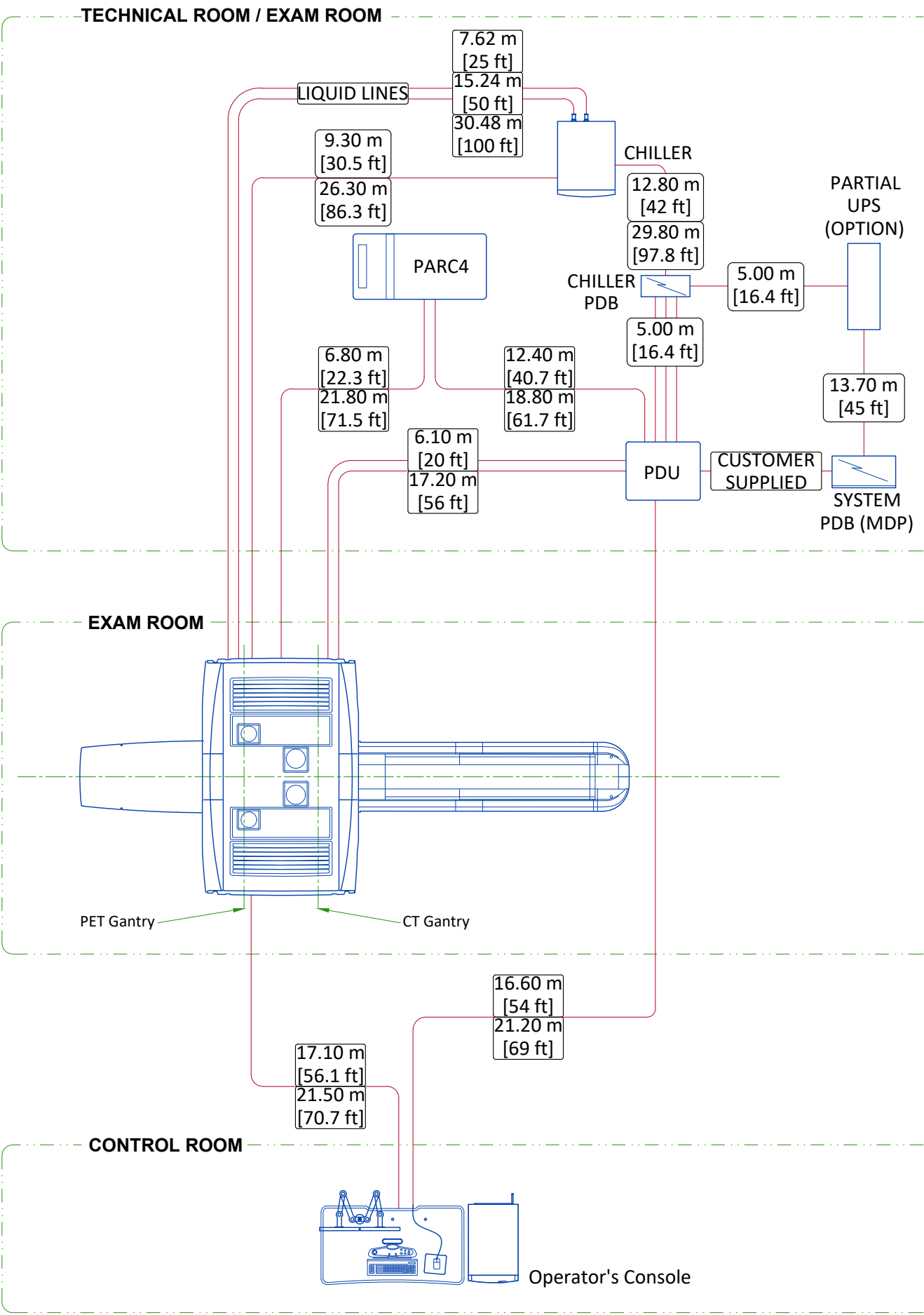
NOT TO SCALE

SCAN ROOM WARNING LIGHT AND DOOR INTERLOCK



- Notes :
- (1) Wire size: 2mm² [14 AWG] at 24V
 - (2) Door Interlock circuit is jumpered out if a door switch is not provided.
 - (3) Grounding not shown on the detail, but must comply with local codes.

INTERCONNECTIONS



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APPENDIX 03

MEDICAL EQUIPMENT LIST



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Arch Dept Room # Room	Atta3 ID Category Subcat	Mfr Model Item Cat #	Status Stage	Item Qty	Arch Code Furnish Resp Install Resp	Funding Src	Width Depth Height	Product Wt Arch Sig Item Spat Sig	Mounting	Volts Amp Hz	Electrical Phase Plug Type	BTU/hr	Ded Circuit Emerg Pwr	Drain Gas Type Medical Gas	Steam Dental Vac Medical Vac	Cold Water Hot Water Treated Water	Diss Type Vent Vent Type
Nuclear Medicine 1618 Nuc Med GE PET/CT	BRK-389CE Bracket Canister, Suction, Wall Mount	Cardinal Health - Medical 65652-516 Canister/Br acket (1500 cc) 65652- 516/65652 -145	New Pending	1	01-Fixed Equipment Owner Contractor	Capital	6.000 9.000 12.000	1 Yes No	Wall	--- --- ---	N/A N/A	--- ---	No No	No ---	No No No	No No No	Actual No ---
Nuclear Medicine 1618 Nuc Med GE PET/CT	DIS-F3AAD Disposal, Sharps Floor Cart	Stericycle Bio Systems C- 08- 2004LR/D- 08 C-08- 2004LR/D- 08	New Pending	1	03-Movable Non- Electrical Owner Owner	Capital	13.500 13.000 23.000	--- No No	Floor - Mobile	--- --- ---	N/A N/A	--- ---	No No	No ---	No No No	No No No	N/A No ---
Nuclear Medicine 1618 Nuc Med GE PET/CT	DSP-4B2B3 Dispenser Soap, Wall Mount	Henkel Consumer Goods, Inc. Dial FIT X2 Manual Slate 1.2L 170001663 0	New Pending	1	01-Fixed Equipment Owner Contractor	Capital	--- --- ---	--- No No	---	--- --- ---	---	--- ---	No No	No ---	No No No	No No No	--- No ---
Nuclear Medicine 1618 Nuc Med GE PET/CT	DSP-AB508 Dispenser Emesis Bag, Wall Mount	Medline Industries Inc. NONEMBG DISP NONEMBG DISP	New Pending	1	01-Fixed Equipment Owner Contractor	Capital	6.000 6.000 6.500	8 Yes No	Wall	--- --- ---	N/A N/A	--- ---	No No	No ---	No No No	No No No	Actual No ---
Nuclear Medicine 1618 Nuc Med GE PET/CT	DSP-D9F1F Dispenser Paper Towel, Surface Mount	Georgia Pacific Combi-Fold (C-Fold) Paper Towel Dispenser Black 56650A	New Pending	1	01-Fixed Equipment Owner Contractor	Capital	--- --- ---	--- No No	---	--- --- ---	---	---	No No	No ---	No No No	No No No	--- No ---

Arch Dept Room # Room	Atta3 ID Category Subcat	Mfr Model Item Cat #	Status Stage	Item Qty	Arch Code Furnish Resp Install Resp	Funding Src	Width Depth Height	Product Wt Arch Sig Item Spat Sig	Mounting	Volts Amp Hz	Electrical Phase Plug Type	BTU/hr	Ded Circuit Emerg Pwr	Drain Gas Type Medical Gas	Steam Dental Vac Medical Vac	Cold Water Hot Water Treated Water	Diss Type Vent Vent Type
Nuclear Medicine 1618 Nuc Med GE PET/CT	DSP-DA5AE Dispenser Disinfectant Wipes, Wall Mount	Professional Disposable Sani- Bracket Extra Large Single Canister (1 Pack) Q51500	New Pending	1	01-Fixed Equipment Owner Contractor	Capital	5.354 5.512 5.512	N/A Yes No	Wall	-- -- --	N/A N/A	-- -- --	No No No	No -- No	No No No	No No No	Actual No --
Nuclear Medicine 1618 Nuc Med GE PET/CT	DSP-F282A Dispenser Hand Sanitizer, Wall Mount	3M Health Care 3M Avagard D Instant 9236	New Pending	1	01-Fixed Equipment Owner Contractor	Capital	3.500 4.000 8.500	1 Yes No	Wall	-- -- --	N/A N/A	-- -- --	No No No	No -- No	No No No	No No No	Actual No --
Nuclear Medicine 1619A Control Room	ECG-5FDB8 Electrocardi ograph (ECG) Interpretive	GE Healthcare - Cardiology MAC 5500 HD w/Cart 2053900- 013/Cart	Existing Pending	1	02-Movable Electrical Owner Owner	Existing	19.000 27.000 40.750	81 Yes No	Floor - Mobile	115 N/A 60	Single Phase Type B (NEMA 5-15)	-- -- --	No No No	No -- No	No No No	No No No	Actual No --
Nuclear Medicine 1618 Nuc Med GE PET/CT	FLW-779C7 Flowmeter Oxygen	Amico Corporatio n FMO-15U- OM (Ohmeda Male) FMO-15U- OM	New Pending	1	03-Movable Non- Electrical Owner Owner	Capital	2.700 1.500 5.600	1 No No	Wall	-- -- --	N/A N/A	-- -- --	No No No	No N/A No	No No No	No No No	Actual No --
Nuclear Medicine 1618 Nuc Med GE PET/CT	GAM-C1B36 Camera, Gamma SPECT/CT	GE Healthcare - Imaging Systems NM/CT 850 (8 Slice) --	New Purchased	1	01-Fixed Equipment Owner Vendor	Capital	75.870 68.560 83.000	7,363 Yes Yes	Floor	480 75 60	3 Phase Hardwire	24,516	Yes No	No -- No	No No No	No No No	Actual No --
Nuclear Medicine 1618 Nuc Med GE PET/CT	GLV-12461 Dispenser, Glove Triple Box	Bowman Dispensers GP-015 Clear PETG Plastic GP-015	New Pending	1	01-Fixed Equipment Owner Contractor	Capital	15.950 3.950 10.100	1 Yes No	Wall	-- -- --	N/A N/A	-- -- --	No No No	No -- No	No No No	No No No	Actual No --

Arch Dept Room # Room	Atta3 ID Category Subcat	Mfr Model Item Cat #	Status Stage	Item Qty	Arch Code Furnish Resp Install Resp	Funding Src	Width Depth Height	Product Wt Arch Sig Item Spat Sig	Mounting	Volts Amp Hz	Electrical Phase Plug Type	BTU/hr	Ded Circuit Emerg Pwr	Drain Gas Type Medical Gas	Steam Dental Vac Medical Vac	Cold Water Hot Water Treated Water	Diss Type Vent Vent Type
Nuclear Medicine 1618 Nuc Med GE PET/CT	HAM-CFB06 Hamper Linen	Pedigo Products, Inc P-1120-L- SS P-1120-L- SS	New Pending	1	03-Movable Non- Electrical Owner Owner	Capital	23.500 23.500 32.000	24 No No	Floor - Mobile	--- --- ---	N/A N/A	---	No No	No ---	No No No	No No No	Actual No ---
Nuclear Medicine 1618 Nuc Med GE PET/CT	IJT-DA045 Injector Allowance	Bracco Diagnostic s CardioGen- 82 Infusion System ---	Lease Pending	1	02-Movable Electrical Owner Vendor	Capital	22.000 40.000 64.000	620 No No	---	--- --- ---	---	---	No No	No ---	No No No	No No No	---
Nuclear Medicine 1618 Nuc Med GE PET/CT	INJ-09475 Injector, Contrast Media Ceiling Mount	Bayer HealthCare Radiology Medrad Stellant FLEX with Certegra and OCS ---	New Pending	1	01-Fixed Equipment Owner Contractor	Capital	11.000 9.000 11.300	13 Yes No	Ceiling	120 2 60	Single Phase Type B (NEMA 5-15)	---	No No	No ---	No No No	No No No	Actual No ---
Nuclear Medicine 1618 Nuc Med GE PET/CT	IVS-6BDAB Stand, IV Chrome	Pedigo Products, Inc P-576-4 Four Hook P-576-4	New Pending	1	03-Movable Non- Electrical Owner Owner	Capital	21.000 21.000 116.000	22 No No	Floor - Mobile	--- --- ---	N/A N/A	---	No No	No ---	No No No	No No No	Actual No ---
Nuclear Medicine 1618 Nuc Med GE PET/CT	MGS-E1357 Medical Gas System Medical Gas Hoses	W.T. Farley OXYGEN HOSE, 6 FEET, OHMEDA MALE QC X DISS MALE NO CHECK MRI- OH072030 8	New Pending	1	03-Movable Non- Electrical Owner Owner	Capital	--- --- ---	--- No No	---	--- --- ---	---	---	No No	No ---	No No No	No No No	---

Arch Dept Room # Room	Atta3 ID Category Subcat	Mfr Model Item Cat #	Status Stage	Item Qty	Arch Code Furnish Resp Install Resp	Funding Src	Width Depth Height	Product Wt Arch Sig Item Spat Sig	Mounting	Volts Amp Hz	Electrical Phase Plug Type	BTU/hr	Ded Circuit Emerg Pwr	Drain Gas Type Medical Gas	Steam Dental Vac Medical Vac	Cold Water Hot Water Treated Water	Diss Type Vent Vent Type
Nuclear Medicine 1618 Nuc Med GE PET/CT	MGS-E6454 Medical Gas System Allowance	W.T. Farley OXYGEN ADAPTER, 90 DEGREE ELBOW, OHMEDA MALE X DISS MALE by WT Farley Inc MF-SP150- O	New Pending	1	03-Movable Non- Electrical Owner Owner	Capital	-- -- --	-- No No	--	-- -- --	--	--	No No No	No -- No	No No No	No No No	-- No --
Nuclear Medicine 1618 Nuc Med GE PET/CT	MON-241A1 Monitor, Physiologic Blood Pressure, Ambulatory	Philips Healthcare - Monitoring Systems Adult NIBP Air Hose 3.0m (Philips) M1599B	New Pending	1	03-Movable Non- Electrical Owner Owner	Capital	-- -- --	-- No No	--	-- -- --	--	--	No No No	No -- No	No No No	No No No	-- No --
Nuclear Medicine 1618 Nuc Med GE PET/CT	MON-5AB72 Monitor, Physiologic Blood Pressure, Ambulatory	Philips Healthcare - Monitoring Systems Reusable Clip Adult SpO2 Sensor (Philips) M1196A	New Pending	1	03-Movable Non- Electrical Owner Owner	Capital	-- -- --	-- No No	--	-- -- --	--	--	No No No	No -- No	No No No	No No No	-- No --
Nuclear Medicine 1618 Nuc Med GE PET/CT	MON-D2112 Monitor, Physiologic Vital Signs, w/Stand	Philips Healthcare - Monitoring Systems EarlyVue VS30 w/ Premium Rollstand 863380/98 980317660 1	New Pending	1	02-Movable Electrical Owner Owner	Capital	22.500 22.500 51.055	13 Yes No	Floor - Mobile	120 N/A 60	Single Phase Type B (NEMA 5-15)	--	No No No	No -- No	No No No	No No No	Actual No --

Arch Dept Room # Room	Atta3 ID Category Subcat	Mfr Model Item Cat #	Status Stage	Item Qty	Arch Code Furnish Resp Install Resp	Funding Src	Width Depth Height	Product Wt Arch Sig Item Spat Sig	Mounting	Volts Amp Hz	Electrical Phase Plug Type	BTU/hr	Ded Circuit Emerg Pwr	Drain Gas Type Medical Gas	Steam Dental Vac Medical Vac	Cold Water Hot Water Treated Water	Diss Type Vent Vent Type
Nuclear Medicine 1618 Nuc Med GE PET/CT	MON-E0573 Monitor, Physiologic Cardiac, ECG Trigger	IVY Biomedical Systems 7600 Cardiac Gating Monitor 7600	New Purchased	1	02-Movable Electrical Owner Owner	Capital	7.900 5.200 7.500	3 Yes No	Counter/Cart /Table/Pole	120 N/A 60	Single Phase Type B (NEMA 5-15)	---	No No	No ---	No No No	No No No	Actual No ---
Nuclear Medicine 1618 Nuc Med GE PET/CT	REG-4FB72 Regulator Suction, Intermittent/ Continuous	Amico Corporatio n SRA-CIUT- DH Scout Analog (DISS Handtight) SRA-CIUT- DH	New Pending	1	03-Movable Non- Electrical Owner Owner	Capital	2.930 4.040 5.940	1 No No	Special	---	N/A N/A	---	No No	No ---	No No Yes	No No No	Actual No ---
Nuclear Medicine 1618 Nuc Med GE PET/CT	SHD-EB2FF Shield Lead, Mobile	Biodex Medical Systems, Inc. 042-580 Clear-Lead Mobile Barrier (Regular Window) 042-580	New Pending	1	03-Movable Non- Electrical Owner Owner	Capital	33.000 10.500 73.620	103 No No	Floor - Mobile	---	N/A N/A	---	No No	No ---	No No No	No No No	Actual No ---
Nuclear Medicine 1618 Nuc Med GE PET/CT	STL-B5D17 Stool Exam, Cushion- Seat	Midmark Corporatio n - Medical Basic Stool, Pneumatic ally Adjustable, Soft Rubber Casters 272-002- 856	New Pending	1	03-Movable Non- Electrical ---	Capital	23.000 23.000 ---	---	N/A	---	---	---	No No	No ---	No No No	No No No	---
Nuclear Medicine 1618 Nuc Med GE PET/CT	TOB-BCD22 Table, Overbed General	Baxter - Hillrom, Room & Furniture Dual Top Overbed Table P009498 P009498	New Pending	1	03-Movable Non- Electrical Owner Owner	Capital	19.000 32.500 42.500	55 No No	Floor - Mobile	---	N/A N/A	---	No No	No ---	No No No	No No No	Actual No ---

Arch Dept Room # Room	Atta3 ID Category Subcat	Mfr Model Item Cat #	Status Stage	Item Qty	Arch Code Furnish Resp Install Resp	Funding Src	Width Depth Height	Product Wt Arch Sig Item Spat Sig	Mounting	Volts Amp Hz	Electrical Phase Plug Type	BTU/hr	Ded Circuit Emerg Pwr	Drain Gas Type Medical Gas	Steam Dental Vac Medical Vac	Cold Water Hot Water Treated Water	Diss Type Vent Vent Type
Nuclear Medicine 1618 Nuc Med GE PET/CT	WST-9DF14 Waste Can 20-31 Gallon	Rubbermaid Commercial Products FG354060 Slim Jim (23 Gal./Gray) FG354060 GRAY	New Pending	1	03-Movable Non-Electrical Owner	Capital	11.000 22.000 30.000	7 No No	Floor	---	N/A N/A	---	No No	No ---	No No No	No No No	Actual No ---
Nuclear Medicine 1619A Control Room	WST-A0761 Waste Can Open Top	Rubbermaid Commercial Products 2956 Deskside Medium (28 qt Gray) FG295600 GRAY	New Pending	2	03-Movable Non-Electrical Owner	Capital	10.300 14.400 15.000	1 No No	Floor	---	N/A N/A	---	No No	No ---	No No No	No No No	Actual No ---
Nuclear Medicine 1618 Nuc Med GE PET/CT	WST-A94DB Waste Can Open Top	Rubbermaid Commercial Products 2957 Large Deskside 41 Qt./Gray FG295700 GRAY	New Pending	1	03-Movable Non-Electrical Owner	Capital	15.300 11.300 20.000	2 No No	Floor	---	N/A N/A	---	No No	No ---	No No No	No No No	Actual No ---

Project Item Quantity:

29



APPENDIX 04

MEDICAL EQUIPMENT CUTSHEETS



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Model:042-580 Clear-Lead Mobile Barrier (Regular Window)
Category: Shield
Subcategory: Lead, Mobile
Manufacturer:Biodex Medical Systems, Inc.
Catalog #: 042-580

Atta 3 ID: SHD-EB2FF
Atta ID: 4311-034
JSN:
RefID 1:
RefID 2:

Mobile lead shield. Features: 24 H x 30 W inches clear lead acrylic window (0.5 millimeter lead equivalent). Opaque Panel: 0.8 millimeter lead equivalent. Four hospital grade casters, two locking, two non-locking. 72 x 30 inches shielding area.

General Production Detail

Arch Sig: No	Spatial Sig: No
Arch Code: 03-Movable Non-Electrical	ADA: No
Critical Path: No	Antimicrobial: No
Type: Medical	Green: No
Furnish Install: Owner / Owner	

Physical Requirements

Width (in.): 33.0000	Left (in.): N/A
Depth (in.): 10.5000	Right (in.): N/A
Height (in.): 73.6200	Front (in.): N/A
Product Weight (lbs): 103.0000	Back (in.): N/A
Max Operating Weight (lbs):	Top (in.): N/A
Mounting: Floor - Mobile	Bottom (in.): N/A
Specification notes:	

Structural Requirements

Seismic: No	OPA #:
	Pre-Approval:
Structural notes:	

Technology Requirements

Patient Data: No	Network:
Connection Type: N/A	System:
Technical Connection notes:	

Electrical Requirements

Volts:	Watts: N/A
Hz: N/A	Amps: N/A
KVA:	Circuit: No
UPS: N/A	Plug Type: N/A
Emerg. Power: No	Plug Detail:
Other Volts Avail.: No	Electrical Phase: N/A
BTU/hr: N/A	
Electrical notes:	

Utility Requirements

Water - Cold: No	Gas Type:
Water - Hot: No	Gas Location:
Water - Treated: No	Medical Gas: No
Drain: No	Vent Type:
Drain Location:	Heat Dissipation: N/A
Steam: No	Dissipation Type: Actual
Vacuum - Den. / Med.: No/No	
Plumbing notes:	
Mechanical notes:	

Locations

Level	Arch Dept	Room	Room #	Status	Item Qty
Level 1	Nuclear Medicine	Nuc Med GE PET/CT	1618	New	1

Total: 1

Clear-Lead™ Mobile Barriers

MOBILE X-RAY BARRIERS

Ionizing Radiation Protection - Mobile Barriers offer large, durable and shatter resistant protection wherever it's needed.



- Meets all infection-control criteria
- Sleek design is easy to clean
- Durable and shatter resistant protection
- Effortless maneuverability
- 0.5 mm lead equivalency window
- 0.8 mm lead stainless steel panel
- Superior stability

Clear-Lead™ acrylic mobile x-ray barriers are designed for use around any imaging procedures using ionizing radiation, e.g., fluoroscopy, x-ray, CT, mammography.

The greatest advantage of these barriers over others on the market is the time they save behind the scenes. Their sleek design exposes no hardware, nooks or crannies while the opaque section of the shield is covered with stainless steel – the result, a smooth, easy-to-clean finish.

Grab-handle edges and large casters make them effortless to maneuver. Clear-Lead™ Mobile Barriers offer large, durable and shatter resistant protection wherever it is needed.

SPECIFICATIONS:

042-580 Clear-Lead Mobile Barrier, Standard Window

Dimensions:

- Overall: 33" w x 73.62" h (84 x 187 cm)
- Window: 30" w x 22" h (76 x 56 cm)
- Opaque Panel: 30" w x 46.25" h (76 x 117 cm)
- Shielded Area: 30" w x 68.25" h (76 x 173 cm)

Shielding:

- Window: 0.5 mm lead equivalency
- Opaque Panel: 0.8 mm lead

Leg Depth: 10.5" (26.7 cm)

Casters: Four hospital grade; two locking, two non-locking

Weight: 103 lb (47 kg)

Warranty: One year parts and labor

042-582 Clear-Lead Mobile Barrier, Full Window

Dimensions:

- Overall: 33" w x 73.62" h (84 x 187 cm)
- Window: 30" w x 46" h (76 x 116.8 cm)
- Opaque Panel: 30" w x 22.25" h (76 x 56.5 cm)
- Shielding Area: 30" w x 68.25" h (76 x 173 cm)

Shielding:

- Window: 0.5 mm lead equivalency
- Opaque Panel: 0.8 mm lead

Leg Depth: 10.5" (26.7 cm)

Casters: Four hospital grade; two locking, two non-locking

Weight: 97 lb (44 kg)

Warranty: One year parts and labor

- 042-580** Barrier, Mobile, Clear-Lead, Standard Window
For ionizing radiation, 0.5 mm LE
Window size 30" w x 22" h (76 x 56 cm)
- 042-582** Barrier, Mobile, Clear-Lead, Full Window
For ionizing radiation, 0.5 mm LE
Window size 30" w x 46" h (76 x 116.8 cm)

www.biodex.com/clear-lead



Model:2956 Deskside Medium (28 qt Gray)
Category: Waste Can
Subcategory: Open Top
Manufacturer:Rubbermaid Commercial Products
Catalog #: FG295600GRAY

Atta 3 ID: WST-A0761
Atta ID: 4688-054
JSN:
RefID 1:
RefID 2:

Open top waste can. Rectangular, 28-quart capacity. Gray plastic. Fits under standard-height desk.

General Production Detail

Arch Sig: No	Spatial Sig: No
Arch Code: 03-Movable Non-Electrical	ADA: No
Critical Path: No	Antimicrobial: No
Type: Non-Medical	Green: No
Furnish Install: Owner / Owner	

Electrical Requirements

Volts:	Watts: N/A
Hz: N/A	Amps: N/A
KVA:	Circuit: No
UPS: N/A	Plug Type: N/A
Emerg. Power: No	Plug Detail:
Other Volts Avail.: No	Electrical Phase: N/A
BTU/hr: N/A	
Electrical notes:	

Physical Requirements

Width (in.): 10.3000	Left (in.): N/A
Depth (in.): 14.4000	Right (in.): N/A
Height (in.): 15.0000	Front (in.): N/A
Product Weight (lbs): 1.6000	Back (in.): N/A
Max Operating Weight (lbs):	Top (in.): N/A
Mounting: Floor	Bottom (in.): N/A
Specification notes:	

Utility Requirements

Water - Cold: No	Gas Type:
Water - Hot: No	Gas Location:
Water - Treated: No	Medical Gas: No
Drain: No	Vent Type:
Drain Location:	Heat Dissipation: N/A
Steam: No	Dissipation Type: Actual
Vacuum - Den. / Med.: No/No	
Plumbing notes:	
Mechanical notes:	

Structural Requirements

Seismic: No	OPA #:
	Pre-Approval:
Structural notes:	

Technology Requirements

Patient Data: No	Network:
Connection Type: N/A	System:
Technical Connection notes:	

Locations

Level	Arch Dept	Room	Room #	Status	Item Qty
Level 1	Nuclear Medicine	Control Room	1619A	New	2

Total: 2

Deskside Waste and Recycling Baskets and Tops

Space-efficient, economical, and an easy and effective way to recycle.

- All-plastic construction won't chip, rust, or dent. Rolled rims add strength, and are easy to clean
- Fits under standard-height desk even when swing top is fully extended
- Recycling options available
- Use Waste Stream Label Kit Version A (1977785) to ensure waste sortation accuracy. See more on page 44.



Side bins create a compact deskside recycling center.

- Add side bins to turn a regular wastebasket into a convenient recycling station
- Customize with different colors for all your recycling sortation needs
- Designed to fit under any standard desk or counter while handling all the waste in a day's work



Deskside Wastebaskets

NO.	COLOR	DESCRIPTION	U.S. DIMENSIONS	U.S. CAPACITY	U.S. SHIP WT/CTN	METRIC DIMENSIONS	METRIC CAPACITY	METRIC SHIP WT/CTN	CAN LINERS	PACK
FG295500	GRAY, BEIG, BLA	Wastebasket, Small	11.4" l x 8.3" w x 12.13" h	13% qt	14.3 lb	28.9 cm x 21 cm x 30.8 cm	12.9 L	6.5 kg	5002-88	12
2044159	WHITE	Wastebasket, Small	11.4" l x 8.3" w x 12.13" h	13% qt	14.3 lb	28.9 cm x 21 cm x 30.8 cm	12.9 L	6.5 kg	5002-88	12
FG295600	GRAY, BEIG, BLA	Wastebasket, Medium	14.4" l x 10.3" w x 15.0" h	28% qt	20.7 lb	36.5 cm x 26 cm x 38.1 cm	26.6 L	9.4 kg	5002-88	12
2044160	WHITE	Wastebasket, Medium	14.4" l x 10.3" w x 15.0" h	28% qt	20.7 lb	36.5 cm x 26 cm x 38.1 cm	26.6 L	9.4 kg	5002-88	12
2031824	BLUE	Wastebasket, Medium	14.4" l x 10.3" w x 15.0" h	28% qt	20.7 lb	36.5 cm x 26 cm x 38.1 cm	26.6 L	9.4 kg	5002-88	12
2031812	GREEN	Wastebasket, Medium	14.4" l x 10.3" w x 15.0" h	28% qt	20.7 lb	36.5 cm x 26 cm x 38.1 cm	26.6 L	9.4 kg	5002-88	12
FG295700	GRAY, BEIG, BLA	Wastebasket, Large	11.3" l x 15.3" w x 20" h	41% qt	27.3 lb	27.9 cm x 39.4 cm x 52.7 cm	12.4 kg	12.4 kg	5003-88	12

Deskside Recycling Containers

NO.	COLOR	DESCRIPTION	U.S. DIMENSIONS	U.S. CAPACITY	U.S. SHIP WT/CTN	METRIC DIMENSIONS	METRIC CAPACITY	METRIC SHIP WT/CTN	CAN LINERS	PACK
FG295073	BLUE, GRAY, BLA	Side Bin Recycling Center	10.6" l x 7.3" w x 11.7" h	4% qt	9.0 lb	26.9 cm x 18.5 cm x 29.7 cm	4.50 L	4.1 kg		12
FG295573	BLUE	Deskside Recycling Container, Small with Universal Recycle Symbol	11.4" l x 8.3" w x 12.1" h	13% qt	14.3 lb	29.0 cm x 21.0 cm x 30.8 cm	12.9 L	6.5 kg	5002-88	12
FG295606	GRN	Deskside Recycling Container, Medium with Universal Recycle Symbol	14.5" l x 10.5" w x 15.0" h	28% qt	21.7 lb	36.8 cm x 26.7 cm x 38.1 cm	26.6 L	9.8 kg	5002-88	12
FG295673	BLUE	Deskside Recycling Container, Medium with Universal Recycle Symbol	14.5" l x 10.5" w x 15.0" h	28% qt	21.7 lb	36.8 cm x 26.7 cm x 38.1 cm	26.6 L	9.8 kg	5002-88	12
FG295773	BLUE	Deskside Recycling Container, Large with Universal Recycle Symbol	15.3" l x 11.3" w x 20.0" h	41% qt	28.3 lb	38.7 cm x 28.6 cm x 50.8 cm	39 L	12.8 kg	5003-88	12



Model:2957 Large Deskside 41 Qt./Gray
Category: Waste Can
Subcategory: Open Top
Manufacturer:Rubbermaid Commercial Products
Catalog #: FG295700GRAY

Atta 3 ID: WST-A94DB
Atta ID: 4688-005
JSN:
RefID 1:
RefID 2:

Open top waste can. Features: Rectangular Container Shape. 10-gallon (41 Qt.) capacity. All-plastic construction, gray color. Fits under standard-height desk. ADA Compliant.

General Production Detail

Arch Sig: No	Spatial Sig: No
Arch Code: 03-Movable Non-Electrical	ADA: Yes
Critical Path: No	Antimicrobial: No
Type: Non-Medical	Green: No
Furnish Install: Owner / Owner	

Electrical Requirements

Volts:	Watts: N/A
Hz: N/A	Amps: N/A
KVA:	Circuit: No
UPS: N/A	Plug Type: N/A
Emerg. Power: No	Plug Detail:
Other Volts Avail.: No	Electrical Phase: N/A
BTU/hr: N/A	
Electrical notes:	

Physical Requirements

Width (in.): 15.3000	Left (in.): N/A
Depth (in.): 11.3000	Right (in.): N/A
Height (in.): 20.0000	Front (in.): N/A
Product Weight (lbs): 2.2500	Back (in.): N/A
Max Operating Weight (lbs):	Top (in.): N/A
Mounting: Floor	Bottom (in.): N/A
Specification notes:	

Utility Requirements

Water - Cold: No	Gas Type:
Water - Hot: No	Gas Location:
Water - Treated: No	Medical Gas: No
Drain: No	Vent Type:
Drain Location:	Heat Dissipation: N/A
Steam: No	Dissipation Type: Actual
Vacuum - Den. / Med.: No/No	
Plumbing notes:	
Mechanical notes:	

Structural Requirements

Seismic: No	OPA #:
	Pre-Approval:
Structural notes:	

Technology Requirements

Patient Data: No	Network:
Connection Type: N/A	System:
Technical Connection notes:	

Locations

Level	Arch Dept	Room	Room #	Status	Item Qty
Level 1	Nuclear Medicine	Nuc Med GE PET/CT	1618	New	1

Total: 1

Deskside Waste and Recycling Baskets and Tops

Space-efficient, economical, and an easy and effective way to recycle.

- All-plastic construction won't chip, rust, or dent. Rolled rims add strength, and are easy to clean
- Fits under standard-height desk even when swing top is fully extended
- Recycling options available
- Use Waste Stream Label Kit Version A (1977785) to ensure waste sortation accuracy. See more on page 44.



Side bins create a compact deskside recycling center.

- Add side bins to turn a regular wastebasket into a convenient recycling station
- Customize with different colors for all your recycling sortation needs
- Designed to fit under any standard desk or counter while handling all the waste in a day's work



Deskside Wastebaskets

NO.	COLOR	DESCRIPTION	U.S. DIMENSIONS	U.S. CAPACITY	U.S. SHIP WT/CTN	METRIC DIMENSIONS	METRIC CAPACITY	METRIC SHIP WT/CTN	CAN LINERS	PACK
FG295500	GRAY, BEIG, BLA	Wastebasket, Small	11.4" l x 8.3" w x 12.13" h	13% qt	14.3 lb	28.9 cm x 21 cm x 30.8 cm	12.9 L	6.5 kg	5002-88	12
2044159	WHITE	Wastebasket, Small	11.4" l x 8.3" w x 12.13" h	13% qt	14.3 lb	28.9 cm x 21 cm x 30.8 cm	12.9 L	6.5 kg	5002-88	12
FG295600	GRAY, BEIG, BLA	Wastebasket, Medium	14.4" l x 10.3" w x 15.0" h	28% qt	20.7 lb	36.5 cm x 26 cm x 38.1 cm	26.6 L	9.4 kg	5002-88	12
2044160	WHITE	Wastebasket, Medium	14.4" l x 10.3" w x 15.0" h	28% qt	20.7 lb	36.5 cm x 26 cm x 38.1 cm	26.6 L	9.4 kg	5002-88	12
2031824	BLUE	Wastebasket, Medium	14.4" l x 10.3" w x 15.0" h	28% qt	20.7 lb	36.5 cm x 26 cm x 38.1 cm	26.6 L	9.4 kg	5002-88	12
2031812	GREEN	Wastebasket, Medium	14.4" l x 10.3" w x 15.0" h	28% qt	20.7 lb	36.5 cm x 26 cm x 38.1 cm	26.6 L	9.4 kg	5002-88	12
FG295700	GRAY, BEIG, BLA	Wastebasket, Large	11.3" l x 15.3" w x 20" h	41% qt	27.3 lb	27.9 cm x 39.4 cm x 52.7 cm	12.4 kg	12.4 kg	5003-88	12

Deskside Recycling Containers

NO.	COLOR	DESCRIPTION	U.S. DIMENSIONS	U.S. CAPACITY	U.S. SHIP WT/CTN	METRIC DIMENSIONS	METRIC CAPACITY	METRIC SHIP WT/CTN	CAN LINERS	PACK
FG295073	BLUE, GRAY, BLA	Side Bin Recycling Center	10.6" l x 7.3" w x 11.7" h	4% qt	9.0 lb	26.9 cm x 18.5 cm x 29.7 cm	4.50 L	4.1 kg		12
FG295573	BLUE	Deskside Recycling Container, Small with Universal Recycle Symbol	11.4" l x 8.3" w x 12.1" h	13% qt	14.3 lb	29.0 cm x 21.0 cm x 30.8 cm	12.9 L	6.5 kg	5002-88	12
FG295606	GRN	Deskside Recycling Container, Medium with Universal Recycle Symbol	14.5" l x 10.5" w x 15.0" h	28% qt	21.7 lb	36.8 cm x 26.7 cm x 38.1 cm	26.6 L	9.8 kg	5002-88	12
FG295673	BLUE	Deskside Recycling Container, Medium with Universal Recycle Symbol	14.5" l x 10.5" w x 15.0" h	28% qt	21.7 lb	36.8 cm x 26.7 cm x 38.1 cm	26.6 L	9.8 kg	5002-88	12
FG295773	BLUE	Deskside Recycling Container, Large with Universal Recycle Symbol	15.3" l x 11.3" w x 20.0" h	41% qt	28.3 lb	38.7 cm x 28.6 cm x 50.8 cm	39 L	12.8 kg	5003-88	12



Model:3M Avagard D Instant
Category: Dispenser
Subcategory: Hand Sanitizer, Wall Mount
Manufacturer:3M Health Care
Catalog #: 9236

Atta 3 ID: DSP-F282A
Atta ID: 5869-065
JSN:
RefID 1:
RefID 2:

Wall mounted hand sanitizer dispenser. Features: For Avagard Instant Hand Antiseptic (9222, 9222C, 9338, 9431 500 mL pump bottles.) Ships 16/case.

General Production Detail

Arch Sig: Yes	Spatial Sig: No
Arch Code: 01-Fixed Equipment	ADA: No
Critical Path: No	Antimicrobial: No
Type: Non-Medical	Green: No
Furnish Install: Owner / Contractor	

Physical Requirements

Width (in.): 3.5000	Left (in.): N/A
Depth (in.): 4.0000	Right (in.): N/A
Height (in.): 8.5000	Front (in.): N/A
Product Weight (lbs): 1.0000	Back (in.): N/A
Max Operating Weight (lbs):	Top (in.): N/A
Mounting: Wall	Bottom (in.): N/A
Specification notes:	

Structural Requirements

Seismic: No	OPA #:
	Pre-Approval:
Structural notes:	

Technology Requirements

Patient Data: No	Network:
Connection Type: N/A	System:
Technical Connection notes:	

Electrical Requirements

Volts:	Watts: N/A
Hz: N/A	Amps: N/A
KVA:	Circuit: No
UPS: N/A	Plug Type: N/A
Emerg. Power: No	Plug Detail:
Other Volts Avail.: No	Electrical Phase: N/A
BTU/hr: N/A	
Electrical notes:	

Utility Requirements

Water - Cold: No	Gas Type:
Water - Hot: No	Gas Location:
Water - Treated: No	Medical Gas: No
Drain: No	Vent Type:
Drain Location:	Heat Dissipation: N/A
Steam: No	Dissipation Type: Actual
Vacuum - Den. / Med.: No/No	
Plumbing notes:	
Mechanical notes:	

Locations

Level	Arch Dept	Room	Room #	Status	Item Qty
Level 1	Nuclear Medicine	Nuc Med GE PET/CT	1618	New	1

Total: 1

3M™ Avagard™ Family Wall Brackets and Dispensers

Strong Support

For Improving Hand Hygiene Compliance



3M™ Avagard™ Family of Hand Antiseptics Wall Brackets and Dispensers

Are you looking for another way to support hand hygiene compliance?
Here are three reasons these wall brackets and dispensers can help:

- Promotes patient safety by putting an effective hand hygiene product right where your staff needs it.
- Color may increase awareness for hand hygiene compliance.
- Helps create awareness of hand hygiene, a key critical factor influencing adherence to protocol.*

* Backed by CDC, Joint Commission and the 3M Six Sigma Hand Hygiene Compliance Program in 5 facilities

3M Infection Prevention Solutions

Lead
The Way

3M

Ordering Information

Cat. No.	Product Name	Description	Size	Items/Case
9201A	3M™ Avagard™ Wall Bracket and Foot Pump	Use with 9200 and 9216	—	6
9202	3M™ Avagard™ Wall Bracket and Hand Pump	Use with 9200 and 9216	—	1
9203	3M™ Avagard™ Replacement Foot Pump	Use with 9201	—	1
9236	3M™ Avagard™ D Wall Bracket (white) (Available through your 3M Infection Prevention representative)	Use with 9222, 9338, 9431 – 500 mL pump bottle	3.43" w x 8.44" h x 3.81" d	16
NEW 9246	3M™ Avagard™ Foaming Wall Bracket (white)	Use with 9321 – 500 mL pump bottle	3.43" w x 8.47" h x 3.81" d	16
9228	3M™ Avagard™ Hands Free Wall Dispenser	Use with 9200 and 9216	—	4
9240	3M™ Avagard™ Hands Free Wall Dispenser	Use with 9230 and 9322A	7.3" w x 12.5" h x 4.0" d	4
9241	3M™ Avagard™ Manual-Push Dispenser	Use with 9230 and 9322A	7.2" w x 11.9" h x 4.0" d	4

To learn more, contact your 3M Representative, or call the 3M Health Care Helpline at 1-800-228-3957, or visit us at www.3M.com/avagard.



Infection Prevention Division 3M Health Care

2510 Conway Avenue
St. Paul, MN 55144-1000
U.S.A.
1-800-228-3957
www.3M.com/infectionprevention

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70-2009-9711-5



Model: 65652-516 Canister/Bracket (1500 cc)
Category: Bracket
Subcategory: Canister, Suction, Wall Mount
Manufacturer: Cardinal Health - Medical
Catalog #: 65652-516/65652-145
Atta 3 ID: BRK-389CE
Atta ID: 7696-012
JSN:
RefID 1:
RefID 2:

Wall mounted canister/bracket assembly with built-in on/off valve. For use with disposable CRD liner. 1500 cc capacity. Bracket assembly has pre attached tubing for connection to disposable liner. Configured with wall plate (65652-145)

General Production Detail

Table with 2 columns: Attribute, Value. Rows include Arch Sig, Arch Code, Critical Path, Type, Furnish Install, Spatial Sig, ADA, Antimicrobial, Green.

Electrical Requirements

Table with 2 columns: Attribute, Value. Rows include Volts, Hz, KVA, UPS, Emerg. Power, Other Volts Avail., BTU/hr, Watts, Amps, Circuit, Plug Type, Plug Detail, Electrical Phase, Electrical notes.

Physical Requirements

Table with 2 columns: Attribute, Value. Rows include Width, Depth, Height, Product Weight, Max Operating Weight, Mounting, Specification notes, Left, Right, Front, Back, Top, Bottom.

Utility Requirements

Table with 2 columns: Attribute, Value. Rows include Water - Cold, Water - Hot, Water - Treated, Drain, Drain Location, Steam, Vacuum - Den. / Med., Plumbing notes, Mechanical notes, Gas Type, Gas Location, Medical Gas, Vent Type, Heat Dissipation, Dissipation Type.

Structural Requirements

Table with 2 columns: Attribute, Value. Rows include Seismic, Structural notes, OPA #, Pre-Approval.

Technology Requirements

Table with 2 columns: Attribute, Value. Rows include Patient Data, Connection Type, Technical Connection notes, Network, System.

Locations

Table with 6 columns: Level, Arch Dept, Room, Room #, Status, Item Qty. Row 1: Level 1, Nuclear Medicine, Nuc Med GE PET/CT, 1618, New, 1.

Total: 1

Reusable outer canisters

Reusable clear plastic canisters used to hold the disposable semirigid liners.



Canister with built-in on/off valve

Reusable polycarbonate canister/bracket assembly for use with disposable CRD™ liner. Has preattached bracket assembly with built-in on/off valve and preattached tubing for connection to disposable liner.

Cat. No.	Size	Technical information	Qty.
65652-511	1000cc	Wall to outer edge of canister: 8 in.	1/cs
65652-516	1500cc	Wall to outer edge of canister: 9 in.	1/cs
65652-531	3000cc	Wall to outer edge of canister: 10¾ in.	1/cs



Canister for wall mount

Reusable polycarbonate canister/bracket assembly for use with disposable CRD™ liner. Bracket assembly has preattached tubing for connection to disposable liner.

Cat. No.	Size	Technical information	Qty.
65652-513	1000cc	Wall to outer edge of canister: 8 in.	1/cs
65652-518	1500cc	Wall to outer edge of canister: 9 in.	1/cs
65652-533	3000cc	Wall to outer edge of canister: 10¾ in.	1/cs



Canister with extended bracket for regulator (with D.I.S.S. and hose assembly)

Reusable polycarbonate canister/bracket assembly for use with disposable CRD™ liner. Used to mount regulator on bracket assembly. Comes with the following preattached: 65652-131 Universal female D.I.S.S. Preattached tubing for connection to canister.

Cat. No.	Size	Technical information	Qty.
65652-512	1000cc	Wall to outer edge of canister: 12¾ in.	1/cs
65652-517	1500cc	Wall to outer edge of canister: 13¾ in.	1/cs
65652-532	3000cc	Wall to outer edge of canister: 15¾ in.	1/cs

Reusable accessories

Medi-Vac® reusable accessories are the common denominators for all Medi-Vac® suction systems. The valves, manifolds and connectors work in conjunction with CRD™, Flex Advantage® and Guardian™ suction canister systems. These interchangeable parts make it easy to customize and change your suctioning systems.

Wall plate and adapter

Attachment devices for use with ring brackets.



Variable height adapter

Variable height adapter (low boy)

Used with existing wall plate to attach ring brackets at varying heights below the original wall plate height.

Cat. No.	Qty.
65652-134	1/ea



Wall plate

Wall plate

Used to attach ring brackets to a vertical surface. Predrilled with four 1/4 in. holes.

Cat. No.	Qty.
65652-145	1/ea

Vacuum manifolds

Used to connect one vacuum source to multiple canisters.



Four-canister manifold

Four-canister manifold

Used to connect one vacuum source to four canisters.

Cat. No.	Qty.
65652-004	1/cs



Three-canister manifold

Three-canister manifold

Used to connect one vacuum source to three canisters.

Cat. No.	Qty.
65652-003	1/cs



Two-canister manifold

Two-canister manifold

Used to connect one vacuum source to two canisters.

Cat. No.	Qty.
65652-002	1/cs

Bracket

Support device for a regulator.



Regulator bracket

Regulator bracket

Used to attach regulator to wall plate or mobile suction cart.

Cat. No.	Qty.
65652-149	1/ea



Model: 7600 Cardiac Gating Monitor
Category: Monitor, Physiologic
Subcategory: Cardiac, ECG Trigger
Manufacturer: IVY Biomedical Systems
Catalog #: 7600

Atta 3 ID: MON-E0573
Atta ID: 5886-014
JSN:
RefID 1:
RefID 2:

ECG cardiac trigger monitor. Features: < 2ms trigger delay, R wave synchronization, on-screen color coded trigger pulse indication, ECG R-wave peak detection, synchronized ECG trigger outputs, 4 lead ECG configuration with auto lead selection, built-in ECG simulator, multi-language user interface and patient isolation/protection. Lexan case material. **Configurable per site, actual list price may vary. See manufacturer for site specific pricing and documentation.

General Production Detail

Table with 2 columns: General Production Detail. Rows include Arch Sig: Yes, Arch Code: 02-Movable Electrical, Critical Path: No, Type: Medical, Furnish Install: Owner / Owner, Spatial Sig: No, ADA: No, Antimicrobial: No, Green: No.

Electrical Requirements

Table with 2 columns: Electrical Requirements. Rows include Volts: 120, Hz: 60, KVA: N/A, UPS: N/A, Emerg. Power: No, Other Volts Avail.: No, BTU/hr: N/A, Watts: 45.0000, Amps: 0.3750, Circuit: No, Plug Type: Type B (Nema 5-15), Plug Detail, Electrical Phase: Single Phase, Electrical notes.

Physical Requirements

Table with 2 columns: Physical Requirements. Rows include Width (in.): 7.9000, Depth (in.): 5.2000, Height (in.): 7.5000, Product Weight (lbs): 3.9000, Max Operating Weight (lbs):, Mounting: Counter/Cart/Table/Pole, Specification notes, Left (in.): N/A, Right (in.): N/A, Front (in.): N/A, Back (in.): N/A, Top (in.): N/A, Bottom (in.): N/A.

Utility Requirements

Table with 2 columns: Utility Requirements. Rows include Water - Cold: No, Water - Hot: No, Water - Treated: No, Drain: No, Drain Location, Steam: No, Vacuum - Den. / Med.: No/No, Plumbing notes, Mechanical notes, Gas Type, Gas Location, Medical Gas: No, Vent Type, Heat Dissipation: N/A, Dissipation Type: Actual.

Structural Requirements

Table with 2 columns: Structural Requirements. Rows include Seismic: No, Structural notes, OPA #: Pre-Approval.

Technology Requirements

Table with 2 columns: Technology Requirements. Rows include Patient Data: No, Connection Type: Data, Technical Connection notes, Network, System.

Locations

Table with 6 columns: Level, Arch Dept, Room, Room #, Status, Item Qty. Row 1: Level 1, Nuclear Medicine, Nuc Med GE PET/CT, 1618, New, 1.

Total: 1



Key Features

- Precision ECG R-wave peak detection
- Synchronized ECG trigger outputs
- 4 lead ECG configuration with auto lead selection
- Built-in ECG Simulator
- On-screen color coded trigger pulse indication
- Compact design
- Multi-language user interface
- Patient isolation/protection
- Optional strip chart recorder
- Universal power supply/voltage
- FDA 510(k) & CE Mark

Product Description

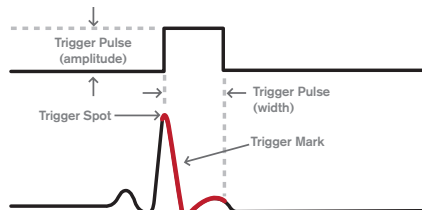
The Ivy Biomedical Systems' Model 7600 is our fifth generation of cardiac gating monitors. It is ideal for use in applications requiring precision ECG R-wave synchronization such as with gamma cameras, nuclear medicine, and molecular imaging systems for cardiac studies.

Value added features such as automatic ECG lead selection ensures that the best trigger vector will be used, while a built-in ECG simulator allows for pre-scan testing of the entire system. An optional strip chart recorder is also available for hardcopy documentation of ECG rhythms.

Ivy Biomedical System's renowned high quality and reliability ensure consistent uptime and long operational life.

Synchronized ECG Trigger Output*

Trigger Delay	< 2ms
R-to-R Accuracy	$\pm 75\mu\text{s}$ dither (typ.) @ 1mV input
Pulse Width**	1, 50, 100 or 150 ms
Pulse Amplitude**	0V to +5V or -10V to +10V
Pulse Polarity**	Positive or Negative
Output Impedance	< 100 Ω



- * Input signal test conditions: 1/2 sine wave, 60ms width, 1mV amplitude, 1 pulse/sec;
 ** Pre-configured at the factory only

ECG

Configuration	4-Lead system
Trigger Lead Selection	I, II, III, or AUTO
Second Lead Display	I, II, III
ECG Simulator	Integrated
Patient Isolation	>4 kV rms, 5.5 kV peak
Frequency Response	0.67 - 100Hz unfiltered 1.5-40Hz Filtered
Notch Filter	50/60 Hz (auto)
CMRR	$\geq 90\text{dB}$
Tall T-wave Rejection	$\leq 1.2 \times \text{R-wave}$
Pacer Rejection	0.1 to 2ms pulse width (user on/off) @ ± 2 to ± 700 mV
Defibrillator Protection	360 J discharge; < 5 sec recovery time (Type CF)

Cardiotach

Adult	10-300 bpm
Pediatric/Neonate	10-350 bpm
Accuracy	$\pm 1\% \pm 1$ bpm
Resolution	1 bpm
Sensitivity	300 μV peak
HR Averaging	Exponential @ 1Hz; 2 or 8 sec max response time

Alarms

High HR Limit	15-250 bpm (5 bpm inc.)
Low HR Limit	10-245 bpm (5 bpm inc.)
Asystole	R-to-R interval > 6 sec
ECG Lead Off	Each detached lead
Check ECG Lead	Lead imbalance > 0.5V

(Specifications subject to change without notice)

Display

Waveform Type	Dual trace; Freeze Active Matrix TFT Color Touch Screen LCD
Resolution Size	640x480 pixels 6.5" (16.5 cm) diagonal

Input/Output Interface

Synch Output	BNC; Provides trigger pulse output synch to ECG R-wave peak
ECG Output	1/4" stereo jack; Provides trigger pulse output synchronized to ECG R-wave peak as well as analog ECG waveform output
RS-232 Comm	Micro DB-9 device interface

Mechanical

Size (HxWxD)	19.0x20.2x13.2 cm (7.5x7.9x5.2 inches)
Weight	1.8 kg (3.9 lbs.)
Case Material	Lexan®

Electrical

Input Voltage	100-120Vac; 200-230Vac
Frequency	50/60 Hz
Power Consumption	45 VA (max.)
Power Recovery	Auto if power restored within 30 seconds

Environmental

Water Resistance	IPX1
Operating Temperature Range	5°C to 40°C
Relative Humidity	0% to 90% non-condensing
Altitude	-100m to +3,600m

Storage

Temperature Range	-40°C to +70°C
Relative Humidity	5% to 95% non-condensing
Altitude	-100m to +14,000m

Options

Integrated Recorder	2 trace, direct thermal
Mounting Plate	3" adaptor for rollstand
Roll Stand	with 3" receiver plate

Accessories

Electrodes	Low impedance; 10% KCI wet gel sponge type
ECG Leads	4-lead metallic with pinch clips; AHA or IEC color code; 24", 30" or 36" lengths available
Patient Cable	10' cable with 6-pin AAMI connector

Globalization

User Interface	12 selectable languages
Operator's Manual	33 languages on CD
Registrations	Multiple countries

Compliance & Certifications

ANSI/AAMI ES60601-1:2005
 CAN/CSA C22.2 No 601.1-M90:2005
 CAN/CSA C22.2 No 60601-1:2008
 CDN MDR (CMDCAS)
 CE 0413
 EAC
 IEC 60601-1 2nd edition
 IEC 60601-1 3rd edition
 IEC 60601-2-27
 ISO 13485:2003
 FDA
 MDD 93/42/EEC
 RoHS 2011/65/EU
 UL 60601-1 1st edition
 WEEE 2012/19/EC

Notified Body

Intertek Semko AB
 Identification Number 0413
 MDD Classification IIb

Authorized Representative

Emergo Europe



For additional specifications,
 refer to Operator Manual



Manufactured by:



Ivy Biomedical Systems, Inc.
 11 Business Park Drive
 Branford, Connecticut 06405 USA
 Toll Free 800 247 4614
 Main 203 481 4183
 Fax 203 481 8734
 www.ivybiomedical.com

Distributed by:



Model:Adult NIBP Air Hose 3.0m (Philips)
Category: Monitor, Physiologic
Subcategory: Blood Pressure, Ambulatory
Manufacturer:Philips Healthcare - Monitoring Systems
Catalog #: M1599B

Atta 3 ID: MON-241A1
Atta ID: MON-241A1
JSN:
RefID 1:
RefID 2:

General Production Detail

Arch Sig: No	Spatial Sig: No
Arch Code: 03-Movable Non-Electrical	ADA:
Critical Path: No	Antimicrobial:
Type: Medical	Green:
Furnish Install: Owner / Owner	

Electrical Requirements

Volts: N/A	Watts: N/A
Hz: N/A	Amps: N/A
KVA:	Circuit:
UPS: N/A	Plug Type:
Emerg. Power: No	Plug Detail:
Other Volts Avail.:	Electrical Phase:
BTU/hr: N/A	
Electrical notes:	

Physical Requirements

Width (in.):	Left (in.): N/A
Depth (in.):	Right (in.): N/A
Height (in.):	Front (in.): N/A
Product Weight (lbs):	Back (in.): N/A
Max Operating Weight (lbs):	Top (in.): N/A
Mounting:	Bottom (in.): N/A
Specification notes:	

Utility Requirements

Water - Cold:	Gas Type: N/A
Water - Hot:	Gas Location:
Water - Treated:	Medical Gas:
Drain:	Vent Type:
Drain Location:	Heat Dissipation: N/A
Steam:	Dissipation Type:
Vacuum - Den. / Med.: /	
Plumbing notes:	
Mechanical notes:	

Structural Requirements

Seismic:	OPA #:
	Pre-Approval:
Structural notes:	

Technology Requirements

Patient Data: N/A	Network: N/A
Connection Type: N/A	System: N/A
Technical Connection notes:	

Locations

Level	Arch Dept	Room	Room #	Status	Item Qty
Level 1	Nuclear Medicine	Nuc Med GE PET/CT	1618	New	1

Total: 1



Model: Basic Stool, Pneumatically Adjustable, Soft Rubber Casters

Category: Stool

Subcategory: Exam, Cushion-Seat

Manufacturer: Midmark Corporation - Medical

Catalog #: 272-002-856

Atta 3 ID: STL-B5D17

Atta ID: STL-B5D17

JSN:

RefID 1:

RefID 2:

Basic stool, pneumatically adjustable, soft rubber casters. Color option: Dark Linen

General Production Detail

Arch Sig: No

Arch Code: 03-Movable Non-Electrical

Critical Path: No

Type: Medical

Furnish Install: Unassigned / Unassigned

Spatial Sig: No

ADA:

Antimicrobial:

Green:

Electrical Requirements

Volts: N/A

Hz: N/A

KVA:

UPS: N/A

Emerg. Power: No

Other Volts Avail.:

BTU/hr: N/A

Electrical notes:

Watts: N/A

Amps: N/A

Circuit:

Plug Type:

Plug Detail:

Electrical Phase:

Physical Requirements

Width (in.): 23.0000

Depth (in.): 23.0000

Height (in.):

Product Weight (lbs):

Max Operating Weight (lbs):

Mounting: N/A

Specification notes:

Left (in.): N/A

Right (in.): N/A

Front (in.): N/A

Back (in.): N/A

Top (in.): N/A

Bottom (in.): N/A

Utility Requirements

Water - Cold:

Water - Hot:

Water - Treated:

Drain:

Drain Location:

Steam:

Vacuum - Den. / Med.: /

Plumbing notes:

Mechanical notes:

Gas Type: N/A

Gas Location:

Medical Gas:

Vent Type:

Heat Dissipation: N/A

Dissipation Type:

Structural Requirements

Seismic:

Structural notes:

OPA #:

Pre-Approval:

Technology Requirements

Patient Data: N/A

Connection Type: N/A

Technical Connection notes:

Network: N/A

System: N/A

Locations

Level	Arch Dept	Room	Room #	Status	Item Qty
Level 1	Nuclear Medicine	Nuc Med GE PET/CT	1618	New	1

Total: 1

Stools & Chairs



Designed and Manufactured to Exceed Your Expectations

It begins with a wide, five-leg caster base that provides support and stability. The star-shaped base allows closer accessibility to the patient while heavy duty, dual-wheel, hooded casters enable stools to maneuver quietly over all types of surfaces.

Adding to the strength and stability of our stools is the solid steel machine screw on manual models, or air cylinder on pneumatic models. The air cylinder further acts as a built-in shock absorber, taking the abuse of a hard day’s work instead of you, and is a simple and efficient method for adjusting the seat height (ideal for group practices).

Comfort is provided in the form of a wide, amply padded seat section constructed of dense foam. A beadless upholstery seam eliminates the seat edge from digging into your legs. Add a backrest to promote better posture and support to leave you feeling less fatigued at day’s end.

With many choices, colors and accessories, there is certain to be a stool just right for you.

Classic Series Stools

The healthcare industry’s most demanded stools and the foundation of our seating product line. The Classic Series features a polished aluminum/black accented five-leg caster base and hood with a hand ring or foot lever height control (on pneumatic models). The seat height of the 274 (without back) and 275 (with back) adjusts manually while that of the 276 (without back) and 277 (with back) adjusts pneumatically. The 278 (foot lever) and 279 (hand ring) offer pneumatic height adjustment and an armrest to stabilize the physician’s arm during delicate procedures.



425 Air Lift Physician Stool

The ergonomic design of the 425 features a contoured seat that molds to your body shape, making it the most comfortable stool you will ever sit on. A simple lift of the hand ring pneumatically adjusts the seat height, allowing you to find your most comfortable working height effortlessly and efficiently. Plastic covers hide the steel substructures and five-leg caster base to provide a warm, aesthetic appearance.



276 Air Lift Stool

Our best selling stool, the 276 has become the industry standard in healthcare facilities.



427 Air Lift Physician Stool

Includes the same features as the 425, but with a foot lever instead of a hand ring. A touch of your heel to the foot lever pneumatically adjusts the height, allowing you to maintain a sterile field. The 427 is shown with optional back kit that adjusts in, out, up and down—and optional arm kit that adjusts in, out and angularly.

Value Series Stools

Economy version of the popular Classic Series Stools without compromising reliability and style. The Value Series offers a black, plastic composite five-leg caster base and hood, and a single lever height control on pneumatic models. The seat height of the 270 (without back) and 271 (with back) adjusts manually while that of the 272 (without back) and 273 (with back) adjusts pneumatically.



680 Side Chair

Soft and comfortable seating for your patients in the exam room, waiting room and front office. The 680 comes with all the extras: contoured seat and back section for added support; sturdy, powder coated black steel tube frame with leveling feet for increased stability; and a wall-saver kickback leg design that allows the chair to be close to the wall without damaging it. Available with or without high-impact plastic chair arms.



281 Blood Drawing Chair

The slightly angled back and adjustable chair arms offer patient comfort and security. Arms are equipped with quick release mechanisms for simple and efficient positioning of their height and inward/outward angle. The 281 is available with a drawer, ideal for storing supplies and providing an additional work surface.





Let our seating products
provide the comfort and
support you deserve.

You are up and down all day, every
day—so what you need most in
seating is comfort and support. Our
seating products offer wide, amply
padded seats for greater comfort
while a strong base structure provides
superb stability.

The Ritter brand has been providing
quality products to the healthcare
industry for over 50 years and
is recognized as an industry
leader—our seating products
are durable and built to last.

Coordinating your rooms with Ritter
and Midmark exam chairs and casework
will provide a warm, inviting look that
your staff and patients will recognize
and appreciate.

Stools and Chairs		
S P E C I F I C A T I O N S		
Classic Series Stools Seat Height: 18" – 24.5" (274-278) 19" – 25.5" (279) Seat Diameter: 16.25" Seat Cushion Thickness: 3.25" Back Cushion Dimensions: 14" W x 7.5" H (275, 277) Caster Base Diameter: 21.5" Weight Capacity: 350 lb (274, 276) 225 lb (275, 277, 278, 279)	Classic and Value Series Options Locking casters Soft rubber casters Glides 6" Lab height extension Foot ring	281 Blood Drawing Chair Seat Height: 20" Seat Cushion Dimensions: 20" W x 16.5" D Seat Cushion Thickness: 2" Back Cushion Dimensions: 20" W x 16.5" H Inside Arm Width: 21" Outside Arm Width: 32" Storage Drawer Capacity: 8.5" W x 15.25" D x 4.5" H Weight Capacity: 400 lb
Value Series Stools Seat Height: 18" – 24.5" (270-273) Seat Diameter: 16.25" Seat Cushion Thickness: 3.25" Back Cushion Dimensions: 14" W x 7.5" H (271, 273) Caster Base Diameter: 23" Weight Capacity: 300 lb (270, 272) 225 lb (271, 273)	425/427 Air Lift Physician Stools Seat Height: 17.5" – 24" (425) 17" – 23" (427) Seat Cushion Dimensions: 16.5" W x 17" D Seat Cushion Thickness: 3" Back Cushion Dimensions: 13" W x 9.5" H (with back kit accessory) Caster Base Diameter: 23" Weight Capacity: 225 lb	680 Side Chair Seat Height: 17" Seat Cushion Dimensions: 18" W x 19.5" D Seat Cushion Thickness: 2" Back Cushion Dimensions: 18" W x 13.5" H Inside Arm Width: 17.5" (on model with arms) Outside Arm Width: 23.5" (on model with arms) Weight Capacity: 400 lb
 <i>Classic and Value Series Backrest</i>	 <i>Classic Series Glides</i>	 <i>Value Series Glides</i>
 <i>Classic and Value Series Locking Casters</i>	 <i>Classic Series Soft Rubber Casters</i>	 <i>Value Series Soft Rubber Casters</i>
 <i>Classic Series 277 shown with optional 6" lab height extension and foot ring.</i>		

Standard Upholstery Colors

- Mist-813
- Stone-814
- Restful Path-858
- Iron Ore-851
- Lunar Gray-845
- Obsidian-857
- Oasis-843
- Soothing Blue-855
- Dream-847
- Mineral-844
- Healing Waters-848
- Shaded Garden-853
- Citrus-849
- Sandy Retreat-850
- Curative Copper-846
- Cranberry-859
- Dark Linen-856
- Latte-860
- Robust Brown-852
- Deep Earth-854

UltraFree® Upholstery Colors

- UltraFree Stone-865
- UltraFree Restful Path-868
- UltraFree Obsidian-867
- UltraFree Harbor-861
- UltraFree Wheatgrass-862
- UltraFree Spice-863
- UltraFree Cranberry-869
- UltraFree Dark Linen-866
- UltraFree Latte-870
- UltraFree Branch-864

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Model:Bio Systems C-08-2004LR/D-08
Category: Disposal, Sharps
Subcategory: Floor Cart
Manufacturer:Stericycle
Catalog #: C-08-2004LR/D-08

Atta 3 ID: DIS-F3AAD
Atta ID: 6457-008
JSN:
RefID 1:
RefID 2:

8 gallon, red sharps container with mobile wire dolly. Container typically provided at no charge with monthly service contract.

General Production Detail

Arch Sig: No

Spatial Sig: No

Arch Code: 03-Movable Non-Electrical

ADA: No

Critical Path: No

Antimicrobial: No

Type: Medical

Green: No

Furnish Install: Owner / Owner

Physical Requirements

Width (in.): 13.5000

Left (in.): N/A

Depth (in.): 13.0000

Right (in.): N/A

Height (in.): 23.0000

Front (in.): N/A

Product Weight (lbs):

Back (in.): N/A

Max Operating Weight (lbs):

Top (in.): N/A

Mounting: Floor - Mobile

Bottom (in.): N/A

Specification notes:

Structural Requirements

Seismic: No

OPA #:

Pre-Approval:

Structural notes:

Technology Requirements

Patient Data: No

Network:

Connection Type: N/A

System:

Technical Connection notes:

Electrical Requirements

Volts:

Watts: N/A

Hz: N/A

Amps: N/A

KVA:

Circuit: No

UPS: N/A

Plug Type: N/A

Emerg. Power: No

Plug Detail:

Other Volts Avail.: No

Electrical Phase: N/A

BTU/hr: N/A

Electrical notes:

Utility Requirements

Water - Cold: No

Gas Type:

Water - Hot: No

Gas Location:

Water - Treated: No

Medical Gas: No

Drain: No

Vent Type:

Drain Location:

Heat Dissipation: N/A

Steam: No

Dissipation Type: N/A

Vacuum - Den. / Med.: No/No

Plumbing notes:

Mechanical notes:

Locations

Level	Arch Dept	Room	Room #	Status	Item Qty
Level 1	Nuclear Medicine	Nuc Med GE PET/CT	1618	New	1

Total: 1



2, 3 & 4 Gallon Containers

Code # C-02RES-0203, C-03RES-0203,
C-04RES-04

Our **2, 3 & 4 gallon containers** are appropriate for patient rooms and medication areas where security and convenience are critical. The fill line and contents are readily visible through the container's large window.

8 Gallon Container

Code # C-08-2004LR

For increased capacity, the **8 gallon container** is utilized in intensive care, pharmacies, labs and the ER.



17 Gallon Container

Code # C-17

The **17 gallon container** is appropriate for the OR, ER and labs where a higher volume of sharps waste is generated.





Vertical Drop Lid

Code # 0203LIDX

Vertical drop lid allows for simple, single-handed disposal of sharps. A puncture resistant cap is inserted into the opening to secure the contents for transport. The vertical drop lid handles a wide variety of sharps (including butterflies).

Horizontal Drop Lid

Code # 04HORZ-2007

The **Horizontal drop lid** has been designed to easily activate with a small 1cc syringe but this versatile design can also accommodate a syringe as large as 60 cc's. The horizontal lid also incorporates safety/engineering controls that include limited access to the contents of the container. This lid is perfect when space constraints do not allow sufficient room for a vertical drop.



Trap Top Lid

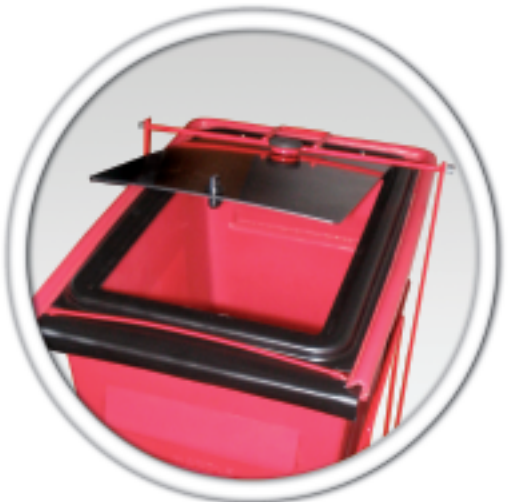
Code # 08-TT-2004

Trap top lid accommodates large sharps or devices. The trap top lid can be kept closed when the container is not in use to reduce exposure.

Hamper Top Lid

Code # LH-17

The **hamper top lid** has been designed for easy operation and can accommodate large sharps and medical devices. When the lid is raised, it provides an opening of 12 inches by 8.5 inches. Easy closure allows reduced exposure to potentially hazardous materials. Used with the wire step-on dolly.



2 Part Slide Top Lid

Code # L2-17

The **slide top lid** allows for simple operation that opens and closes the container. Designed to accommodate large sharps and medical devices, the lid can be easily closed to reduce exposure to potentially hazardous contents.



Wire Wall Bracket

Code # WB-08

The **locking wire wall bracket**, constructed of a durable powder-coated steel, allows the 8 gallon container to be mounted to any vertical surface.

Wire Dolly

Code # D-08

Constructed of a durable powder-coated steel, the **wire dolly** allows the 8 gallon container to be moved from one location to another.



Wire Step-On Dolly

Code # DWS-08, DWS-17, DWSH-17

For mobility and hands-free operation with the 8 or 17 gallon containers, push down on the step-on pedal of the **wire dolly** and the lid will open and close automatically.

Black Dolly

Code # D-17

Made of high density plastic, the 17 gallon **black dolly** makes mobility easy for the 17 gallon container. Wheels on this dolly make it ideal for emergency rooms, labs and operating rooms where mobility is important.



Product Codes

Product Code	Description	Approximate Dimensions (Height x Depth x Width)
C-02RES-0203	2 gallon container (red) with vertical drop lid	15.1" x 4.73" x 12.5"
C-02RES-0203-OC	2 gallon container (red), vertical drop lid, outer cabinet (beige) and key	15.5" x 5.59" x 14.5"
OC-02-2004	2 gallon outer cabinet only (beige)	13.25" x 5.59" x 14.5"
C-03RES-0203	3 gallon container (red) with vertical drop lid	21.1" x 4.73" x 12.5"
C-03RES-0203-OC	3 gallon container (red), vertical drop lid, outer cabinet (beige) and key	21.5" x 5.59" x 14.5"
OC-03-2004	3 gallon outer cabinet only (beige)	19.25" x 5.59" x 14.5"
0203LIDX	2 & 3 gallon vertical drop lid	4.75" x 4.73" x 12.5"
0203WMA	2 & 3 gallon locking wall mount (beige) and key	2.75" x 5.75" x 13"
0203SB	2 & 3 gallon countertop stability base (beige)	4.25" x 7.01" x 11.99"
0203LIDX	4 gallon vertical drop lid	4.78" x 6.85" x 12.25"
04HORZ-2007	4 gallon horizontal drop lid	4.78" x 6.85" x 12.25"
C-04RES-04	4 gallon container (red) with vertical drop lid	21.25" x 6.75" x 11.75"
C-04RES-04HORZ	4 gallon container (red) with horizontal drop lid	21.25" x 6.75" x 11.75"
C-04RES-04-OC	4 gallon container (red), vertical drop lid, outer cabinet (beige) and key	21.81" x 7.47" x 14.5"
C-04RES-04HORZ-OC	4 gallon container (red), horizontal drop lid, outer cabinet (beige) and key	21.81" x 7.47" x 14.5"
OC-04-2004	4 gallon outer cabinet only (beige)	19.25" x 7.47" x 14.5"
WB-04	4 gallon locking wire wall bracket (red) and key	7.12" x 7.75" x 13.02"
C-08-2004LR	8 gallon container only (red)	19.7" x 12.95" x 11.25"
08PT-2004	8 gallon turner top lid	1.25" x 11.25" x 11.25"
08TT-2004	8 gallon trap top lid	1" x 11.25" x 11.25"
WB-08	8 gallon wire wall bracket (red)	21.5" x 13.25" x 14"
D-08	8 gallon wire dolly (red)	23" x 13" x 13.5"
DWS-08	8 gallon wire step-on dolly (red)	23" x 16.5" x 14.25"
C-17	17 gallon container only (red)	24.75" x 17.5" x 13.25"
L-17	17 gallon transport lid (black)	17.25" x 12.62"
L2-17	17 gallon 2 part slide top lid (black)	17.25" x 12.62"
LH-17	17 gallon hamper top lid (black)	17.25" x 12.62"
DWS-17	17 gallon wire step-on dolly (red) for 2 part slide top lid	29.75" x 22.5" x 14.5"
DWSH-17	17 gallon wire step-on dolly (red) for hamper top lid	29.75" x 22.5" x 14.5"
D-17	17 gallon black dolly (black)	9.75" x 19" x 14.25"

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Model: CardioGen-82 Infusion System
Category: Injector
Subcategory: Allowance
Manufacturer: Bracco Diagnostics
Catalog #:

Atta 3 ID: IJT-DA045
Atta ID: IJT-DA045
JSN:
RefID 1:
RefID 2:

General Production Detail

Table with 2 columns: General Production Detail. Rows include Arch Sig: No, Arch Code: 02-Movable Electrical, Critical Path: No, Type: Medical, Furnish Install: Owner / Vendor, Spatial Sig: No, ADA, Antimicrobial, Green.

Electrical Requirements

Table with 2 columns: Electrical Requirements. Rows include Volts: N/A, Hz: N/A, KVA, UPS: N/A, Emerg. Power: No, Other Volts Avail., BTU/hr: N/A, Watts: N/A, Amps: N/A, Circuit, Plug Type, Plug Detail, Electrical Phase, Electrical notes.

Physical Requirements

Table with 2 columns: Physical Requirements. Rows include Width (in.): 22.0000, Depth (in.): 40.0000, Height (in.): 64.0000, Product Weight (lbs): 620.0000, Max Operating Weight (lbs), Mounting, Specification notes, Left (in.): N/A, Right (in.): N/A, Front (in.): N/A, Back (in.): N/A, Top (in.): N/A, Bottom (in.): N/A.

Utility Requirements

Table with 2 columns: Utility Requirements. Rows include Water - Cold, Water - Hot, Water - Treated, Drain, Drain Location, Steam, Vacuum - Den. / Med.: / Plumbing notes, Mechanical notes, Gas Type: N/A, Gas Location, Medical Gas, Vent Type, Heat Dissipation: N/A, Dissipation Type.

Structural Requirements

Table with 2 columns: Structural Requirements. Rows include Seismic, Structural notes, OPA #, Pre-Approval.

Technology Requirements

Table with 2 columns: Technology Requirements. Rows include Patient Data: N/A, Connection Type: N/A, Technical Connection notes, Network: N/A, System: N/A.

Locations

Table with 6 columns: Level, Arch Dept, Room, Room #, Status, Item Qty. Row 1: Level 1, Nuclear Medicine, Nuc Med GE PET/CT, 1618, Lease, 1.

Total: 1

8 APPENDIX

8.1 Specifications

8.1.1 Specifications

The specifications of the CardioGen-82® Infusion System are described below in Table 8-1.

Table 8-1: CardioGen-82® Infusion System Specifications

Feature	Specification
Classification	
Type of protection against Electric Shock	Class 1
Degree of Protection Against Electric Shock	Type BF applied part (Patient tubing)
Classification According to the Degree of Protection Against Ingress of Water	IPX0 (No Protection)
Mode of Operation	Continuous
Power Requirements	
Rated voltage	100 - 240V AC
Rated Current	1.6 - 0.8 A
Rated frequency	50-60 Hz
Fuse	Type F 2.0AL 250V
Display	
Operator Interface	Panel PC with Touch Screen
Screen resolution	1920 x 1080 pixels
Color depth	24 bits-per-pixel
Operational Range and Programming	
Elution Volume	1-100 mL in 1 mL increments: ± 1.5 mL
Patient Volume	1-100 mL in 1 mL increments: ± 1.5 mL
Rb-82 Delivery Range ¹	10 – 60 mCi
Rb-82 Delivery Accuracy	10 to <30 mCi: $\pm 15\%$ 30 to 60 mCi: $\pm 10\%$
Flow Rate	20 mL/min. or 50 mL/min.: ± 0.5 mL/min.
System Pressure Limit	90 psig $\pm 10\%$
Patient/Waste Valves	Patient/Waste and saline wash valve positions are continuously monitored.
Valve Operation	Transition between waste and patient positions in less than 2 sec.
Monitoring Function	Automatic infusion operations will not start if an operation error is detected. Automatic infusion operations are terminated, if in progress, for all of the following conditions: high pressure error, valve error, or if a pump limit is detected. Purge operations will not start and will be terminated, if in progress, if a high-pressure error, valve error, or pump limit is detected.
Product Weight/Dimensions	
System Weight	620 lbs.
System Size	40 x 22 x 64" (L x W x H)
Shipping Weight	840 lbs.
Shipping Size	45 x 32 x 54" (L x W x H)
Operating Conditions	
Temperature:	68-77°F (20-25°C)

¹ For patient dose range for rubidium Rb 82 chloride injection, refer to the Prescribing Information for CardioGen-82® (rubidium Rb 82 generator).



Model:Combi-Fold (C-Fold) Paper Towel Dispenser Black

Category: Dispenser

Subcategory: Paper Towel, Surface Mount

Manufacturer:Georgia Pacific

Catalog #: 56650A

Atta 3 ID: DSP-D9F1F

Atta ID: DSP-D9F1F

JSN:

RefID 1:

RefID 2:

General Production Detail

Arch Sig: No	Spatial Sig: No
Arch Code: 01-Fixed Equipment	ADA:
Critical Path: No	Antimicrobial:
Type: Non-Medical	Green:
Furnish Install: Owner / Contractor	

Physical Requirements

Width (in.):	Left (in.): N/A
Depth (in.):	Right (in.): N/A
Height (in.):	Front (in.): N/A
Product Weight (lbs):	Back (in.): N/A
Max Operating Weight (lbs):	Top (in.): N/A
Mounting:	Bottom (in.): N/A
Specification notes:	

Structural Requirements

Seismic:	OPA #:
	Pre-Approval:
Structural notes:	

Technology Requirements

Patient Data: N/A	Network: N/A
Connection Type: N/A	System: N/A
Technical Connection notes:	

Electrical Requirements

Volts: N/A	Watts: N/A
Hz: N/A	Amps: N/A
KVA:	Circuit:
UPS: N/A	Plug Type:
Emerg. Power: No	Plug Detail:
Other Volts Avail.:	Electrical Phase:
BTU/hr: N/A	
Electrical notes:	

Utility Requirements

Water - Cold:	Gas Type: N/A
Water - Hot:	Gas Location:
Water - Treated:	Medical Gas:
Drain:	Vent Type:
Drain Location:	Heat Dissipation: N/A
Steam:	Dissipation Type:
Vacuum - Den. / Med.: /	
Plumbing notes:	
Mechanical notes:	

Locations

Level	Arch Dept	Room	Room #	Status	Item Qty
Level 1	Nuclear Medicine	Nuc Med GE PET/CT	1618	New	1

Total: 1



Georgia-Pacific

REFERENCE GUIDE: 56650A

Combi-Fold Towel Dispenser



1x

reference guide
guía de referencia
guide de référence



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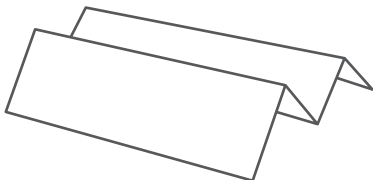
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dispensador
distributeur

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#21000

#23304

#20389

Mounting Instructions | Instrucciones de montaje | Instructions d'installation

- 1

Use key to open the front cover. Position unit on wall so that the top is level and mark the screw locations where indicated.

NOTE: Recommended distance from bottom of dispenser to the floor is 42"-44".

Utilice la llave para abrir la cubierta frontal. Coloque la unidad en la pared de manera que la parte superior esté nivelada y marque la ubicación de los tornillos donde se indica.

NOTA: La distancia recomendada desde la parte inferior del dispensador al piso es de 42" a 44" (106.7 a 111.8 cm).

Utilisez la clé pour ouvrir le couvercle avant. Placez l'unité sur le mur de façon à ce que la partie supérieure soit de niveau et marquez l'emplacement des vis aux endroits indiqués.

REMARQUE : La distance recommandée entre la partie inférieure du distributeur et le plancher est de 106,7 à 111,8 cm (42 à 44 po).
- 2

Secure unit to wall with anchored screws in locations previously marked. Additional slots are available if you would like to add more screws.

Asegure la unidad a la pared con tornillos de anclaje en los lugares previamente marcados. Hay ranuras adicionales disponibles si desea agregar más tornillos.

Fixez l'unité au mur à l'aide de vis d'ancrage aux emplacements marqués précédemment. Des fentes supplémentaires peuvent être utilisées si vous souhaitez ajouter plus de vis.

3

Close cover when finished mounting. Installation is complete. See below for loading instructions.

Cierre la cubierta al finalizar el montaje. La instalación está completa. Vea las instrucciones de carga a continuación.

Lorsque vous aurez terminé d'installer le distributeur, fermez le couvercle. L'installation est terminée. Vous trouverez les instructions de chargement ci-dessous.

Diagram illustrating the mounting dimensions for the dispenser. The front view shows a width of 12" (31 cm) and a height of 15.4" (39 cm) from the floor to the top of the unit. The side view shows a depth of 5.2" (13 cm). The bottom view shows the mounting holes with dimensions: 7.52" (19 cm) between the top holes, 3.52" (8.9 cm) between the middle holes, 1.75" (4.4 cm) from the top edge to the first hole, 4.5" (11.4 cm) between the middle holes, 4.15" (10.5 cm) from the bottom edge to the first hole, and 2" TYP (5 cm) between the bottom holes. The floor is labeled 'floor | piso | plancher'.

Loading Instructions | Instrucciones de recarga | Instructions de chargement

- 1

Place no more than three packs of folded towels in dispenser. Close dispenser.

No coloque más de tres paquetes de toallas plegadas en el dispensador. Cierre el dispensador.

Ne placez pas plus de trois paquets de serviettes pliées dans le distributeur. Fermez le distributeur.
- 2

Pull first towel from dispenser so the tail of the next towel protrudes from dispenser.

Tire de la primera toalla del dispensador para que el extremo de la siguiente toalla sobresalga del dispensador.

Tirez sur la première serviette du distributeur pour que le bas de la prochaine serviette dépasse du distributeur.
-



Model:Dial FIT X2 Manual Slate 1.2L
Category: Dispenser
Subcategory: Soap, Wall Mount
Manufacturer:Henkel Consumer Goods, Inc.
Catalog #: 1700016630

Atta 3 ID: DSP-4B2B3
Atta ID: DSP-4B2B3
JSN:
RefID 1:
RefID 2:

General Production Detail

Arch Sig: No	Spatial Sig: No
Arch Code: 01-Fixed Equipment	ADA:
Critical Path: No	Antimicrobial:
Type: Non-Medical	Green:
Furnish Install: Owner / Contractor	

Physical Requirements

Width (in.):	Left (in.): N/A
Depth (in.):	Right (in.): N/A
Height (in.):	Front (in.): N/A
Product Weight (lbs):	Back (in.): N/A
Max Operating Weight (lbs):	Top (in.): N/A
Mounting:	Bottom (in.): N/A
Specification notes:	

Structural Requirements

Seismic:	OPA #:
	Pre-Approval:
Structural notes:	

Technology Requirements

Patient Data: N/A	Network: N/A
Connection Type: N/A	System: N/A
Technical Connection notes:	

Electrical Requirements

Volts: N/A	Watts: N/A
Hz: N/A	Amps: N/A
KVA:	Circuit:
UPS: N/A	Plug Type:
Emerg. Power: No	Plug Detail:
Other Volts Avail.:	Electrical Phase:
BTU/hr: N/A	
Electrical notes:	

Utility Requirements

Water - Cold:	Gas Type: N/A
Water - Hot:	Gas Location:
Water - Treated:	Medical Gas:
Drain:	Vent Type:
Drain Location:	Heat Dissipation: N/A
Steam:	Dissipation Type:
Vacuum - Den. / Med.: /	
Plumbing notes:	
Mechanical notes:	

Locations

Level	Arch Dept	Room	Room #	Status	Item Qty
Level 1	Nuclear Medicine	Nuc Med GE PET/CT	1618	New	1

Total: 1



Model:Dual Top Overbed Table P009498
Category: Table, Overbed
Subcategory: General
Manufacturer:Baxter - Hillrom, Room & Furniture
Catalog #: P009498

Atta 3 ID: TOB-BCD22
Atta ID: 5934-205
JSN:
RefID 1:
RefID 2:

General overbed table. Features: 100 pounds maximum load capacity. 1.8 inches low-profile base base height. 0.75 inches table thickness. U-base with steel column features wheels and an integrated rail on both sides to accommodate accessories. Two seamless thermofoil table surfaces include a main table with spill guard edge and a flip table with 2 cup holder indentation for a minimal footprint when flip table not in use.

General Production Detail

Arch Sig: No	Spatial Sig: No
Arch Code: 03-Movable Non-Electrical	ADA: No
Critical Path: No	Antimicrobial: No
Type: Medical	Green: No
Furnish Install: Owner / Owner	

Electrical Requirements

Volts:	Watts: N/A
Hz: N/A	Amps: N/A
KVA:	Circuit: No
UPS: N/A	Plug Type: N/A
Emerg. Power: No	Plug Detail:
Other Volts Avail.: No	Electrical Phase: N/A
BTU/hr: N/A	
Electrical notes:	

Physical Requirements

Width (in.): 19.0000	Left (in.): N/A
Depth (in.): 32.5000	Right (in.): N/A
Height (in.): 42.5000	Front (in.): N/A
Product Weight (lbs): 55.0000	Back (in.): N/A
Max Operating Weight (lbs):	Top (in.): N/A
Mounting: Floor - Mobile	Bottom (in.): N/A
Specification notes:	

Utility Requirements

Water - Cold: No	Gas Type:
Water - Hot: No	Gas Location:
Water - Treated: No	Medical Gas: No
Drain: No	Vent Type:
Drain Location:	Heat Dissipation: N/A
Steam: No	Dissipation Type: Actual
Vacuum - Den. / Med.: No/No	
Plumbing notes:	
Mechanical notes:	

Structural Requirements

Seismic: No	OPA #:
	Pre-Approval:
Structural notes:	

Technology Requirements

Patient Data: No	Network:
Connection Type: N/A	System:
Technical Connection notes:	

Locations

Level	Arch Dept	Room	Room #	Status	Item Qty
Level 1	Nuclear Medicine	Nuc Med GE PET/CT	1618	New	1

Total: 1

Dual Top Overbed Table

FEATURES AND BENEFITS:

- Two seamless thermofoil table surfaces:
 - Main table with spill guard edge
 - Flip table with 2 cup holders indentations
- Variable height adjustment from 28.5" to 42.5"
- Integrated rail on both sides of column for optional quick mount accessories
- U-base design for fit and function with beds & furniture
- Low base compatible with beds & furniture
- Graphite grey steel base and steel column with no plastic cover for easy cleaning
- One hand activation to lift flip table
- Available in multiple thermofoil colors

Dimensions	Height: (hi/hi) 42.5" (low/low) 28.5"
	Width: Table: 17" Base: 19"
	Length: Main Table: 32" Flip Table:13.5" Base: 32.5"
	Base Height: 1.8" Table Thickness: 0.75"
Weight Capacity	100 lbs evenly distributed
Part Number	P009498
Overall Weight	55 lbs



Single Top Overbed Table

FEATURES AND BENEFITS:

- Seamless thermofoil table surface with spill guard edge
- Variable height adjustment from 28.5" to 42.5"
- Integrated rail on both sides of column for optional quick mount accessories
- U-base design for fit and function with beds & furniture
- Low base compatible with beds & furniture
- Graphite grey steel base and steel column with no plastic cover for easy cleaning
- Available in multiple thermofoil colors

Dimensions	Height: (hi/hi) 42.5" (low/low) 28.5"
	Width: Table: 17" Base: 19"
	Length: Table: 32" Base: 32.5"
	Base Height: 1.8" Table Thickness: 0.75"
Weight Capacity	100 lbs evenly distributed
Part Number	P009497
Overall Weight	50 lbs



Model: EarlyVue VS30 w/ Premium Rollstand
Category: Monitor, Physiologic
Subcategory: Vital Signs, w/Stand
Manufacturer: Philips Healthcare - Monitoring Systems
Catalog #: 863380/989803176601

Atta 3 ID: MON-D2112
Atta ID: 4071-092
JSN:
RefID 1:
RefID 2:

Vital signs physiologic monitor with pulse ox and mobile stand. Features: 10 inch color touch screen, task light, dark/light display, Caregiver authentication, patient ID and/or record validation at the bedside. Patient record export via native HL7 to EHR. QuickCapture, QuickAlerts, QuickNBP, SpO2, SpHb and RRa options. Microstream etCO2 option, Welch Allyn Predictive or Exergen Temporal, dual purpose barcode scanners, monitor to monitor sharing, Biomedical and IT device maintenance tool kit. SureSigns Premium Rollstand includes a molded basket, dedicated sections for bar code scanner, cleaning wipes, NBP cuffs, extra disposable temperature covers and an SpO2 sensor.

General Production Detail

Table with 2 columns: Attribute, Value. Rows include Arch Sig, Arch Code, Critical Path, Type, Furnish Install, Spatial Sig, ADA, Antimicrobial, Green.

Electrical Requirements

Table with 2 columns: Attribute, Value. Rows include Volts, Hz, KVA, UPS, Emerg. Power, Other Volts Avail., BTU/hr, Electrical notes, Watts, Amps, Circuit, Plug Type, Plug Detail, Electrical Phase.

Physical Requirements

Table with 2 columns: Attribute, Value. Rows include Width, Depth, Height, Product Weight, Max Operating Weight, Mounting, Specification notes, Left, Right, Front, Back, Top, Bottom.

Utility Requirements

Table with 2 columns: Attribute, Value. Rows include Water - Cold, Water - Hot, Water - Treated, Drain, Drain Location, Steam, Vacuum - Den. / Med., Plumbing notes, Mechanical notes, Gas Type, Gas Location, Medical Gas, Vent Type, Heat Dissipation, Dissipation Type.

Structural Requirements

Table with 2 columns: Attribute, Value. Rows include Seismic, OPA #, Pre-Approval, Structural notes.

Technology Requirements

Table with 2 columns: Attribute, Value. Rows include Patient Data, Connection Type, Technical Connection notes, Network, System.

Locations

Table with 6 columns: Level, Arch Dept, Room, Room #, Status, Item Qty. Row 1: Level 1, Nuclear Medicine, Nuc Med GE PET/CT, 1618, New, 1.

Total: 1