

# Alta View Hospital – Acute Rehabilitation Unit

9960 SOUTH 1300 EAST | SANDY, UTAH

## OWNER

Intermountain Healthcare  
36 S State Street, 16th Floor | Salt Lake City, Utah

## DATE

15 December 2020

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**SECTION 00 1000**

**INVITATION TO BID**

**PROJECT:** Renovation for Acute Rehabilitation Suite in Intermountain Alta View Hospital in Sandy, Utah.

**LOCATION:** 9660 South 1300 East  
Sandy, Utah

**OWNER:** Intermountain Healthcare.

**TIME AND PLACE:** The Owner will receive bids on Monday, January 18, 2021 at 2:00 pm:  
Intermountain Healthcare  
Security Desk - 16th Floor  
36 South State Street  
Salt Lake City, Utah 84111-1486  
  
Attention: AnnaLisa Silcox ([AnnaLisa.Silcox@imail.org](mailto:AnnaLisa.Silcox@imail.org))  
  
Bids shall be received by sealed envelope or emailed electronically to the Owner by time and at address noted above. If submitting a sealed bid, deliver to Security on the 16<sup>th</sup> floor.

**TYPE OF BID:** Bids shall be on a lump sum basis.

**TIME OF COMPLETION** Bidders shall provide a construction duration in calendar days and a Date of Substantial Completion on their bid forms. Consideration will be given to bidders offering earlier times of completion.

**BIDDING DOCUMENTS:** Bidding documents will be available on December 22, 2020, thru the office of VCBO Architecture, 524 South 600 East, Salt Lake City, Utah 84102 in accordance with the Instructions to Bidders. PDF's will be given to invited Contractors only. Bidding documents are not to be posted in the plan rooms.

**BONDS:** Bonds will not be required for this project.

**RIGHT TO REJECT BIDS:** The Owner reserves the right to reject any or all bids, and to waive any irregularities in any bid or in the bidding

**MANDATORY PREBID CONSTRUCTION MEETING** Monday, January 4, 2021 at 1:00 pm.

**END OF SECTION**

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## SECTION 00 2213

### SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

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

#### 3.1.5 COPIES

Add the following:

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

#### 3.3 SUBSTITUTIONS

Amend 3.3.2 to read:

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

#### 3.4 ADDENDA

Amend 3.4.3 to read:

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

#### 4.2 BID SECURITY

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

#### 4.3 SUBMISSION OF BIDS

Amend 4.3.4 to read:

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

### **5.3 ACCEPTANCE OF BID (AWARD)**

Amend 5.3.2 to read:

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

### **ARTICLE 7 - PERFORMANCE AND PAYMENT BOND**

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

**END OF SECTION**

SECTION 00 4000

BID FORM

TO: Intermountain Healthcare
Facility Planning and Development
36 South State Street, 16th Floor
Salt Lake City, Utah 84111-1486

Attention: AnnaLisa Silcox

PROJECT: Intermountain Alta View Hospital Acute Rehabilitation Unit
9660 South 1300 East
Sandy, Utah

NAME OF BIDDER: \_\_\_\_\_

DATE: \_\_\_\_\_

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

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

BASE BID – for the Acute Rehabilitation Unit at Alta View Hospital for Intermountain Healthcare:

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

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

ALTERNATES:

Alternate #1: EIFS System on Entry Canopy:

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

Alternate #2: Wall Protection:

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

Alternate #3: Finishes in Lactation Room:

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

**CONTRACTOR’S PROPOSED CONSTRUCTION TIME PERIOD:**

This bid requires a construction time in **calendar days** from the date of authorization of \_\_\_\_\_ calendar days. The anticipated date of Substantial Completion is thus \_\_\_\_\_, 202\_.

The above bid includes \_\_\_\_\_ winter weather delay days.

**ADDENDA:**

I/We acknowledge receipt of the following addenda for the **Alta View Hospital Acute Rehabilitation Unit:**  
\_\_\_\_/\_\_\_\_/\_\_\_\_/\_\_\_\_

**TYPE OF ORGANIZATION:**

Corporation, Partnership, Individual, etc.) \_\_\_\_\_

SEAL (If a Corporation)

Respectfully Submitted,

\_\_\_\_\_  
Name of Bidder

\_\_\_\_\_

\_\_\_\_\_  
Authorized Signature

**SECTION 00 4373**

**SCHEDULE OF VALUES**

**NAME OF BIDDER:** \_\_\_\_\_

**DATE:** \_\_\_\_\_

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

**END OF SECTION**

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## SECTION 00 5200

### OWNER/CONTRACTOR AGREEMENT

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. AIA Document A101 '**Standard Form of Agreement for Construction between the Owner and General Contractor**' where the basis of payment is a STIPULATED SUM, will *presumably* be used on this project. A copy may be obtained from the Architect for the cost of reproduction.
- B. **The Owner reserves the right** to use a contract form of their own creation.

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## SECTION 00 5433

### ELECTRONIC MEDIA AGREEMENT

#### PART 1 - GENERAL

##### 1.1 AGREEMENT CONCERNING DRAWING FILES ON ELECTRONIC MEDIA

- A. The electronic files will be distributed from the Architect to the General Contractor only once the following form has been signed. It will be the General Contractor's responsibility to control distribution.
- B. Valentiner Crane Brunjes Onyon Architects, L.L.C. (the Architect) does not assume any responsibility for the accuracy of the information contained in these drawing files. Any and all users are aware that differences may exist between the electronic files delivered and the printed hard-copy construction documents. In the event of a conflict between the signed and sealed hard-copy construction documents prepared by the Architect and the electronic files, the signed or sealed hard-copy construction documents shall govern.
- C. Any and all users who may obtain these drawings **from the General Contractor** under this agreement, including but not limited to; subcontractors, vendors, suppliers etc., agree to indemnify and hold harmless the Architect, its officers, directors, employees and sub-consultants against all damages, liabilities or costs, including reasonable attorneys' fees and defense costs, arising from any changes made by anyone other than the Architect or from any transfer or reuse of the electronic files including data contained in the files without the prior written consent of the Architect.
- D. Building Information Model (BIM) drawing files will be made available to the Contractor and its subcontractors for the purposes of preparing submittals for their portion of the work **only** after the "Agreement Concerning Drawing Files on Electronic Media" has been signed by the General Contractor.

#### PART 2 - PRODUCTS - Not Used

#### PART 3 - EXECUTION – Not Used

END OF SECTION

**AGREEMENT CONCERNING DRAWING FILES ON ELECTRONIC MEDIA**

Valentiner Crane Brunjes Onyon Architects, L.L.C. (the Architect) does not assume any responsibility for the accuracy of the information contained in these digital models. Any and all users are aware that differences may exist between the electronic files delivered and the printed hard-copy construction documents. In the event of a conflict between the signed and sealed hard-copy construction documents prepared by the Architect and the electronic files, the signed or sealed hard-copy construction documents shall govern.

**Any and all users who may obtain these digital models from the General Contractor under this agreement, including but not limited to; subcontractors, vendors, suppliers etc., agree to indemnify and hold harmless the Architect, its officers, directors, employees and sub-consultants against all damages, liabilities or costs, including reasonable attorneys' fees and defense costs, arising from any changes made by anyone other than the Architect or from any transfer or reuse of the electronic files without the prior written consent of the Architect.**

Under no circumstances shall delivery of the electronic digital models be deemed a sale by the Architect, and the Architect makes no warranties, either express or implied, of merchantability and fitness for any particular purpose. In no event shall the Architect be liable for any loss of profit or any consequential damages as a result of the use or reuse of the electronic files.

The digital Building Information Models provided will contain information as provided on construction documents. The user shall remove all notes, text, detail cuts and member designations from the electronic file prior to use. If used as submittal documents, submittals will be rejected if non-compliant. The drawing files provided by VCBO may not be reproduced or distributed to individuals outside the company or collective organization signing this agreement.

**LIST OF DRAWINGS:**

Project Name: **Intermountain Riverton Hospital MRI Caring Suite**  
VCBO Project # **18875**

List of Revit Models: **Architectural, Structural, Mechanical and Electrical.**

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**ACCEPTANCE OF TERMS, CONDITIONS & LIMITATIONS:**

\_\_\_\_\_  
Name of Company/Contractor

\_\_\_\_\_  
Signature of Company/Contractor  
Representative

\_\_\_\_\_  
Printed Name of Individual Signing

\_\_\_\_\_  
Position/Title

\_\_\_\_\_  
Date

**This agreement must be signed and returned to VCBO prior to release of any electronic document.**

## SECTION 00 6000

### BONDS AND CERTIFICATES

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. The following AIA documents are incorporated by reference; copies may be obtained from the Architect for the cost of reproduction.
1. AIA Document G702 – 'Application and Certificate for Payment'
  2. AIA Document G703 – 'Application and Certificate for Payment - Continuation'
  3. AIA Document G701 – 'Change Order'
  4. AIA Document G704 – 'Certificate of Substantial Completion'
  5. AIA Document G707 – 'Consent of Surety to Final Payment'
  6. AIA Document G707A – 'Consent of Surety to Reduction in or Partial Release of Retainage'

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**SECTION 00 6276.13**  
**EXEMPTION CERTIFICATE**

**PART 1 - GENERAL**

**1.1 SUMMARY**

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

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## Exemption Certificate

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

TC-721

Rev. 11/17

Name of business or institution claiming exemption (purchaser)		Telephone number	
Street address	City	State	ZIP Code
Authorized signature	Name (please print)	Title	
Name of Seller or Supplier:			Date
Sales Tax License Number: N10701		<i>Required for all exemptions marked with an asterisk (*)</i>	

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

### DO NOT SEND THIS CERTIFICATE TO THE TAX COMMISSION

Keep it with your records in case of an audit.

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

**Resale or Re-lease**

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

**Religious or Charitable Institution**

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

**Construction Materials Purchased for Religious and Charitable Organizations**

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

Name of religious or charitable organization:  
Intermountain Healthcare

Name of project: Alta View Hospital Acute Rehab Unit

**Machinery and Equipment and Normal Operating Repair or Replacement Parts Used in a Manufacturing Facility, Mining Activity or Web Search Portal or Electronic Payment Service**

I certify the machinery and equipment and normal operating repair or replacement parts have an economic life of three years or more and are for use in a Utah manufacturing facility described in SIC Codes 2000-3999; in a qualifying scrap recycling operation; in a co-generation facility placed in service on or after May 1, 2006; in the operation of a Web search portal by a new or expanding business described in NAICS Code 518112 between July 1, 2010 and June 30, 2014; in the operation of an electronic financial payment service described in NAICS Code 522320; or in a business described in NAICS 212, Mining (except Oil and Gas), or NAICS 213113, Support Activities for Coal Mining, NAICS 213114, Support Activities for Metal Mining, or NAICS 213115, Support Activities for Nonmetallic Minerals (except Fuels) Mining. For a definition of exempt mining equipment, see Utah Code §59-12-104(14).

**Fuels, Gas, Electricity**

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

**Refinery Machinery, Equipment and Normal Repair or Replacement Parts**

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

**Auto, Industrial Gas, or Drilling Equipment Manufacturer**

I certify the machinery, equipment, normal operating or replacement parts are used or consumed in a manufacturing process as described in NAICS 336111 (Automotive Manufacturing), or 325120 (Industrial Gas Manufacturing) to manufacture hydrogen of the 2002 North American Industry Classifications Systems, or by a drilling equipment manufacturer as defined in Utah Code §59-12-102.

**Pollution Control Facility**

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

**Steel Mill**

I certify the rolls, rollers, refractory brick, electric motors or other replacement parts will be used in the furnaces, mills or ovens of a steel mill as described in Standard Industrial Classification (SIC) 3312.

**Municipal Energy**

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

**Short-term Lodging Consumables**

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

**Direct Mail**

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

\*  **Commercial Airlines**

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

\*  **Commercials, Films, Audio and Video Tapes**

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

\*  **Alternative Energy**

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

\*  **Locomotive Fuel**

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

\*  **Research and Development of Alternative Energy Technology**

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

\*  **Life Science Research and Development Facility**

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

\*  **Mailing Lists**

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

\*  **Semiconductor Fabricating, Processing or Research and Development Material**

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

\*  **Aircraft Maintenance, Repair and Overhaul Provider**

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

\*  **Ski Resort**

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

\*  **Machinery or Equipment Used by Payers of Admissions or User Fees**

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

\*  **Telecommunications Equipment, Machinery or Software**

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

**Leasebacks**

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

**Film, Television, Radio**

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

**Prosthetic Devices**

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

**Out-of-State Construction Materials**

I certify this tangible personal property will be shipped out of state and will become part of real property located in a state that does not have a sales tax or allow credit for tax paid to Utah.

**Construction Materials Purchased for Airports**

I certify the construction materials are purchased by, on behalf of, or for the benefit of Salt Lake International Airport, or a new airport owned or operated by a city in Davis, Utah, Washington or Weber County. I further certify the construction materials will be installed or converted into real property owned by and located at the airport.

**Agricultural Producer**

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

**Tourism/Motor Vehicle Rental**

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

**Textbooks for Higher Education**

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

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

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

Questions? Email [taxmaster@utah.gov](mailto:taxmaster@utah.gov), or call 801-297-2200 or 1-800-662-4335.

**SECTION 00 7000**  
**GENERAL CONDITIONS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. **Owner's General Conditions of the Contract for Construction**, dated 01/2016, follow this cover page.

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**INTERMOUNTAIN HEALTHCARE**  
**GENERAL CONDITIONS**

January 2016

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## ARTICLE 1 GENERAL PROVISIONS

### 1.1 BASIC DEFINITIONS

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

**A/E's AGREEMENT.** □A/E's Agreement□ means, unless the context requires otherwise, the agreement executed by the A/E and Intermountain for the Project.

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

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

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

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

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

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

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

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

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

**CONSTRUCTION CHANGE DIRECTIVE.** A "Construction Change Directive" or "CCD" means a written order signed by Intermountain, directing a change in the Work and stating a proposed basis for adjustment, if any, in the Contract Sum or Contract Time, or both. Intermountain may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions; even if it may impact the Contract Sum and Contract Time.

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

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

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

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

**CONTRACTOR.** The Contractor is the person or entity identified as such in the Contractor's Agreement or the CM/GC Agreement, as applicable, and is referred to throughout the Contract Documents as if singular in number. The term "Contractor" means the Contractor or the Contractor's authorized representative. When separate contracts are awarded for different

portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case, shall mean the Contractor who executes each separate Contractor's or CM/GC Agreement, as applicable.

**CONTRACTOR'S AGREEMENT.** "Contractor's Agreement" means, unless the context requires otherwise, the stipulated sum agreement executed by the Contractor and Intermountain for the Project.

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

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

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

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

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

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

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

**INVITATION TO BID.** "Invitation to Bid" means Intermountain's solicitation or request to a contractor to provide a Bid.

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

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



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

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

**PRODUCT DATA.** "Product Data" means illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

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

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

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

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

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

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

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

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

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

**SHOP DRAWINGS.** [Shop Drawings] means drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.

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

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

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

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

## **ARTICLE 2 INTERMOUNTAIN**

### **2.1 INFORMATION AND SERVICES REQUIRED OF INTERMOUNTAIN**

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

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

**2.1.3 SURVEYS AND LEGAL DESCRIPTION.** Intermountain shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall review this information, including the surveys and any provided geotechnical studies, and compare such information with observable physical conditions and the Contract Documents.

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

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

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

## **2.2 CONSTRUCTION BY INTERMOUNTAIN OR BY SEPARATE CONTRACTORS**

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

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

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

### **2.2.2 MUTUAL RESPONSIBILITY**

(1) **CONTRACTOR COORDINATION.** The Contractor shall afford Intermountain and separate contractor(s) a reasonable opportunity for delivery and storage of their materials and equipment and performance of their activities and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

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

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

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

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

### **ARTICLE 3**

#### **A/E**

#### **3.1 A/E'S ADMINISTRATION OF THE CONTRACT**

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

#### **3.1.2 SITE VISITS**

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

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

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

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

provisions of the Contract Documents, whether or not such Work is fabricated, installed or completed, provided, however, the A/E must obtain Intermountain's prior written approval of any such additional inspections or testing. However, neither this authority of the A/E nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the A/E to the Contractor, Subcontractors, their agents or employees or other persons performing portions of the Work, including separate contractors. If the Contractor disputes the rejection of any Work and the correction thereof shall involve additional cost or time, it shall be Intermountain's option to accept such Work whether it be conforming or nonconforming.

### **3.1.5 A/E REVIEW CONTRACTOR'S SUBMITTALS**

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

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

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

(4) Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents.

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

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

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

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

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

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

## **ARTICLE 4 CONTRACTOR**

### **4.1 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR**

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

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

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

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

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

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

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

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

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

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

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

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

**4.1.6 DIVIDING WORK AND CONTRACTOR REPRESENTATION.** Organization of the specifications into divisions, sections and articles, and arrangement of Drawings, shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade. Contractor represents that the Subcontractors, Sub-subcontractors, manufacturers and suppliers engaged or to be engaged by it are and will be familiar with the requirements for performance by them of their obligations.

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

## **4.2 SUPERVISION AND CONSTRUCTION PROCEDURES**

**4.2.1 SUPERVISION AND CONTROL.** The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for and have control over the construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, except to the extent that the Contract Documents expressly and specifically state otherwise.

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

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

### **4.2.4 INSPECTIONS AND APPROVALS**

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

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

## **4.3 LABOR AND MATERIALS**

**4.3.1 PAYMENT BY CONTRACTOR.** Except to the extent it is otherwise stated in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities, supplies, consumables and services necessary for the proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

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

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



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

#### **4.5 PERMITS, FEES, NOTICES, LABOR AND MATERIALS**

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

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

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

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

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

#### **4.7 TIME AND CONTRACTOR'S CONSTRUCTION SCHEDULES**

##### **4.7.1 PROGRESS AND COMPLETION**

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

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

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

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

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

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

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

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

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

(9) Identification of all critical path activities;

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

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

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

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

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

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

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

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

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

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

#### **4.7.12 SCHEDULE CHANGES AND MODIFICATIONS.**

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

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

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

#### **4.7.13 EXCUSABLE DELAY**

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

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

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

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

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

#### **4.7.14 COMPENSABLE DELAY, SUSPENSION OR INTERRUPTION**

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

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

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

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

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

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

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

#### **4.7.16 LIQUIDATED DAMAGES**

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

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

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

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

#### **4.9 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES**

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

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

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

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

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

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

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

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

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

#### **4.10 USE OF SITE**

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

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

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

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



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

#### **4.13 INDEMNIFICATION**

##### **4.13.1 IN GENERAL**

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

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

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

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

## **ARTICLE 5 SUBCONTRACTORS**

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

### **5.1.1 APPROVAL REQUIRED**

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

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

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

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

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

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

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

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

## **5.2 SUBCONTRACTUAL RELATIONS**

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

**5.2.2 RIGHTS.** Each Subcontractor agreement shall preserve and protect the rights of InterMountain and A/E under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the Subcontractor agreement, the

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

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

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

### **5.3 CONTINGENT ASSIGNMENT OF SUBCONTRACTS**

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

## **ARTICLE 6 PROTECTION OF PERSONS AND PROPERTY**

### **6.1 SAFETY OF PERSONS AND PROPERTY**

**6.1.1 CONTRACTOR RESPONSIBILITY.** The Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Contract. The Contractor shall take all reasonable precautions for the safety of, and shall provide reasonable protection to prevent damage, injury or loss to:

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

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

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

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

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

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

**6.1.6 PROMPT REMEDY.** The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Paragraph 6.1.1 of these General Conditions caused in whole or in part by the Contractor, a Subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under said Paragraph 6.1.1, except to the extent such damage or loss is directly due to errors in the Contract Documents or caused by agents or employees of the A/E or Intermountain. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under the Contract Documents.

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

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

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

**6.1.10 EMERGENCIES.** In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss. Contractor shall promptly notify Intermountain Representative of the action taken.

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

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

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

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

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

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

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

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

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

## **7.1 MODIFICATIONS: IN GENERAL**

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

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

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

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

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

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

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

(b) If the Contractor encounters unknown physical conditions of an unusual nature which differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents.

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

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

## **7.2 CONTRACTOR INITIATED REQUESTS**

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

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

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

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

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

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

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

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

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

#### **7.4 EVALUATION OF PROPOSAL FOR ISSUING CHANGE ORDERS**

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

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

- (1) All direct and indirect costs of labor; including workers compensation insurance, social security and other federal and state payroll based taxes, and payroll based fringe benefits paid by Contractor so long as they are reasonable and no higher than that charged to other clients;
- (2) Costs of materials, on-site temporary facilities, supplies and equipment (except hand tools) required for or incorporated into the work;
- (3) Rental costs of machinery, equipment, tools (except hand tools), and on-site temporary facilities, whether rented from the Contractor or others;
- (4) Costs of permits and other fees, sales, use or similar taxes related to the Work;
- (5) Additional costs of field supervision and field office personnel directly attributable to the change; and



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

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

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

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

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

## **7.5 CONSTRUCTION CHANGE DIRECTIVES**

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

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

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

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

**7.8. RESOLUTION OF CLAIMS.**

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

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

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

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

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

## **7.9 PAYMENT OF CLAIM**

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

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

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

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

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

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

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

## **7.10 ALLOCATION OF COSTS OF CLAIM RESOLUTION PROCESS**

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

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

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

## **ARTICLE 8 PAYMENTS AND COMPLETION**

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

## **8.2 APPLICATIONS FOR PAYMENT**

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

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

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

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

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

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

**8.2.2 PAYMENT FOR MATERIAL AND EQUIPMENT.** Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by Intermountain and A/E, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to Intermountain to establish Intermountain's title to such materials and equipment or otherwise protect Intermountain's interest, and shall include applicable insurance, storage and transportation to the site for such materials and equipment stored off the site. Intermountain may require copies of invoices or other suitable documentation.

**8.2.3 WARRANTY OF TITLE.** The Contractor warrants that title to all Work covered by an Application for Payment will pass to Intermountain no later than the time for payment. The Contractor further warrants that upon submittal of an Application for Payment, all

Work for which Certificates for Payment have been previously issued and payments received from Intermountain shall, to the best of the Contractor's knowledge, information and belief, be free and clear of liens, claims, security interests or encumbrances in favor of the Contractor, Subcontractors, or other persons or entities making a claim by reason of having provided labor, materials and/or equipment relating to the Work.

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

### **8.3 CERTIFICATES FOR PAYMENT**

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

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

### **8.4 DECISIONS TO WITHHOLD CERTIFICATION**

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

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

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

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

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

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

## **8.5 PROGRESS PAYMENTS**

### **8.5.1 IN GENERAL, INTEREST ON LATE PAYMENTS**

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

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

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

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

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

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

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

## **8.7 PARTIAL OCCUPANCY OR USE**

**8.7.1 IN GENERAL.** Intermountain may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, and authorized by public authorities having jurisdiction over the Work. Such partial occupancy or use may commence whether or not the portion is Substantially Complete, provided Intermountain and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of the warranties required by the Contract Documents. When the Contractor considers a portion to be substantially complete, the Contractor shall prepare and submit a list to the A/E as previously provided for herein. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. Contractor shall have continuing responsibility to protect the unoccupied portions of the site and the Work during such partial occupancy and shall be responsible for damage except to the extent caused solely by Intermountain during such partial occupancy or use.

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

**8.7.2 INSPECTION.** Immediately prior to such partial occupancy or use, Intermountain, Contractor and A/E shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

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

## **8.8 FINAL PAYMENT**

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

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

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

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

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

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

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

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

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

**8.8.3 WAIVER OF CLAIMS: FINAL PAYMENT.** The making of final payment shall constitute a waiver of Claims by Intermountain except those arising from:



- (1) Liens, Claims, security interests or encumbrances arising out of the Contract and unsettled;
- (2) Failure of the Work to comply with the requirements of the Contract Documents;
- (3) Terms of warranties required by the Contract Documents; or
- (4) The one-year guaranty period and any corrected Work.

**8.8.4 DELAYS NOT CONTRACTOR'S FAULT.** If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, Intermountain shall, upon application by the Contractor and certification by the A/E, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of claims. Unless otherwise stated by Intermountain in writing, the making of final payment shall constitute a waiver of claims by Intermountain as provided in Paragraph 8.8.3 for that portion of that Work fully completed and accepted by Intermountain.

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

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

### **9.1 TESTS AND INSPECTIONS**

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

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

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

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

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

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

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

**9.1.4 CERTIFICATES.** Required certificates of testing, inspection or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the A/E.

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

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

## **9.2 INSPECTIONS: SUBSTANTIAL AND FINAL**

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

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

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

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

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

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

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

### **9.3 UNCOVERING OF WORK**

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

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

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

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

#### **9.4 CORRECTION OF WORK AND GUARANTY PERIOD**

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

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

### **9.4.3 REMOVAL OF WORK**

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

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

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

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

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

**9.4.4 NOT LIMIT OTHER OBLIGATIONS.** Nothing contained in this Article 9.4 shall be construed to establish a period of limitation with respect to other obligations which the Contractor may have under the Contract Documents. Establishment of the time period of one year as described in Paragraph 9.4.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

### **9.5 ADDITIONAL WARRANTIES**

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

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

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

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

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

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

## **ARTICLE 10 INSURANCE AND BONDS**

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

#### **10.1.14 ADDITIONAL REQUIREMENTS**

- (1) Any type of insurance or any increase of limits of liability not described in this Agreement which the Contractor requires for its own protection or on account of any statute, rule or regulation, shall be its own responsibility and at its own expense.
- (2) The carrying of any insurance required by this Agreement shall in no way be interpreted as relieving the Contractor or Subcontractors of any other responsibility or liability under this Agreement or any applicable law, statute, rule, regulation or order.
- (3) Contractor shall not violate or knowingly permit to be violated any of the provisions of the policies on insurance required under these General Conditions.

#### **10.2 BUILDER'S RISKPROPERTY INSURANCE**

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



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

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

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

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

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

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

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

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

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

## **ARTICLE 11 MISCELLANEOUS PROVISIONS**

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

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

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

#### **11.4 RIGHTS AND REMEDIES**

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

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

#### **11.5 COMMENCEMENT OF STATUTORY LIMITATION PERIOD**

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

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

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

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

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

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

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

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

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

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

## **ARTICLE 12 TERMINATION OR SUSPENSION OF THE CONTRACT**

### **12.1 TERMINATION BY CONTRACTOR**

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

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

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

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

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

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

## **12.2 TERMINATION BY INTERMOUNTAIN FOR CAUSE**

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

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

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

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

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

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

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

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

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

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

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

### **12.2.2 INTERMOUNTAIN'S RIGHT TO CARRY OUT THE WORK**

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

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

### **12.2.3 ITEMS REQUIRED TO BE TRANSFERRED OR DELIVERED.**

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

(1) Any completed portion of the Work; and

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

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

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

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

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

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

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

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

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

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

### **12.4 TERMINATION FOR CONVENIENCE OF INTERMOUNTAIN**

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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



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

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

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

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

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# INTERMOUNTAIN HEALTHCARE ACCESS AND CONFIDENTIALITY AGREEMENT

## SECTION 1.0 PURPOSE AND DEFINITION

- 1.1 **Purpose of this Agreement.** Federal and state laws, as well as Intermountain's policies, protect Confidential Information, assure that it remains confidential, and permit it to be used for appropriate purposes. Those laws and policies assure that Confidential Information, which is sensitive and valuable, remains confidential. They also permit you to use Confidential Information only as necessary to accomplish legitimate and approved purposes. You need access to Confidential Information because you have one of the following roles:
- A. An Intermountain Workforce member, which includes volunteers (a "Workforce Member"); or
  - B. An Intermountain-affiliated or Intermountain-credentialed Provider (a "Provider"); or
  - C. A vendor or agent of IHC Health Services, Inc. (a "Vendor" or "Agent").
- 1.2 **Definition.** "Confidential Information" means data proprietary to Intermountain, other companies, or other persons, plus any other information that is private and sensitive and which Intermountain has a duty to protect. You may learn or access Confidential Information through oral communications, paper documents, computer systems, or through your activities at or with Intermountain. Examples of Confidential Information include the following information that is maintained by, or obtained from, Intermountain:
- A. An individual's demographic, employment, or health information;
  - B. Peer-review information;
  - C. Intermountain's business information, (e.g., financial and statistical records, strategic plans, internal reports, memos, contracts, peer review information, communications, proprietary computer programs, source code, proprietary technology, etc.); and
  - D. Intermountain's or a Third-party's information (e.g., computer programs, client and vendor proprietary information, source code, proprietary technology, etc.).

## SECTION 2.0 YOUR DUTIES UNDER THIS AGREEMENT

- 2.1 **Principal Duties.** To qualify to access or use Confidential Information, you will comply with the laws and Intermountain policies governing Confidential Information. Your principal duties regarding Confidential Information include, but are not limited to, the following:
- A. Safeguard the privacy and security of Confidential Information;
  - B. Use Confidential Information only as needed to perform your legitimate and Intermountain-approved responsibilities. This means, among other things, that you will not:
    - (1) Access Confidential Information for which you have no legitimate need to know;
    - (2) Divulge, copy, release, sell, loan, revise, alter, or destroy any Confidential Information except as properly authorized within the scope of your legitimate and Intermountain-approved responsibilities; or
    - (3) Misuse Confidential Information;
  - C. Safeguard, and not disclose, your access code or any other authorization that allows you to access Confidential Information. This means, among other things, that you will:
    - (1) Accept responsibility for all activities undertaken using your access code and other authorization; and
    - (2) Report any suspicion or knowledge that you have that your access code, authorization, or any Confidential Information has been misused or disclosed without Intermountain's permission (Report this suspicion or knowledge to the Intermountain Compliance Hotline at 1-800-442-4845, or, if you are a member of Intermountain's Workforce, to your supervisor or facility compliance coordinator.);
  - D. Not remove Confidential Information from an Intermountain facility unless necessary for your legitimate and Intermountain-approved responsibilities (If removal of Confidential Information from an Intermountain facility is necessary, you will use reasonable and appropriate physical and technical safeguards—such as encrypting electronic Confidential Information.);
  - E. Report activities by any individual or entity that you suspect may compromise the confidentiality of Confidential Information (To the extent permitted by law, Intermountain will hold in confidence reports that are made in good faith about suspect activities, as well as the names of the individuals reporting the activities.);
  - F. Not use or share Confidential Information after termination of your role triggering the requirement to sign this Agreement (For example, if you are a Workforce Member, when you leave Intermountain's employment; if you are a Provider, when you lose your privileges at an Intermountain facility or your privileges to access Confidential Information; and if you are a Vendor or Agent, when you finish your assignment or project with Intermountain or when your company stops doing business with Intermountain, whichever is first.); and
  - G. Claim no right or ownership interest in any Confidential Information referred to in this Agreement.

## SECTION 3.0 VIOLATION OF DUTY – CHANGE OF STATUS

- 3.1 **Responsibility.** You are responsible for your noncompliance with this Agreement.
- 3.2 **Discipline.** If you violate any provision of this Agreement, you will be subject to discipline, including but not limited to, the following:
- A. If you are a Workforce Member, to dismissal as a member of Intermountain's Workforce, loss of employment with Intermountain, termination of your ability to access Confidential Information, and legal liability;
  - B. If you are a Provider, a Vendor, or an Agent, to discipline, including revocation of your ability to access or use Confidential Information, and legal liability.
- 3.3 **Relief.** Any violation by you of any provision of this Agreement will cause irreparable injury to Intermountain that would not be adequately compensable in monetary damages alone or through other legal remedies, and will entitle Intermountain to the following:
- A. If you are a Workforce Member, or an Vendor or Agent, to preliminary and permanent injunctive relief, a temporary restraining order, and other equitable relief in addition to damages and other legal remedies; or
  - B. If you are a Provider, to a court order prohibiting your use of Confidential Information except as permitted by this Agreement, and Intermountain may also seek other remedies; and
- 3.4 **Authority.** Intermountain may terminate your access to Confidential Information if your status as a Workforce Member, Provider, Vendor, or Agent changes, if Intermountain determines that to be in the best interests of Intermountain's mission, or if you violate any provision of this Agreement.

**SECTION 4.0 Continuing Obligations.** Your obligations under this Agreement continue after termination of your status as a Workforce Member, Provider, Vendor, or Agent.

Printed Name: \_\_\_\_\_

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

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**Third Party Remote Access Form**

**Company Information**

Date of request: \_\_\_\_\_

Company Name: \_\_\_\_\_

Contact Name: \_\_\_\_\_

Address: \_\_\_\_\_

City, State, Zip: \_\_\_\_\_

Phone: \_\_\_\_\_

Fax: \_\_\_\_\_

**\*\*NOTE:** The above stated company will notify Intermountain Healthcare and change any passwords or access codes into Intermountain's computer systems upon the termination of the Contact Name or other employees associated with the remote access process.

List all individuals who will be accessing Intermountain Healthcare's network (Name and DOB)


**\*\*NOTE:** All individuals who will be accessing Intermountain's network must sign the Trustee Confidentiality Agreement. Please attach all signed agreements for the individuals above to the request form.

**INTERMOUNTAIN Contact Information**

Facility: \_\_\_\_\_

Department: \_\_\_\_\_

Intermountain Healthcare  
Steward: \_\_\_\_\_

Phone: \_\_\_\_\_

**Business purpose for requesting access:** \_\_\_\_\_

**Type of access required (i.e., authority needed):** \_\_\_\_\_

Please fax this form when completed and signed, along with completed and signed 3<sup>rd</sup> Party Confidentiality documents to the following number:

**FAX: 801-442-0463**



**Intermountain Healthcare systems to be accessed (Host IP addresses, protocols and ports used, etc):**

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**Time period for which access is requested:**

**Does Intermountain already have a signed Business Associate Agreement (BAA) in place with the 3rd party?**

YES / NO

(Please check this at the following URL: <http://ihcweb/enterprise/compliance/hipaa/ba.php> If not, the Intermountain Steward will need to obtain one before access can be granted. For more information, please contact: [privacy@intermountainmail.org](mailto:privacy@intermountainmail.org), or the compliance hotline number at 1-800-442-4845)

**Does Intermountain already have a support agreement with the appropriate confidentiality agreements signed and submitted?**

YES / NO

(The Intermountain Steward is responsible for obtaining signed copies of the appropriate confidentiality agreement for each individual from the 3<sup>rd</sup> party company that will be accessing Intermountain's Information Systems)

**Additional Comments:**

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To be completed by Intermountain Healthcare's Corporate IS Security Team

Security/Access Concerns:

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Access into Intermountain Healthcare's computer systems is monitored and reviewed on a regular basis. Intermountain reserves the right to cancel access to all entities at any time if it feels there is a possible security breach or risk that requires immediate disconnection. Further, all access into Intermountain's computer systems is bound to the current confidentiality and appropriate usage policies in effect.

**Your signatures below act as your acknowledgement and agreement to these policies.**

Vendor Contact Signature

Intermountain Healthcare  
Steward Signature

Request Approved by:

Intermountain Corporate IS Security

Date Approved

## **DIVISION 1 - GENERAL REQUIREMENTS**

Section 01 1000	Summary of Work
Section 01 1001	Responsibility Matrix
Section 01 1900	Definitions and Standards
Section 01 2600	Contract Modification Procedures
Section 01 2900	Payment Procedures
Section 01 3100	Project Management and Coordination
Section 01 3313	Submittals
Section 01 5050	Temporary Facilities and Controls
Section 01 6000	Product Requirements
Section 01 7300	Execution Requirements
Section 01 7301	Construction Safety Requirements
Section 01 7700	Closeout Procedures
Section 01 7701	Record Drawing Requirements
Section 01 7820	Operation and Maintenance Data

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**SECTION 01 1000**  
**SUMMARY OF WORK**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Requirements of Division 00 "Procurement and Contracting Requirements" and Division 01 "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.
- C. The Project consists of renovations of space in the original Alta View Hospital to create an acute rehabilitation unit, including a new exterior ramp and entrance.

**1.2 PROJECT LOCATION**

- A. Facility is located at 9660 South 1300 East, Sandy, Utah.

**1.3 SEPARATE CONTRACTS**

- A. **The Owner may enter into separate 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 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.

**1.5 CONTRACTOR USE OF PREMISES**

- A. **General:** Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

- 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 vehicles and construction equipment, when parked and unattended, to prevent unauthorized use. Do not leave vehicles or equipment unattended with the motor running or the ignition key in place.

## 1.6 OWNER'S OCCUPANCY REQUIREMENTS

- A. **Partial Owner Occupancy:** Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits, unless otherwise indicated.
1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
  2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.
- B. **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.

## 1.7 WORK RESTRICTIONS

- A. **On-Site Work Hours:** Work shall be generally performed inside the existing building during normal business working hours of 8:00 a.m. to 5:00 p.m., Monday through Friday, except otherwise indicated.
1. **Weekend Hours:** No work on weekends.
  2. **Hours for Utility Shutdowns:** Shall not occur during Owner's business hours.
  3. **Hours for Core Drilling and Slab Removal:** Consult with Owner as to best times. Work shall be scheduled with Owner not less than 3 days in advance of proposed noisy activity.
- B. **Existing Utility Interruptions:** Do not interrupt utilities serving facilities occupied by Owner or others 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 days in advance of proposed utility interruptions.

## 1.8 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.
- B. The Owner's "**Responsibility Matrix**" follows this section. Provide equipment and services as part of the Work as noted in Matrix.

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION (NOT USED)**

**END OF SECTION**

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**RESPONSIBILITY MATRIX**

The following list identifies the majority of the items that are to be included in the capital project build-out.

ITEM	STATUS - Furnished / Installed	NOTES	Additional Notes		
			Data	Power	Backlog
<b>OFOI - (Owner Furnished / Owner Installed)</b>					
Art	Owner / Vendor				
Brochure Racks	Owner / Vendor	G.C. to provide proper backing			
Chart Racks	Owner / Vendor (Midwest-Peter Pepper)	G.C. to provide proper backing			
Copiers, fax	Owner / Vendor		Yes	Yes	
Cup Dispensers	Owner / Vendor				
Exam Tables	Owner / Vendor				Yes
Systems Furniture	Owner / Vendor (Midwest Furn.)	Coordinate Modesty Panels with Elec. Outlets. Coordinate data and power with Midwest & Design Team.	Yes	Yes	
Moveable Metal Shelving	Owner / Vendor				
Recliners / Draw Chairs	Owner / Vendor				
Signage - Exterior	Owner / Vendor (IG Signs, YESCO)	Provide power and data to required exterior signage. Provide circuits for above ceiling signs. Coordinate thru-wall conduit sleeves with weather barrier. Intermountain Logo Signs - (2) 20A Circuits - May vary. InstaCare and other Signs - (1) 20 A Circuits - May vary.	Yes	Yes	Yes
Signage - Interior	Owner / Vendor (Scribbly, or Hightech)	Provide power to required signage.			
Radiology Equipment	Owner / Vendor (IMG - James Jeppson, Hospitals - Steve Isakson)		Yes	Yes	
Clinical Garbage Cans (Clinical, Office, PT, Etc.)	Owner / Owner				
Computers, Printers, Scanners, Keyboards, Mice, etc.	Owner / Owner	In-ceiling & wall mounts, conduits and boxes mounted by G.C. IMG computers will be All-in-One computers.	Yes	Yes	Yes
Televisions, Digital Projectors, etc.	Owner / Owner	These items to be provided by Owner, but A/E to coordinate locations and infrastructure	Yes	Yes	Yes
Coat Hooks (Offices only)	Owner / Owner				
Keyboard Trays	Owner / Owner				
PACS	Owner / Owner				
Marker Boards (if not shown in drawings)	Owner / Owner				
Emergency Evacuation Medical Sled (Med Sled)	Owner / Vendor				
Supply Area Panels	Owner / Owner	G.C. to provide proper backing			Yes
<b>OFCI - (Owner Furnished / Contractor Installed)</b>					
			<b>(Coordinate location of items with Owner/Users)</b>		
Automated External Defibrillator (AED)	Owner / Contractor	Verify locations with Owner. Architect to coordinate recess, semi-recessed, or surface mount options with Owner.			
Time Clocks	Owner / Contractor	Conduit and boxes by G.C., Coordinate location with Owner	Yes	Yes	
Paper Towel Dispensers	Owner / Contractor	Location coordinated during mockup			
Soap Dispensers	Owner / Contractor	Location coordinated during mockup			
Toilet Paper Dispensers	Owner / Contractor	Location coordinated during mockup			
Glove Dispensers	Owner / Contractor	Location coordinated during mockup			
Hand Sanitizer Dispensers (Avagard)	Owner / Contractor	Location coordinated during mockup			
Diagnostic Board (Otoscope / Ophthalmoscope)	Owner / Contractor	Location coordinated during mockup			Yes
Sharps Disposal Container	Owner / Contractor	Location coordinated during mockup			
Stadiometers, Recessed Scales	Owner / Contractor	Location coordinated during mockup; coordinate power			Yes
Procedure Lights	Owner / Contractor	Location coordinated during mockup; G.C. to provide and install procedure light support structure			Yes
Scrub Sinks & Carriers	Owner / Contractor	G.C. to coordinate with Owner for ordering for Install coord.			
IV Track	Owner, Vendor / Contractor				
Boom Mounting Plates (Equipment, Lighting, Anesthesia)	Owner / Contractor	G.C. to coordinate with Owner for ordering for Install coord.			
OR Clocks	Owner / Contractor	G.C. to coordinate with Owner for ordering for Install coord.	Yes	Yes	Yes
Clinical Clocks	Owner / Contractor	G.C. to coordinate with Owner for ordering for Install coord.			Yes
Cubicle Curtains, Shower Curtains & Rods & IV Hangers	Owner, Vendor (Medline) / Contractor	Owner to provide Medline "On the Right Track" or similar, Contractor to install.			
Digital Projector Mounts, TV Mounts, & Computer Mounts (Ergotron Brackets/Mounts, etc.)	Owner / Contractor	In-ceiling & wall mounts, conduits and boxes mounted by G.C. Facility to coordinate with A/V company to pull required cabling.	Yes	Yes	Yes
Radiation Protection Certification	Owner, (Medical Physics Consultants) / Contractor	G.C. to coordinate prior to Gyp.install.			
MRI Metal Detectors (Where these are required/approved)	Owner / Contractor	G.C. to coordinate with Owner			Yes
Nurse Call System & Patient Monitoring System (Hospital Campus)	Owner, Vendor (Hill-Rom) / Contractor	Hospital Local Facilities to contract directly with Nurse Call & Patient Monitoring vendor for devices, equipment, monitors, etc. (from wall side out). Contractor to provide infrastructure, back boxes, and cabling (from wall side back).	Yes	Yes	
Staff Assist Notification System (Medical Group Clinics on hospital campuses to match nurse call system)	Owner, Vendor (Hill-Rom) / Contractor	System to be coordinated with Hospital Campus system, as applicable, Medical Group Strategic Planner, and IMG Operations Officer. IMG to contract directly with Staff Assist System vendor for devices, equipment, monitors, etc. (from wall side out). Contractor to provide infrastructure, back boxes, and cabling (from wall side back).	Yes	Yes	
Staff Assist Notification System (Stand-alone Medical Group Clinics)	Owner, Vendor / Contractor	System to be coordinated with Medical Group Strategic Planner and Operations Officer. IMG to contract directly with Staff Assist System vendor for devices, equipment, monitors, etc. (from wall side out). Contractor to provide infrastructure, back boxes, and cabling (from wall side back).	Yes	Yes	
Patient Lifts	Owner, Vendor (Liko Hill-Rom) / Contractor	G.C. to coordinate shop drawings and Installation. Connect to Equipment branch if provided.			Yes
Building Alarms / Medication Refrigerator Alarm / Pharmacy Alarm System	Owner / Contractor	G.C. to provide conduit and infrastructure into accessible ceiling for access from equipment and/or devices. Local Facility to contract with alarm company for alarm, wire, and monitoring.			Yes
UPS	Owner / Contractor	Verify location with Owner			Yes
Signage - Exterior	Owner / Contractor	G.C. to provide and install power and required backing			Yes
<b>OFCI - (Contractor Furnished / Contractor Installed)</b>					
Blinds/Shades (manual and powered)	Contractor / Contractor				Yes
Apron Hooks/Rack (Heavy Duty in Radiology)	Contractor / Contractor				Yes
Marker Boards & Cork Boards	Contractor / Contractor	Coordinate with Owner			Yes
Emergency Phones	Contractor / Contractor	Conduit and boxes by G.C.	Yes	Yes	
Med Gas Certification	Contractor / Contractor	Coordinate Vendor with Owner			
Diaper Changing Station	Contractor / Contractor				Yes
Emergency Shower Station / Eye Wash Station	Contractor / Contractor	Shall meet the ANSI requirements			
Fire Extinguishers	Contractor / Contractor				
Grab Bars (Rest rooms, Radiology, Exam rooms, etc.)	Contractor / Contractor				Yes
Mirrors (Rest rooms, Exams, Radiology, etc.)	Contractor / Contractor				
Pneumatic Tube Systems	Contractor / Contractor (SwissLog, Atreo Group, or other approved)	If Swisslog, verify pricing is per Intalere (Amerinet) Contract Agreement. Design fees are included in this agreement.	Yes	Yes	
Plumbing Shrouds	Contractor / Contractor				
Sanitary Napkin Dispensers/Receptacles	Contractor / Contractor				
Security Cameras	Contractor / Contractor (AlphaCorp)	Coordinate final location with Owner.	Yes		
Voice/Data Cabling (all horizontal cabling - see Div. 27 specs)	Contractor / Contractor (Cache Valley Elec., IES Commercial, Data Tech Professionals, Americom)	Coordinate with Owner/User on connections, pairs of fiber/copper, conduits, inner-ducts.	Yes		
Radiation Support Bracing for Radiology Equipment	Contractor / Contractor	Architect to coordinate with Intermountain selected Radiology Vendor. Architect to coordinate Final Site Specific Drawings with Construction Documents.	Yes	Yes	Yes
Wall Protection (Incl. Bumper and Corner Guards)	Contractor / Contractor				

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## SECTION 01 1900

### DEFINITIONS AND STANDARDS

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. **Definitions:** Basic Contract definitions are included in the General Conditions.
1. **Directed:** Terms such as "directed", "requested", "authorized", "selected", "approved", "required", and "permitted" mean "directed by the Architect", "requested by the Architect", and similar phrases. However, no implied meaning shall be interpreted to extend the Architect's responsibility into the Contractor's area of construction supervision.
  2. **Approve:** The term "approved," where used in conjunction with the Architect's action on the Contractor's submittals, applications, and requests, is limited to the duties and responsibilities of the Architect as stated in General and Supplementary Conditions. Such approval shall not release the Contractor from responsibility to fulfill Contract requirements unless otherwise provided in the Contract Documents.
  3. **Furnish:** The term "furnish" is used to mean "supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations."
  4. **Install:** The term "install" is used to describe operations at project site including the actual "unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations."
  5. **Provide:** The term "provide" means "to furnish and install, complete and ready for the intended use."
  6. **Protect:** Except as otherwise defined in greater detail, the term "protect" is used to describe the process of shielding from harm existing fixtures, elements or materials.
  7. **Stabilize:** To apply measures designed to reestablish a weather-resistant enclosure and the structural reinforcement of an item or portion of the building while maintaining the essential form as it exists at present.
  8. **Protect and Maintain:** To remove deteriorating corrosion, reapply protective coatings, and install protective measures such as temporary guards; to provide the least degree of intervention.
  9. **Remove:** To detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.
  10. **Remove and Salvage:** To detach items from existing construction and deliver them to Owner ready for reuse.
  11. **Remove and Reinstall:** To detach items from existing construction, repair and clean them for reuse, and reinstall them where indicated.
  12. **Existing to Remain or Retain:** Existing items of construction that are not to be removed and that are not otherwise indicated to be removed and salvaged, or removed and reinstalled.
  13. **Existing to Remain:** Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

**B. Specification Format and Conventions:**

1. **Specification Format:** The Specifications are organized into Divisions and Sections using the 49-division format and CSI/CSC's "MasterFormat" numbering system.
  - a. **Section Identification:** The Specifications use section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of sections in the Contract Documents.
2. **Specification Content:** The Specifications use certain conventions for style of language and the intended meaning of terms, words, and phrases when used in particular situations. These conventions are as follows.
  - a. **Abbreviated Language:** Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
  - b. **mood** and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.
    - 1) The words "shall", "shall be", or "shall comply with", depending on the context, are implied where a colon (:) is used within a sentence or phrase.

**C. Drawing Symbols:**

1. **Graphic symbols:** Where not otherwise noted, symbols are defined by "**Architectural Graphic Standards**", published by John Wiley & Sons, Inc., latest edition.
  - a. **Mechanical/Electrical Drawings:** Graphic symbols used on mechanical and electrical Drawings are generally aligned with symbols recommended by ASHRAE. Where appropriate, they are supplemented by more specific symbols recommended by technical associations including ASME, ASPE, IEEE, and similar organizations. Refer instances of uncertainty to the Architect for clarification before proceeding.

**D. Industry Standards:**

1. **Applicability of Standards:** Except where the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents. Such standards are made a part of the Contract Documents by reference. Individual Sections indicate which codes and standards the Contractor must keep available at the Project Site for reference.
2. **Publication Dates:** Where the date of issue of a referenced standard is not specified, comply with the standard in effect as of date of Contract Documents.
3. **Conflicting Requirements:** Where compliance with two or more standards is specified, and they establish different or conflicting requirements for minimum quantities or quality levels, the most stringent requirement will be enforced, unless the Contract Documents indicate otherwise. Refer requirements that are different, but apparently equal, and uncertainties as to which quality level is more stringent to the Architect for a decision before proceeding.



4. **Copies of Standards:** Each entity engaged in construction on the Project is required to be familiar with industry standards applicable to that entity's construction activity. Copies of applicable standards are not bound with the Contract Documents.
- a. **Where copies of standards are needed** for performance of a required construction activity, the Contractor shall obtain copies directly from the publication source.
  - b. **Although copies of standards needed** for enforcement of requirements also may, be included as part of required submittals, the Architect reserves the right to require the Contractor to submit additional copies as necessary for enforcement of requirements.
- E. **Abbreviations and Names:** Trade association names and titles of general standards are frequently abbreviated. Where such acronyms or abbreviations are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards generating organization, authority having jurisdiction, or other entity applicable to the context of the text provision.

**END OF SECTION**

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## SECTION 01 2300

### ALTERNATES

#### 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 alternates.

##### 1.3 DEFINITIONS

- A. **Alternate:** An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
- B. **The cost or credit** for each alternate is the **net addition to** or **deduction from** the **Contract Sum** to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

##### 1.4 PROCEDURES

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

#### PART 2 - PRODUCTS - NOT USED

## PART 3 - EXECUTION

### 3.1 SCHEDULE OF ALTERNATES

- A. **Alternate No. 1 – EIFS System on Entry Canopy**
1. Base Bid: ACM cladding on entry canopy.
  2. Alternate (Deductive): Instead of ACM, provide EIFS cladding on entry canopy system. Refer to Drawings and section 07 2400 “Exterior Insulation and Finish System”.
- B. **Alternate No. 2 – Wall Protection**
1. Base Bid: Patch and paint walls in hallways as indicated on Drawings.
  2. Alternate (Additive): In addition to patching and painting hallways, provide 48 inch rigid wall protection. Refer to section 10 2600 “Wall and Corner Guards” for materials and application method.
- C. **Alternate No. 3 – Finishes in Lactation Room**
1. Base Bid: Remove toilet, associated accessories, grab bars, nurse call, existing flooring and floor drain. Install new flooring as indicated on Drawings. Provide stainless steel escutcheon plates and new blank cover plates to conceal holes in existing wall tile to remain. Repaint walls above existing tile wainscot as indicated on Finish Schedule.
  2. Alternate (Additive): In addition to demolition as described in Base Bid, remove wall tile and patch and repaint walls entirely.

END OF SECTION

## SECTION 01 2600

### 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 6000 "**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 applicable taxes, 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,** Contractor shall generate Change Orders on a monthly basis.

## 1.6 CONSTRUCTION CHANGE DIRECTIVE

A. **Construction Change Directive:** Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. **Documentation:** Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

**PART 2 – PRODUCTS - NOT USED**

**PART 3 – EXECUTION - NOT USED**

**END OF SECTION**

## SECTION 01 2900

### 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. Section 01 2600 "**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:
  - 2. Application for Payment forms with Continuation Sheets.
  - 3. Submittals Schedule.
  - 4. 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.
  - 5. 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.
    - 1) Percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
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.
    - a. Include line items for Commissioning under 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. 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.
  8. 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. **Transmittal:** Submit **one signed and notarized original copy** of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- F. **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.

**PART 2 – PRODUCTS - NOT USED**

**PART 3 – EXECUTION - NOT USED**

**END OF SECTION**

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## SECTION 01 3100

### 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. **The Contractor shall participate in coordination requirements.**
- C. **Related Sections:** The following Sections contain requirements that relate to this Section:
  - 1. Section 01 7300 "**Execution Requirements**" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
  - 2. Section 01 7700 "**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, that depend on each other for proper installation, connection, and operation.
  - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
  - 2. Coordinate installation of different components 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.
- 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 Owner's Submittal Exchange. 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.
- C. **Coordination Drawings:** Provide complete coordination drawings as specified in "Coordination Meetings and Submittals".

#### 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.
- B. **Perform project quality control** in accordance with requirements specified in Related Sections, including:
1. Division 1 Section "Quality Control Services".
  2. Division 1 Section "Construction Waste Management and Disposal".

## 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.

## 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.
3. **Documentation:** Furnish Architect certificate of insurance naming VCBO as an additional insured.

- C. **Progress Meetings:** Conduct progress meetings at intervals as agreed by Owner, Contractor and Design Professionals. Coordinate dates of meetings with preparation of payment requests.
1. 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.

## 1.8 REQUESTS FOR INFORMATION (RFI)

- A. **Procedure:** Immediately on discovery of the need for interpretation of Contract Document, and if not possible to request interpretation at Project meeting, prepare and submit an RFI in the form specified.
1. RFIs shall be submitted by the Contractor. RFIs submitted by entities other than Contractor will be returned with no response.
  2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
  3. Contractor is to keep a printed record of all RFI's and post them on the 'Record Drawings' kept on site.
- B. **Content of the RFI:** Include a detailed, legible description of item needing interpretation and the following:
1. Project name.
  2. Date.
  3. Name of Contractor.
  4. Name of Architect and Owner.
  5. RFI number, numbered sequentially.
  6. Specification Section number and title and related paragraphs, as appropriate.
  7. Drawing number and detail references, as appropriate.
  8. Field dimensions and conditions, as appropriate.
  9. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contractor Time or the Contract Sum, Contractor shall state impact in the RFI.
  10. Contractor's signature.
  11. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.
    - a. Supplementary drawings prepared by Contractor shall include dimensions, thickness, structural grid references, and details of affected materials, assemblies, and attachments.
- C. **Electronic RFI's:**
1. **RFI's shall be processed and delivered electronically through web-based RFI processing software (via Owner's Submittal Exchange).**
  2. **Identify each page of attachments with the General Contractors RFI number and sequential page number.**
  3. **Attachments shall be electronic files in PDF format.**
- D. **Architect's Action:** Architect will review each RFI, determine action required, and return it. Allow seven working days for Architect's response for each RFI. RFI's received after 1:00 p.m. will be considered as received the following working day.
1. The following RFIs will be returned without action:
    - a. Requests for approval of submittals.
    - b. Request for approval of substitutions.

- c. Requests for coordination information already indicated in the Contract Documents.
    - d. Request for adjustments in the Contract Time or Contract Sum.
    - e. Requests for interpretation of Architect's actions on submittals.
    - f. Incomplete RFIs or RFI with numerous errors.
  2. Architect's action may include a request for additional information, in which case Architect's Time for response will start again.
  3. Architect's action on RFI that may result a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."
    - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect and Owner in writing within 10 calendar days of receipt of the RFI response.
- E. **On receipt of Architect's Owner's action**, update the RFI log and immediately distribute the RFI response to the affected parties. Review response and notify Architect and Owner within seven calendar days if Contractor disagrees with response.
- F. **RFI Log**: Prepare, maintain, and submit a tabular log of RFIs organized by RFI number. Submit log monthly.
  1. Project name.
  2. Name and address of Contractor.
  3. Name and address of Architect and Owner.
  4. RFI number including RFIs that were dropped and not submitted.
  5. RFI description.
  6. Date the RFI was submitted.
  7. Date Architect's and Owner's response was received.
  8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
  9. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

**PART 2 - PRODUCTS - NOT USED**

**PART 3 - EXECUTION - NOT USED**

**END OF SECTION**

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## SECTION 01 3313

### 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 3100 "**Project Management and Coordination**" for electronic web-based construction administration software (using Owner's Submittal Exchange).

##### 1.3 ELECTRONIC SUBMITTAL DELIVERY

- A. **To minimize printing reimbursables**, shipping reimbursables and the impact on the environment, process and deliver submittals electronically through Submittal Exchange.
  - 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 Submittal Exchange shall be sent to both the project manager and the appropriate administrative assistant in the Architect's office simultaneously with posting to Submittal Exchange.
- 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 Submittal Exchange, 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 the Architect's File Transfer Site.
- F. **Submittal Stamps**
1. Contractor or Construction Manager shall affix an electronic stamp to PDF submittals.
- G. **Submittal Logs**
1. Architect shall maintain a submittal log through Submittal Exchange, 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 14 calendar 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 21 calendar 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 14 calendar 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.

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, or PDF submittals that include multiple related specification sections 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.
- 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 Professional's title block 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**

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## SECTION 01 5050

### TEMPORARY FACILITIES AND CONTROLS

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. This section **specifies administrative and procedural requirements** for temporary services and facilities, including such items as temporary utility services, temporary construction and support facilities, and project security and protection.
- B. **Temporary construction and support facilities** required for the project include but are not limited to the following:
  - 1. Sanitary facilities, including drinking water.
  - 2. Hoists.
  - 3. First aid station.
  - 4. Waste disposal services.
  - 5. Construction aids and miscellaneous general services and facilities.
- C. **Security and protection facilities** and services required for the project include but are not limited to the following:
  - 1. Temporary fire protection.
  - 2. Barricades, warning signs, lights.
  - 3. Enclosure fence for stored material.
  - 4. Environmental protection.

##### 1.2 QUALITY ASSURANCE

- A. **Regulations: Comply with requirements** of local laws and regulations governing construction and local industry standards, in the installation and maintenance of temporary services and facilities, including but not limited to the following:
  - 1. Building codes, including requirements for permits, testing and inspection.
  - 2. Health and safety regulations.
  - 3. Utility company regulations and recommendations governing temporary utility services.
  - 4. Environmental protection regulations governing use of water and energy, and the control of dust, noise and other nuisances.
- B. **Standards:** Comply with the requirements of NFPA Code 241, "Building Construction and Demolition Operations", and ANSI A-10 Series standards for "Safety Requirements for Construction and Demolition", and the NECA National Joint Guideline NJG-6 "Temporary Job Utilities and Services."
- C. Refer to the most current "**Guidelines for Bid Conditions for Temporary Job Utilities and Services**", as prepared jointly by AGC and ASC industry recommendations.

##### 1.3 JOB CONDITIONS

- A. **General:** Provide each temporary service and facility ready for use at each location when the service or facility is first needed to avoid delay in the performance of the work. Maintain, expand as required and modify temporary services and facilities as needed throughout the progress of the Work. Do not remove until services or facilities are no longer needed, or are replaced by the authorized use of completed permanent facilities.

- B. **Conditions of Use:** Operate temporary services and facilities in a safe and efficient manner. Do not overload temporary services or facilities, and do not permit them to interfere with the progress of the work. Do not allow unsanitary conditions, public nuisances or hazardous conditions to develop or persist on the site.
  - 1. **Temporary Construction and Support Facilities:** Maintain temporary facilities in such a manner as to prevent discomfort to users. Take necessary fire prevention measures. Maintain temporary support facilities in a sanitary manner so as to avoid health problems and other deleterious effects.
  - 2. **Security and Protection:** Maintain site security and protection facilities in a safe, lawful and publicly acceptable manner. Take necessary measures to prevent erosion of the site.

## PART 2 - PRODUCTS

### 2.1 MATERIALS AND EQUIPMENT

- A. **General:** Provide new materials and equipment for temporary services and facilities, used materials and equipment that are undamaged and in serviceable condition may be used, if acceptable to the Architect.
- B. **Temporary Construction and Support Facilities:** Provide facilities that can be maintained properly throughout their use at the project site.
- C. **Temporary Offices and Similar Construction:** For temporary offices, fabrication shops, storage sheds and similar construction, provide either standard prefabricated or mobile units or the equivalent job-built construction.
  - 1. **Self-contained Toilet Units:** Provide single-occupant self-contained toilet units of the chemical, aerated recirculation, or combustion type, properly vented and fully enclosed with a glass fiber reinforced polyester shell or similar non-absorbent material.
  - 2. **Tarpaulins:** Provide waterproof, fire-resistant, UL labeled tarpaulins with a flame-spread rating of 15 or less.
  - 3. **First Aid Supplies:** Comply with governing regulations and recognized recommendations within the construction industry.
  - 4. **Drinking Water:** Provide potable water approved by local health authorities.
  - 5. **Sign Materials:** For signs and directory boards, provide exterior type, Grade B-B High Density Concrete Form Overlay Plywood conforming to PS-1, of sizes and thicknesses indicated. Provide exterior grade acrylic-latex-base enamel for painting panels and applying graphics.
- D. **Fire Extinguishers:** Provide type "A" fire extinguishers for temporary offices and similar spaces where there is a minimal danger of electrical or grease-oil-flammable liquid fires. In other locations provide type "ABC" dry chemical extinguishers, or a combination of several extinguishers of NFPA recommended types for the exposures in each case.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. **General:** Use qualified tradesmen for installation of temporary services and facilities. Locate temporary services and facilities where they will serve the entire project adequately and result in minimum interference with the performance of the Work.
  - 1. Relocate, modify and extend services and facilities as required during the course of work so as to accommodate the entire work of the project.

### 3.2 TEMPORARY CONSTRUCTION AND SUPPORT FACILITIES INSTALLATION

- A. **General:** Provide a reasonably neat and uniform appearance in temporary construction and support facilities acceptable to the Architect/Engineer and the Owner.
1. Locate field offices, storage and fabrication sheds and other support facilities for easy access to the Work. Position offices so that windows give the best possible view of construction activities.
  2. Maintain field offices, storage and fabrication sheds, temporary sanitary facilities, waste collection and disposal systems, and project identification and temporary signs until near substantial completion. Immediately prior to substantial completion remove these facilities.
- B. **Sanitary Facilities:** Sanitary facilities include temporary toilets, wash facilities and drinking water fixtures. Comply with governing regulations including safety and health codes for the type, number, location, operation and maintenance of fixtures and facilities; provide not less than specified requirements. Install in locations that will best serve the project's needs.
1. Sanitary facilities located within the existing facility will not be permitted to be used by the Contractor.
- C. **Hoists:** Provide adequate facilities for hoisting materials and employees. Do not permit employees to ride hoists which comply only with requirements for hoisting materials. The Contractor is responsible for selection of type, size, and number of facilities. Truck cranes and similar devices used for hoisting are considered as being "tools and equipment" and not temporary facilities.
- D. **Collection and Disposal of Wastes:**
1. Establish a system for daily collection and disposal of waste or extraneous materials from all construction areas on site that may present a hazard to the project, its craftsmen and the expeditious construction of the work. The Contractor shall provide to the Owner a satisfactory method to assure clean-up is performed in a timely and expeditious fashion. Enforce requirements strictly. Do not hold collected materials at the site longer than 1 day. Handle waste materials that are hazardous, dangerous, or unsanitary separately from other inert waste by containerizing appropriately. Dispose of waste material in a lawful manner.
    - a. Burying or burning of waste materials on the site will not be permitted.
    - b. Washing waste materials down sewers or into waterways will not be permitted.
    - c. Provide rodent proof containers located on each floor level of construction work, to encourage depositing of lunch garbage and similar wastes by construction personnel.
  2. The Owner reserves the right to withhold payments and perform the clean-up, if necessary, at the expense of the Contractor, if unsatisfactory clean-up efforts are not performed in a timely fashion.
- E. **Construction Aids and Miscellaneous Services and Facilities:**
1. Design, construct, and maintain construction aids and miscellaneous general services and facilities as needed to accommodate performance of the work. Construction aids and miscellaneous general services and facilities include, but or not limited to the following:
    - a. Temporary stairs and ladders.
    - b. Guardrails and barriers.
  2. Stairs: Provide temporary stairs where ladders are not adequate for performance of work.
  3. Guardrails and Barriers: Provide guardrails at all unprotected edges of floor and roof openings, and at perimeter of roof and unenclosed floors.

### 3.3 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. **General:** Provide a reasonably neat and uniform appearance to security and protection facilities acceptable to the Architect/Engineer and the Owner.
- B. **Temporary Fire Protection:**
1. Install and maintain temporary fire protection facilities of the types needed to adequately protect against reasonably predictable and controllable fire losses. Comply with applicable recommendations of the NFPA Standard 10 "Standard for Portable Fire Extinguishers". Locate fire extinguishers where they are most convenient and effective for their intended purpose. Store combustible materials in containers in recognized fire-safe locations.
  2. Develop and supervise an overall fire prevention and first-aid fire protection program for personnel at the project site. Review needs with the local fire department officials and establish procedures to be followed. Instruct personnel in methods and procedures to be followed. Post warnings and information and enforce strict discipline. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, stairways and other access routes for fighting fires. Prohibit smoking of any kind on school property. Provide supervision of welding operations, and similar sources of ignition for possible fires.
- C. **Security Enclosure and Lockups:**
1. Install general temporary enclosure of partially completed areas of construction. Provide locking entrances adequate to deter unauthorized entrance, vandalism, theft and similar deleterious effects of violations of project security.
  2. Storage: Where materials and equipment must be temporarily stored, prior to and during construction, and are of substantial value or are attractive for possible theft, provide a secure lockup and enforce strict discipline in connection with the timing of installation and release of materials, so that the opportunity for theft and vandalism is minimized.
- D. **General Environmental Protection:** Provide general protection facilities, operate temporary facilities, conduct construction activities, and enforce strict discipline for personnel on the site in ways and by methods that comply with environmental regulations, and that minimize the possibility that air, waterways and subsoil might be contaminated or polluted, or that other undesirable effects might result from the performance of work at the site. Avoid the use of tools and equipment which produce harmful noise. Restrict the use of noise making tools and equipment to hours of use that will minimize noise complaints from persons and firms near the project site.

### 3.4 OPERATION, TERMINATION AND REMOVAL

- A. **Supervision:** Enforce strict discipline in use of temporary services and facilities at the site. Limit availability of temporary services and facilities to essential and intended uses to minimize waste and abuse. Do not permit temporary installations to be abused or endangered. Do not allow hazardous, dangerous or unsanitary conditions to develop or persist on the project site.
- B. **Maintenance:** Operate and maintain temporary services and facilities in good operating condition throughout the time of use and until removal is authorized. Protect from damage by freezing temperatures and similar elements.

- C. **Termination and Removal:** Unless the Architect requests that it be maintained for a longer period of time, remove each temporary service and facility promptly when the need for it or a substantial portion of it has ended, or when it has been replaced by the authorized use of a permanent facility, or no later than substantial completion. Complete, or, if necessary, restore permanent work which may have been delayed because of interference with the temporary service or facility. Repair damaged work, clean exposed surfaces and replace work which cannot be satisfactorily repaired.
1. Materials and facilities that constitute temporary services and facilities and remain the property of the Contractor.

**END OF SECTION**

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## SECTION 01 6000

### PRODUCT 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** the following administrative and procedural requirements: selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.
- B. **Related Sections** include the following:
  - 1. Section 01 1900 "**Definitions and Standards**" for applicable industry standards for products specified.
  - 2. Section 01 7700 "**Closeout Procedures**" for submitting warranties for contract closeout.
  - 4. **Divisions 2 through 48 Sections** for specific requirements for warranties on products and installations specified to be warranted.

##### 1.3 DEFINITIONS

- A. **Products:** Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
  - 1. **Named Products:** Items identified by manufacturer's product name, including make or model number or other designation, shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
  - 2. **New Products:** Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products. Only new products are allowed to be used unless directed by the Architect in writing.
  - 3. **Comparable Product:** Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. **Substitutions:** Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
- C. **Basis-of-Design Product Specification:** Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

- D. **Manufacturer's Warranty:** Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
- E. **Special Warranty:** Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

#### 1.4 SUBMITTALS

- A. **Product List:** Submit a list, in tabular form, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.
  - 1. Coordination: Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.
  - 2. Form: Tabulate information for each product under the following column headings:
    - a. Specification Section number and title.
    - b. Generic name used in the Contract Documents.
    - c. Proprietary name, model number, and similar designations.
    - d. Manufacturer's name and address.
    - e. Supplier's name and address.
    - f. Installer's name and address.
    - g. Projected delivery date or time span of delivery period.
    - h. Identification of items that require early submittal approval for scheduled delivery date.
  - 3. Initial Submittal: Within 30 days after date of commencement of the Work, submit 3 copies of initial product list. Include a written explanation for omissions of data and for variations from Contract requirements.
    - a. At Contractor's option, initial submittal may be limited to product selections and designations that must be established early in Contract period.
  - 4. Completed List: Within 60 days after date of commencement of the Work, submit 3 copies of completed product list. Include a written explanation for omissions of data and for variations from Contract requirements.
  - 5. Architect's Action: Architect will respond in writing to Contractor within 15 days of receipt of completed product list. Architect's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. Architect's response, or lack of response, does not constitute a waiver of requirement that products comply with the Contract Documents.
- B. **Substitution Requests:** Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
  - 1. Substitution Request Form: Use CSI Form 13.1A.
  - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
    - a. Statement indicating why specified material or product cannot be provided.
    - b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
    - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.



- d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
  - e. Samples, where applicable or requested.
  - f. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
  - g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
  - h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
  - i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
  - j. Cost information, including a proposal of change, if any, in the Contract Sum.
  - k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
  - l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 business days of receipt of request, or 7 business days of receipt of additional information or documentation, whichever is later.
- a. Form of Acceptance: Change Order.
  - b. Use product specified if Architect cannot make a decision on use of a proposed substitution within time allocated.

- C. **Basis-of-Design Product Specification Submittal:** Comply with requirements in Division 1 Section "Submittal Procedures." Show compliance with requirements.

## 1.5 QUALITY ASSURANCE

- A. **Compatibility of Options:** If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.
- 1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
  - 2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

## 1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. **Deliver, store, and handle products** using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.
- 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
  - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.

3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
5. Store products to allow for inspection and measurement of quantity or counting of units.
6. Store materials in a manner that will not endanger Project structure.
7. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
8. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
9. Protect stored products from damage.

## 1.7 PRODUCT WARRANTIES

- A. **General:** Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
- B. **Special Warranties:** Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
  1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
  2. Refer to Divisions 2 through 48 Sections for specific content requirements and particular requirements for submitting special warranties.
- C. **Submittal Time:** Comply with requirements in Division 1 Section "Closeout Procedures."

## PART 2 - PRODUCTS

### 2.1 PRODUCT OPTIONS

- A. **General Product Requirements:** Provide products that comply with the Contract Documents, that are undamaged, and unless otherwise indicated, that are new at time of installation.
  1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
  2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
  3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
  4. Where products are accompanied by the term "as selected," Architect will make selection.
  5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
  6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
  7. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.

- B. Product Selection Procedures:** Procedures for product selection include the following:
1. **Product:** Where Specification paragraphs or subparagraphs titled "Product" name a single product and manufacturer, provide the product named.
    - a. Substitutions may be considered, unless otherwise indicated.
  2. **Manufacturer/Source:** Where Specification paragraphs or subparagraphs titled "Manufacturer" or "Source" name single manufacturers or sources, provide a product by the manufacturer or from the source named that complies with requirements.
    - a. Substitutions may be considered, unless otherwise indicated.
  3. **Products:** Where Specification paragraphs or subparagraphs titled "Products" introduce a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
    - a. Substitutions may be considered, unless otherwise indicated.
  4. **Manufacturers:** Where Specification paragraphs or subparagraphs titled "Manufacturers" introduce a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
    - a. Substitutions may be considered, unless otherwise indicated.
  5. **Available Products:** Where Specification paragraphs or subparagraphs titled "Available Products" introduce a list of names of both products and manufacturers, provide one of the products listed or another product that complies with requirements. Comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.
  6. **Available Manufacturers:** Where Specification paragraphs or subparagraphs titled "Available Manufacturers" introduce a list of manufacturers' names, provide a product by one of the manufacturers listed or another manufacturer that complies with requirements. Comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.
  7. **Product Options:** Where Specification paragraphs titled "Product Options" indicate that size, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide either the specific product or system indicated or a comparable product or system by another manufacturer. Comply with provisions in "Product Substitutions" Article.
  8. **Basis-of-Design Products:** Where Specification paragraphs or subparagraphs titled "Basis-of-Design Products" are included and also introduce or refer to a list of manufacturers' names, provide either the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.
    - a. Substitutions may be considered, unless otherwise indicated.
  9. **Visual Matching Specification:** Where Specifications require matching an established Sample, select a product (and manufacturer) that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches satisfactorily.
    - a. If no product available within specified category matches satisfactorily and complies with other specified requirements, comply with provisions of the Contract Documents on "substitutions" for selection of a matching product.
  10. **Visual Selection Specification:** Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product (and manufacturer) that complies with other specified requirements.
    - a. **Standard Range:** Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that does not include premium items.

- b. **Full Range:** Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that includes both standard and premium items.

## 2.2 PRODUCT SUBSTITUTIONS

- A. **Timing:** Architect will consider requests for substitution if received within 60 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.
- B. **Conditions:** Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
  - 1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
  - 2. Requested substitution does not require extensive revisions to the Contract Documents.
  - 3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
  - 4. Substitution request is fully documented and properly submitted.
  - 5. Requested substitution will not adversely affect Contractor's Construction Schedule.
  - 6. Requested substitution has received necessary approvals of authorities having jurisdiction.
  - 7. Requested substitution is compatible with other portions of the Work.
  - 8. Requested substitution has been coordinated with other portions of the Work.
  - 9. Requested substitution provides specified warranty.
  - 10. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

## 2.3 COMPARABLE PRODUCTS

- A. **Where products** or manufacturers are specified by name, submit the following, in addition to other required submittals, to obtain approval of an unnamed product:
  - 1. Evidence that the proposed product does not require extensive revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
  - 2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
  - 3. Evidence that proposed product provides specified warranty.
  - 4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
  - 5. Samples, if requested.

## PART 3 - EXECUTION - NOT USED

### END OF SECTION

## SECTION 01 7300

### 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 3100 "**Project Management and Coordination**" for procedures for coordinating field engineering with other construction activities.
  2. Section 01 3300 "**Submittals**" for administrative submittals and also product and procedural submittals.
  3. Section 01 7700 "**Closeout Procedures**" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

#### 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.
- B. **Site Improvements:** Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.
- C. **Building Lines and Levels:** Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

- D. **Record Log:** Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

### 3.4 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.

### 3.5 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 degrees F.
  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. **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. **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**, 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.

### 3.7 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."

### 3.8 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.

### 3.9 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**

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# Intermountain<sup>SM</sup> Healthcare

## CONSTRUCTION SAFETY REQUIREMENTS

- I. Outside Contractors and Intermountain Construction Employees performing construction activities on Intermountain Healthcare property shall meet the following requirements. Outside Contractors will meet additional qualifications through the Supply Chain Organization Supplier Credentialing Procedure.
  - a. No work will be performed in any Intermountain Facility without prior approval and coordination with the accountable Facility Engineering Manager or Director.
  - b. Each outside contractor will have a Safety Program that complies with 29 CFR 1926 Subpart C. The Safety Program will be in writing.
  - c. Any chemical brought onto Intermountain Property must meet the following requirements:
    - i. Approved by the facility's Chemical Safety Officer,
    - ii. Accompanied by a current material safety data sheet,
    - iii. Stored in accordance with the chemical manufacturer's safety requirements in the appropriate labeled container.
    - iv. Where the chemical quantity is restricted for Healthcare Occupancies by NFPA 30 or other standards, it is the contractor's responsibility to provide for off-site storage.
    - v. The Contractor is responsible to comply with Intermountain's Hazardous Materials policy.
    - vi. The Contractor is responsible for the removal of all chemicals from Intermountain Property and for proper disposal in accordance with applicable laws and regulations.
  - d. No work will be performed without the completion of an Interim Life Safety and Infection Control Risk Assessment. These risk assessments will cover each phase of the construction project.
  - e. In existing facilities, an Asbestos inspection and any necessary abatement will be conducted prior to any renovation or remodel per the Hazmat policy.
  - f. Where work will cause noise or vibration, an assessment will be made following facility procedures to mitigate potential hazards to patients.
  - g. Above the Ceiling Permits
    - i. The Contractor will follow each facility's procedure for obtaining an above the ceiling work permit.
    - ii. No work will be performed prior to obtaining this permit.
  - h. Hot Work Permits
    - i. The Contractor will obtain a Hot Work Permit from Facilities Engineering prior to performing any hot work.
    - ii. The Contractor will provide a continuous and qualified fire watch for the duration and location specified by the Facility Engineering Director.
  - i. Confined Space Permits
    - i. The contractor will coordinate with the Intermountain Facility Engineering Director to assure that all requirements are met and a permit is completed prior to entering a permit required confined space.

- ii. The Facility Engineering Director will be responsible to assure that the contractor is in compliance with Intermountain's Confined Space Policy.
- j. Control of Airborne Contaminants
  - i. The contractor will control all airborne dusts, mists, fumes, and vapors such that there is no exposure to Intermountain employees, patients, or visitors. This includes the generation of contaminants outside the building.
  - ii. If necessary, work will be conducted after hours to minimize potential exposures to staff, patients, and members of the public.
- k. Personal Protective Equipment.
  - i. PPE for head, eye, face, hand, foot, and respiratory protection is the responsibility of the contractor, and will be provided and worn as necessary for the exposure, except as follows:
    - 1. Hard Hats and Safety Glasses are required to be worn at all times when in the construction area.
  - ii. The action level for fall protection on Intermountain Healthcare property is 6'. This includes work from scaffold.

## SECTION 01 7700

### CLOSEOUT PROCEDURES

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. **This Section includes** administrative and procedural requirements for contract closeout, including, but not limited to, the following:
1. Inspection procedures.
  2. Project Record Documents.
  3. Operation and maintenance manuals.
  4. Warranties.
  5. Instruction of Owner's personnel.
  6. Final cleaning.
- B. **Related Sections** include the following:
1. Section 01 2900 "**Payment Procedures**" for requirements for Applications for Payment for Substantial and Final Completion.
  2. Section 01 7300 "**Execution Requirements**" for progress cleaning of Project site.
  3. Section 01 7820 "**Operation and Maintenance Data**" for operation and maintenance manual requirements.
  4. **Divisions 2 through 48** Sections for specific closeout and special cleaning requirements for products of those Sections.

##### 1.3 SUBSTANTIAL COMPLETION

- A. **Preliminary Procedures:** Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
  2. Advise Owner of pending insurance changeover requirements.
  3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
  4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
  5. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs, damage or settlement surveys, property surveys, and similar final record information.
  6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
  7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
  8. Complete startup testing of systems.
  9. Submit test/adjust/balance records.

10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
  11. Advise Owner of changeover in heat and other utilities.
  12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
  13. Complete final cleaning requirements, including touchup painting.
  14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- B. **Inspection:** Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
  2. Results of completed inspection will form the basis of requirements for Final Completion.

#### 1.4 FINAL COMPLETION

- A. **Preliminary Procedures:** Before requesting final inspection for determining date of Final Completion, complete the following:
1. Submit a final Application for Payment according to Division 1 Section "Payment Procedures."
  2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
  3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
  4. Submit pest-control final inspection report and warranty.
  5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
- B. **Inspection:** Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
- C. **Additional Review Fees:** Should Architect perform more than one additional review, or extend its construction period services more than 15 business days beyond the scheduled completion date, due to the failure of the Contractor's work to comply with the claims of status or completion made by the Contractor, Owner will compensate Architect for such additional/ extended services at the rate of \$500.00 per day. The Owner shall then deduct the amount of such compensation from the final payment to the Contractor.

## 1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. **Preparation:** Submit three copies of Contractors list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
  2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
  3. Include the following information at the top of each page:
    - a. Project name.
    - b. Date.
    - c. Name of Architect.
    - d. Name of Contractor.
    - e. Page number.

## 1.6 PROJECT RECORD DOCUMENTS

- A. **General:** Do not use Project Record Documents for construction purposes. Protect Project Record Documents from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.
- B. **Record Drawings:** Maintain and submit one set of blue- or black-line white prints of Contract Drawings and Shop Drawings.
1. 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 cannot be readily identified and recorded 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.
    - d. Mark Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. Where Shop Drawings are marked, show cross-reference on Contract Drawings.
  2. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.
  3. Mark important additional information that was either shown schematically or omitted from original Drawings.
  4. Note Construction Change Directive numbers, Change Order numbers, alternate numbers, and similar identification where applicable.
  5. Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location. Organize into manageable sets; bind each set with durable paper cover sheets. Include identification on cover sheets.
- C. **Record Specifications:** Submit one copy of Project's Specifications, including addenda and contract modifications. Mark copy to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.

2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
  3. Note related Change Orders, Record Drawings, and Product Data, where applicable.
- D. **Record Product Data:** Submit one copy of each Product Data submittal. Mark one set to indicate the actual product installation where installation varies substantially from that indicated in Product Data.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
  3. Note related Change Orders, Record Drawings, and Record Specifications, where applicable.
- E. **Miscellaneous Record Submittals:** 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.

## 1.7 OPERATION AND MAINTENANCE MANUALS

- A. **Assemble a complete set of operation and maintenance data** indicating the operation and maintenance of each system, subsystem, and piece of equipment not part of a system. Include operation and maintenance data required in individual Specification Sections and as follows:
1. **Operation Data:**
    - a. Emergency instructions and procedures.
    - b. System, subsystem, and equipment descriptions, including operating standards.
    - c. Operating procedures, including startup, shutdown, seasonal, and weekend operations.
    - d. Description of controls and sequence of operations.
    - e. Piping diagrams.
  2. **Maintenance Data:**
    - a. Manufacturer's information, including list of spare parts.
    - b. Name, address, and telephone number of Installer or supplier.
    - c. Maintenance procedures.
    - d. Maintenance and service schedules for preventive and routine maintenance.
    - e. Maintenance record forms.
    - f. Sources of spare parts and maintenance materials.
    - g. Copies of maintenance service agreements.
    - h. Copies of warranties and bonds.
- B. **Organize operation and maintenance manuals** into suitable sets of manageable size. Bind and index data in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, with pocket inside the covers to receive folded oversized sheets. Identify each binder on front and spine with the printed title "OPERATION AND MAINTENANCE MANUAL," Project name, and subject matter of contents.

## 1.8 WARRANTIES

- A. **Submittal Time:** Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.



- B. **Organize warranty documents** into an orderly sequence based on the table of contents of the Project Manual.
  - 1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (115-by-280-mm) paper.
  - 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
  - 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
- C. **Provide additional copies** of each warranty to include in operation and maintenance manuals.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. **Cleaning Agents:** Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

## PART 3 - EXECUTION

### 3.1 DEMONSTRATION AND TRAINING

- A. **Instruction:** Instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
  - 1. Provide instructors experienced in operation and maintenance procedures.
  - 2. Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at the start of each season.
  - 3. Schedule training with Owner, through Architect, with at least seven days' advance notice.
  - 4. Coordinate instructors, including providing notification of dates, times, length of instruction, and course content.
- B. **Program Structure:** Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections. For each training module, develop a learning objective and teaching outline. Include instruction for the following:
  - 1. System design and operational philosophy.
  - 2. Review of documentation.
  - 3. Operations.
  - 4. Adjustments.
  - 5. Troubleshooting.
  - 6. Maintenance.
  - 7. Repair.

### 3.2 FINAL CLEANING

- A. **General:** Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

- B. **Cleaning:** Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
    - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
    - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
    - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
    - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
    - e. Remove snow and ice to provide safe access to building.
    - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
      - 1) Use low VOC and low emitting cleaning products to the maximum extent feasible.
    - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
    - h. Sweep concrete floors broom clean in unoccupied spaces.
    - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
    - j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
    - k. Remove labels that are not permanent.
    - l. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
      - 1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
    - m. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
    - n. Replace parts subject to unusual operating conditions.
    - o. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
    - p. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
    - q. Clean ducts, blowers, and coils if units were operated without filters during construction.
    - r. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
    - s. Leave Project clean and ready for occupancy.

- C. **Cleaning Standards:** Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

**END OF SECTION**

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# INTERMOUNTAIN HEALTHCARE

## RECORD DRAWING REQUIREMENTS

PROJECT CONTRACT NAME: Project Contract Name

ARCHITECTURAL FIRM: Architect Firm ARCH. PROJECT NO: ##

CONTRACTOR: Contractor

*Record Drawings are required per the Owner / Architect contract agreement and shall consist of AutoCAD files (.dwg), BIM files (i.e. REVIT [.rvt], etc.), PDF (.pdf) files, Sheet Index (.xls), Renderings/Photos and Specifications as outlined below. Drawing files shall be separated into individual files with all external references (xrefs) and attached files (i.e. images, special fonts, pen settings, etc.) bound to each separate drawing. The AutoCAD, BIM and PDF files can be included under each discipline below in separate folders. Naming of these files shall be sequential and as outlined on the Architects Drawing Index. The file names shall not include any special characters and/or symbols (i.e. \, /, :, \*, ?, ", <, >, |, #, {, }, %, ~, &, etc.). **By submitting Record Drawings to the Owner, Architect has verified that all content is functional and readable.***

**RECORD DRAWING SHEET INDEX**  Provide an Excel File (.xls) of complete drawing index.

RECORD DRAWING DISCIPLINES	AUTOCAD (.dwg)	REVIT (.rvt)	PDF (.pdf)
ARCHITECTURAL.....	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
CIVIL.....	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
LANDSCAPE.....	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
STRUCTURAL.....	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
PLUMBING.....	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
MECHANICAL.....	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
ELECTRICAL.....	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
_____.....	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
_____.....	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
_____.....	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
_____.....	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

**RECORD SPECIFICATIONS**  Separate into Divisions / Sections with T.O.C. (.pdf)

**RENDERINGS | PHOTOS**

REVIEWED BY: Architect DATE REVIEWED: 10/10/2012

SIGNATURE: \_\_\_\_\_

\*This document is to be included in Division I specifications and kept with the Record Drawing file.

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## SECTION 01 7820

### 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 systems and equipment.
- B. **Related Sections** include the following:
  - 1. Section 01 3313 "**Submittal Procedures**" for submitting copies of submittals for operation and maintenance manuals.
  - 2. Section 01 7700 "**Closeout Procedures**" for submitting operation and maintenance manuals.
  - 3. **Divisions 2 through 48** 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. **Initial Submittal:** Submit 2 draft copies of each manual at least 15 days before requesting inspection for Substantial Completion. Include a complete operation and maintenance directory. Architect will return one copy of draft and mark whether general scope and content of manual are acceptable.
- B. **Final Submittal:** Submit 2 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. Name and address of Architect.
  - 7. 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: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
    - 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. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
  3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
  4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
  5. 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.
- E. **Coordinate final O&M manual data and delivery** with Commissioning Agent as required in LEED EA credit 3 "Enhanced Commissioning."

## 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. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  5. Aligning, adjusting, and checking instructions.
  6. 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. **Maintenance Service Contracts:** Include copies of maintenance agreements with name and telephone number of service agent.
  
- H. **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 - EXECUTIpN

### 3.1 MANUAL PREPARATION

- A. **Operation and Maintenance Documentation Directory:** Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.
  
- B. **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.

- C. **Product Maintenance Manual:** Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- D. **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.
- E. **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.
- F. **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."
- G. **Comply with** Division 1 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

**END OF SECTION**

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## **DIVISION 2 – EXISTING CONDITIONS**

Section 02 4101 Cutting and Patching  
Section 02 4102 Selective Demolition

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## SECTION 02 4101

### CUTTING AND PATCHING

#### 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** procedural requirements for cutting and patching.
- B. **The General Contractor is responsible** to patch and repair any and all material disturbed during construction, this is to include but not limited to walls, floors, ceilings, asphalt, concrete, lawns and landscaping, roofs, etc.

##### 1.3 DEFINITION

- A. **Cutting:** Removal of existing construction necessary to permit installation or performance of other Work.
- B. **Patching:** Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

##### 1.4 SUBMITTALS

- A. **Cutting and Patching Proposal:** Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed.
  - 1. **Architect's Approval:** Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

##### 1.5 QUALITY ASSURANCE

- A. **Structural Elements:** Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
- B. **Operational Elements:** Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety, including but not limited to the following:
  - 1. Primary operational systems and equipment.
  - 2. Fire-protection systems.
  - 3. Communication systems.
  - 4. Electrical wiring systems.
- C. **Miscellaneous Elements:** Do not cut and patch the following elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
  - 1. Piping, ductwork, vessels, and equipment.

- D. **Visual Requirements:** Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
1. If possible, retain original Installer or fabricator to cut and patch exposed Work. If it is impossible to engage original Installer or fabricator, engage another recognized, experienced, and specialized firm.
- E. **Cutting and Patching Conference:** Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

## 1.6 WARRANTY

- A. **Existing Warranties:** Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. **General:** Comply with requirements specified in other Sections of these Specifications.
- B. **Existing Materials:** Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. **Examine surfaces** to be cut and patched and conditions under which cutting and patching are to be performed.
1. **Compatibility:** Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
  2. **Proceed with installation** only after unsafe or unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. **Temporary Support:** Provide temporary support of Work to be cut.
- B. **Protection:** 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.
- C. **Adjoining Areas:** Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

- D. **Existing Services:** Where existing services are required to be removed, relocated, or abandoned, bypass such services before cutting to minimize interruption of services to occupied areas.

### 3.3 PERFORMANCE

- A. **General:** Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
1. Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. **Cutting:** Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
1. **General:** use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
  2. **Existing Finished Surfaces:** Cut or drill from the exposed or finished side into concealed surfaces.
  3. **Concrete/Masonry:** Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
  4. **Mechanical and Electrical Services:** Cut off pipe or conduit to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
  5. **Patching:** Proceed with patching after construction operations requiring cutting are complete.
- C. **Patching:** Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Patch masonry with masonry units and grout that match as closely as possible the original. Provide materials and comply with installation requirements specified in other Sections of these Specifications.
1. **Inspection:** Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
  2. **Exposed Finishes:** Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

**END OF SECTION**

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## SECTION 02 4102

### SELECTIVE DEMOLITION

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. **This Section includes** the following:
1. Demolition and removal of selected portions of a building or structure.
  2. Repair procedures for selective demolition operations.
- B. **Related Sections** include the following:
1. Section 02 4101 "**Cutting and Patching**" for cutting and patching procedures for selective demolition operations.

##### 1.3 DEFINITIONS

- A. **Deconstruction:** Disassembly of buildings for the purpose of recovering materials
- B. **Demolish:** Completely remove and legally dispose of off-site.
- C. **Existing to Remain or Retain:** Existing items of construction that are not to be removed and that are not otherwise indicated to be removed and salvaged, or removed and reinstalled
- D. **Protect:** Except as otherwise defined in greater detail, the term "protect" is used to describe the process of shielding from harm existing fixtures, elements or materials.
- E. **Protect and Maintain:** To remove deteriorating corrosion, reapply protective coatings, and install protective measures such as temporary guards; to provide the least degree of intervention.
- F. **Recycle:** Recovery of demolition waste for subsequent processing in preparation for reuse.
- G. **Remove:** To detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.
- H. **Remove and Salvage:** To detach items from existing construction and deliver them to Owner ready for reuse.
- I. **Remove and Reinstall:** To detach items from existing construction, repair and clean them for reuse, and reinstall them where indicated.

- J. **Salvage:** Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner. Include fasteners or brackets needed for reattachment elsewhere.
- K. **Stabilize:** To apply measures designed to reestablish a weather-resistant enclosure and the structural reinforcement of an item or portion of the building while maintaining the essential form as it exists at present.

#### 1.4 MATERIALS OWNERSHIP

- A. **Historic items, relics, and similar objects** including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Owner that may be encountered during selective demolition remain Owner's property. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to Owner.

#### 1.5 SUBMITTALS

- A. **Qualification Data:** For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- B. **Proposed Dust-Control and Noise-Control Measures:** Submit statement or drawing that indicates the measures proposed for use, proposed locations, and proposed time frame for their operation. Identify options if proposed measures are later determined to be inadequate.
- C. **Schedule of items and materials to be salvaged:** Identify procedures for disassembly.
  - 1. Identify materials to be recycled. Identify materials to be salvaged for reuse on site and off site.
- D. **Schedule of Selective Demolition Activities:** Indicate the following:
  - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
  - 2. Interruption of utility services.
  - 3. Coordination for shutoff, capping, and continuation of utility services.
  - 4. Locations of temporary partitions and means of egress.
  - 5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
- E. **Inventory:** After selective demolition is complete, submit a list of items that have been removed and salvaged.
- F. **Pre-demolition Photographs or Videotape:** Show existing conditions of adjoining construction and site improvements, including finish surfaces, which might be misconstrued as damage caused by selective demolition operations. Submit before Work begins.
- G. **Landfill Records:** Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

## 1.6 QUALITY ASSURANCE

- A. **Demolition Firm Qualifications:** An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.
- B. **Regulatory Requirements:** Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. **Standards:** Comply with ANSI A10.6 and NFPA 241.
- D. **Pre-demolition Conference:** Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to selective demolition including, but not limited to, the following:
  - 1. Inspect and discuss condition of construction to be selectively demolished.
  - 2. Review structural load limitations of existing structure.
  - 3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
  - 4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.

## 1.7 PROJECT CONDITIONS

- A. **Owner will occupy portions of building** immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.
- B. **Maintain access to existing walkways**, corridors, and other adjacent occupied or used facilities.
  - 1. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from authorities having jurisdiction.
- C. **Owner assumes no responsibility for condition of areas** to be selectively demolished.
  - 1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- D. **Hazardous Materials:** It is not expected that hazardous materials will be encountered in the Work.
  - 1. Hazardous materials will be removed by Owner before start of the Work.
  - 2. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- E. **Storage or sale of removed items** or materials on-site will not be permitted.
- F. **Utility Service:** Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
  - 1. Maintain fire-protection facilities in service during selective demolition operations.

## PART 2 - PRODUCTS

### 2.1 REPAIR MATERIALS

- A. **Use repair materials** identical to existing materials.
  - 1. **If identical materials are unavailable** or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
  - 2. **Use materials whose installed performance equals** or surpasses that of existing materials.
- B. **Comply with material and installation requirements** specified in individual Specification Sections.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. **Verify** that utilities have been disconnected and capped.
- B. **Survey existing conditions** and correlate with requirements indicated to determine extent of selective demolition required.
- C. **Inventory and record** the condition of items to be removed and reinstalled and items to be removed and salvaged.
- D. **When unanticipated mechanical, electrical, or structural elements** that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
- E. **Engage a professional engineer** to survey condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective demolition operations.
- F. **Perform surveys** as the Work progresses to detect hazards resulting from selective demolition activities.

### 3.2 UTILITY SERVICES

- A. **Existing Utilities:** Maintain services indicated to remain and protect them against damage during selective demolition operations.
- B. **Utility Interruption:** Do not interrupt existing utilities serving occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and to authorities having jurisdiction.
- C. **Provide at least 72 hours'** notice to Owner if shutdown of service is required during changeover.



- D. **Utility Requirements:** Locate, identify, disconnect, and seal or cap off indicated utilities serving areas to be selectively demolished.
- E. **Owner will arrange to shut off indicated utilities** when requested by Contractor.
- F. **If utility services are required to be removed**, relocated, or abandoned, before proceeding with selective demolition provide temporary utilities that bypass area of selective demolition and that maintain continuity of service to other parts of building.
- G. **Cut off pipe or conduit in walls** or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.
- H. **Utility Requirements:** Refer to Mechanical and Electrical Sections for shutting off, disconnecting, removing, and sealing or capping utilities. Do not start selective demolition work until utility disconnecting and sealing have been completed and verified in writing.

### 3.3 PREPARATION

- A. **Dangerous Materials:** Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with selective demolition operations.
- B. **Site Access and Temporary Controls:** Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
  - 1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.
  - 2. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.
  - 3. Protect existing site improvements, appurtenances, and landscaping to remain.
- C. **Temporary Facilities:** Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
  - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
  - 2. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
  - 3. Cover and protect furniture, furnishings, and equipment that have not been removed.
- D. **Temporary Enclosures:** Provide temporary enclosures for protection of existing building and construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
  - 1. Where heating or cooling is needed and permanent enclosure is not complete, provide insulated temporary enclosures. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.

- E. **Temporary Partitions:** Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.
- F. **Temporary Shoring:** Provide and maintain shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of construction to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
  - 1. Strengthen or add new supports when required during progress of selective demolition.

### 3.4 POLLUTION CONTROLS

- A. **Temporary ventilation:** Provide temporary ventilation as follows:
  - 1. Vacuum old carpets prior to removal using a certified Carpet and Rug Institute (CRI) Green Label vacuum cleaner. Vacuum floor immediately after old carpet is removed.
- B. **Dust Control:** Use water mist, temporary enclosures, and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations.
  - 1. Do not use water when it may damage existing construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
  - 2. Wet mop floors to eliminate trackable dirt and wipe down walls and doors of demolition enclosure. Vacuum carpeted areas.
- C. **Disposal:** Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
  - 1. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
- D. **Cleaning:** Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

### 3.5 SELECTIVE DEMOLITION

- A. **General:** Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
  - 1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
  - 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
  - 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
  - 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.

5. Maintain adequate ventilation when using cutting torches.
  6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
  7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
  8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
  9. Dispose of demolished items and materials promptly.
  10. Return elements of construction and surfaces that are to remain to condition existing before selective demolition operations began.
- B. **Existing Facilities:** Comply with Owner's requirements for using and protecting walkways, building entries, and other building facilities during selective demolition operations.
- C. **Removed and Salvaged Items:** Comply with the following:
1. Clean salvaged items.
  2. Pack or crate items after cleaning. Identify contents of containers.
  3. Store items in a secure area until delivery to Owner.
  4. Transport items to Owner's storage area designated by Owner.
  5. Protect items from damage during transport and storage.
- D. **Removed and Reinstalled Items:** Comply with the following:
1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
  2. Pack or crate items after cleaning and repairing. Identify contents of containers.
  3. Protect items from damage during transport and storage.
  4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- E. **Existing Items to Remain:** Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.
- F. **Concrete:** Neatly core drill openings in existing floor - verify locations of services in suspended slab and below before any cutting.

### 3.6 PATCHING AND REPAIRS

- A. **General:** Promptly repair damage to adjacent construction caused by selective demolition operations.
- B. **Repairs:** Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.
1. Completely fill holes and depressions in existing masonry walls that are to remain with an approved masonry patching material applied according to manufacturer's written recommendations.
- C. **Finishes:** Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.

- D. **Floors and Walls:** Where walls or partitions that are demolished extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, as noted on Drawings, to achieve uniform color and appearance.
1. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.
  2. Skim coat entire wall surface with drywall compound to provide smooth, unblemished substrate for new paint finish.
  3. Where patching occurs in a painted surface, apply primer and intermediate paint coats over patch and apply final paint coat over entire unbroken surface containing patch. Provide additional coats until patch blends with adjacent surfaces.
  4. Test and inspect patched areas after completion to demonstrate integrity of installation.
- E. **Ceilings:** Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance. Replace damaged ceiling panels with new panels, matching existing.

### 3.7 DISPOSAL OF DEMOLISHED MATERIALS

- A. **General:** Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.
- B. **Burning:** Do not burn demolished materials.
- C. **Disposal:** Transport demolished materials off Owner's property and legally dispose of them.

**END OF SECTION**

## **DIVISION 03 – CONCRETE**

Section 03 3053

Cast-in Place Concrete (Limited Applications)

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## SECTION 03 3053

### CAST-IN-PLACE CONCRETE (LIMITED APPLICATIONS)

#### 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 **cast-in-place concrete**, including reinforcement, concrete materials, mix design, placement procedures, and finishes.

##### 1.3 SUBMITTALS

- A. **General:** In addition to the following, comply with submittal requirements in ACI 301.
- B. **Product Data:** For each type of manufactured material and product indicated.
- C. **Design Mixes:** For each concrete mix.

##### 1.4 QUALITY ASSURANCE

- A. **Installer Qualifications:** An experienced installer who has completed concrete work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. **Manufacturer Qualifications:** A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
- C. **Source Limitations:** Obtain each type of cement of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.
- D. **Comply with ACI 301**, "Specification for Structural Concrete," including the following, unless modified by the requirements of the Contract Documents.
  - 1. General requirements, including submittals, quality assurance, acceptance of structure, and protection of in-place concrete.
  - 2. Formwork and form accessories.
  - 3. Steel reinforcement and supports.
  - 4. Concrete mixtures.
  - 5. Handling, placing, and constructing concrete.
  - 6. Lightweight concrete.

#### PART 2 - PRODUCTS

##### 2.1 FORMWORK

- A. Furnish formwork and form accessories according to ACI 301.

## 2.2 STEEL REINFORCEMENT

- A. **Reinforcing Bars:** ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- B. **Plain-Steel Wire:** ASTM A 82, as drawn.
- C. **Plain-Steel Welded Wire Fabric:** ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

## 2.3 CONCRETE MATERIALS

- A. **Portland Cement:** ASTM C 150, Type I.
- B. **Normal-Weight Aggregate:** ASTM C 33, uniformly graded, not exceeding 1-1/2-inch nominal size.
- C. **Water:** Potable and complying with ASTM C 94.

## 2.4 ADMIXTURES

- A. **General:** Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cement and to be compatible with other admixtures. Do not use admixtures containing calcium chloride.
- B. **Air-Entraining Admixture:** ASTM C 260.
- C. **Water-Reducing Admixture:** ASTM C 494, Type A.

## 2.5 RELATED MATERIALS

- A. **Fine-Graded Granular Material:** Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a No. 4 (4.75-mm) sieve and 10 to 30 percent passing a No. 100 (0.15-mm) sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates.
- B. **Joint-Filler Strips:** ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork.

## 2.6 CURING MATERIALS

- A. **Evaporation Retarder:** Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. **Absorptive Cover:** AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. 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.

## 2.7 CONCRETE MIXES

- A. **Comply with ACI 301** requirements for concrete mixtures.
- B. **Prepare design mixes**, proportioned according to ACI 301, for normal-weight concrete determined by either laboratory trial mix or field test data bases, as follows:
  - 1. Compressive Strength (28 Days): Minimum 4000 psi.
  - 2. Slump: 4 inches.
    - a. Slump Limit for Concrete Containing High-Range Water-Reducing Admixture: Not more than 8 inches after adding admixture to plant- or site-verified, 2- to 3-inch slump.
- C. **Add air-entraining admixture** at manufacturer's prescribed rate to result in concrete at point of placement having an air content of 5.5 to 7.5 percent.

## 2.8 CONCRETE MIXING

- A. **Ready-Mixed Concrete:** Comply with ASTM C 94 and ASTM C 1116.
  - 1. When air temperature is between 85 and 90 degrees F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 degrees F, reduce mixing and delivery time to 60 minutes.
- B. **Project-Site Mixing:** Measure, batch, and mix concrete materials and concrete according to ASTM C 94. Mix concrete materials in appropriate drum-type batch machine mixer.
  - 1. For mixer capacity of 1 cubic yard or smaller, continue mixing at least one and one-half minutes, but not more than five minutes after ingredients are in mixer, before any part of batch is released.
  - 2. For mixer capacity larger than 1 cubic yard, increase mixing time by 15 seconds for each additional 1 cubic yard.
  - 3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water added. Record approximate location of final deposit in structure.

## PART 3 - EXECUTION

### 3.1 FORMWORK

- A. **Design, construct, erect, shore, brace, and maintain** formwork according to ACI 301.

### 3.2 STEEL REINFORCEMENT

- A. **Comply with CRSI's "Manual of Standard Practice"** for fabricating, placing, and supporting reinforcement.

### 3.3 JOINTS

- A. **General:** Construct joints true to line with faces perpendicular to surface plane of concrete.

- B. **Construction Joints:** Locate and install so as not to impair strength or appearance of concrete, at locations indicated or as approved by Architect.
- C. **Isolation Joints:** Install joint-filler strips at junctions with slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
  - 1. Extend joint fillers full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
- D. **Contraction (Control) 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 the concrete thickness, as follows:
  - 1. **Grooved Joints:** Form contraction joints after initial floating by grooving and finishing each edge of joint with groover tool to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.

### 3.4 CONCRETE PLACEMENT

- A. **Comply with recommendations in ACI 304R** for measuring, mixing, transporting, and placing concrete.
- B. **Do not add water** to concrete during delivery, at Project site, or during placement.
- C. **Consolidate concrete** with mechanical vibrating equipment.

### 3.5 FINISHING FORMED SURFACES

- A. **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 defective areas. Completely remove fins and other projections.
  - 1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete.
  - 2. Do not apply rubbed finish to smooth-formed finish.
- B. **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 UNFORMED SURFACES

- A. **General:** Comply with ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. **Screed surfaces** with a straightedge and strike off. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane before excess moisture or bleedwater appears on the surface.
  - 1. Do not further disturb surfaces before starting finishing operations.

- C. **Trowel Finish:** Apply a hard trowel finish to surfaces indicated and to floor and slab surfaces 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.

### 3.7 TOLERANCES

- A. **Comply with ACI 117,** "Specifications for Tolerances for Concrete Construction and Materials."

### 3.8 CONCRETE PROTECTION 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 follow recommendations in ACI 305R for hot-weather protection during curing.
- B. **Evaporation Retarder:** Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. 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. **Begin curing** after finishing concrete, but not before free water has disappeared from concrete surface.
- D. **Curing Methods:** Cure formed and unformed concrete for at least seven days by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:
  - 1. **Moisture Curing:** Keep surfaces continuously moist for not less than seven days with the following materials:
    - a. Continuous water-fog spray.
    - b. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
  - 2. **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.

### 3.9 FIELD QUALITY CONTROL

- A. **Testing Agency:** Owner will engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement. Tests will be performed according to ACI 301.
  - 1. **Testing Frequency:** Obtain one composite sample for each day's pour of each concrete mix exceeding 5 cubic yard, but less than 25 cubic yard, plus one set for each additional 50 cubic yard or fraction thereof.

### 3.10 REPAIRS

- A. **Remove and replace concrete** that does not comply with requirements in this Section.

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**DIVISION 04 – MASONRY**

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**DIVISION 05 - METALS**

Section 05 1200	Structural Steel Framing
Section 05 3100	Steel Decking
Section 05 4000	Cold-Formed Metal Framing
Section 05 5000	Metal Fabrications
Section 05 5213	Pipe and Tube Railings

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## SECTION 05 1200

### STRUCTURAL STEEL FRAMING

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. **Section Includes:**
  - 1. Structural steel including but not limited to primary beams and columns, steel embedded in concrete, miscellaneous angles around openings and roof edges, and steel tubes in exterior wall system.
  - 2. Grout.
- B. **Related Sections:**
  - 1. Section 05 3100 "Steel Decking".
  - 2. Section 05 5213 Section "Pipe and Tube Railings".

##### 1.3 DEFINITIONS

- A. **Structural Steel:** Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- B. **Seismic-Load-Resisting System:** Elements of structural-steel frame designated as "SLRS" on Drawings, including columns, beams, and braces and their connections.
- C. **Heavy Sections:** Rolled and built-up sections as follows:
  - 1. Shapes included in ASTM A 6/A 6M with flanges thicker than 1-1/2 inches (38 mm).
  - 2. Welded built-up members with plates thicker than 2 inches (50 mm).
  - 3. Column base plates thicker than 2 inches (50 mm).
- D. **Protected Zone:** Structural members or portions of structural members indicated as "Protected Zone" on Drawings. Connections of structural and nonstructural elements to protected zones are limited.
- E. **Demand Critical Welds:** Those welds, the failure of which would result in significant degradation of the strength and stiffness of the Seismic-Load-Resisting System and which are indicated as "Demand Critical" or "Seismic Critical" on Drawings.

## 1.4 SUBMITTALS

- A. **Product Data:** For each type of product indicated.
- B. **Shop Drawings:** Show fabrication of structural-steel components.
  - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
  - 2. Include embedment drawings.
  - 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
  - 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
  - 5. Identify members and connections of the seismic-load-resisting system.
  - 6. Indicate locations and dimensions of protected zones.
  - 7. Identify demand critical welds.
- C. **Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs):** Provide according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for each welded joint whether prequalified or qualified by testing, including the following:
  - 1. Power source (constant current or constant voltage).
  - 2. Electrode manufacturer and trade name, for demand critical welds.
- D. **Qualification Data:** For qualified fabricator.
- E. **Welding certificates.**
- F. **Paint Compatibility Certificates:** From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- G. **Mill test reports** for structural steel, including chemical and physical properties.
- H. **Product Test Reports:** For the following:
  - 1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
  - 2. Direct-tension indicators.
  - 3. Tension-control, high-strength bolt-nut-washer assemblies.
  - 4. Shear stud connectors.
  - 5. Shop primers.
  - 6. Nonshrink grout.
- I. **Source quality-control reports.**

## 1.5 QUALITY ASSURANCE

- A. **Fabricator Qualifications:** A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.
- B. **Shop-Painting Applicators:** Qualified according to AISC's Sophisticated Paint SSPC- QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."

- C. **Welding Qualifications:** Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
  - 1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.
- D. **Comply with applicable provisions** of the following specifications and documents:
  - 1. AISC 303.
  - 2. AISC 341 and AISC 341s1.
  - 3. AISC 360.
  - 4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- E. **Preinstallation Conference:** Conduct conference at Project site.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. **Store materials** to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
  - 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. **Store fasteners** in a protected place in sealed containers with manufacturer's labels intact.
  - 1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
  - 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
  - 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

## 1.7 COORDINATION

- A. **Coordinate selection** of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. **Coordinate installation** of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

## PART 2 - PRODUCTS

### 2.1 STRUCTURAL-STEEL MATERIALS

- A. **W-Shapes:** ASTM A 992/A 992M.
- B. **Channels, Angles-Shapes:** ASTM A 36/A 36M.
- C. **Plate and Bar:** ASTM A 36/A 36M, ASTM A 572/A 572M, Grade 50 (345) or ASTM A 572/A 572M, Grade 42 where indicated.

- D. **Cold-Formed Hollow Structural Sections:** ASTM A 500, Grade C, structural tubing  $F_y = 50$  ksi.
- E. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.
  - 1. Weight Class: As indicated.
  - 2. Finish: Black except where indicated to be galvanized.
- F. **Welding Electrodes:** Comply with AWS requirements.

## 2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. **High-Strength Bolts, Nuts, and Washers:** ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, (ASTM A 563M, Class 8S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers; all with plain finish.
- B. **Zinc-Coated High-Strength Bolts, Nuts, and Washers:** ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH (ASTM A 563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers.
  - 1. Finish: Hot-dip zinc coating.
- C. **Tension-Control, High-Strength Bolt-Nut-Washer Assemblies:** ASTM F 1852, Type 1, consisting of steel structural bolts with splined ends, heavy-hex carbon- steel nuts, and hardened carbon-steel washers.
  - 1. Finish: Plain.
- D. **Shear Connectors:** ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.
- E. **Unheaded Anchor Rods:** ASTM F 1554, Grade as indicated.
  - 1. Configuration: As indicated.
  - 2. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
  - 3. Plate Washers: ASTM A 36/A 36M carbon steel.
  - 4. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
  - 5. Finish: Plain.
- F. **Threaded Rods:** ASTM A 36/A 36M.
  - 1. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
  - 2. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
  - 3. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.
- G. **Sleeve Nuts:** Made from cold-finished carbon steel bars, ASTM A 108, Grade 1018.

## 2.3 PRIMER

- A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust- inhibiting primer complying with MPI#79 and compatible with topcoat.
  - 1. Comply with Division 09 High-Performance Coatings Sections.

- B. **Galvanizing Repair Paint:** MPI#18, MPI#19, or SSPC-Paint 20, ASTM A 780.

## 2.4 GROUT

- A. **Nonmetallic, Shrinkage-Resistant Grout:** ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

## 2.5 FABRICATION

- A. **Structural Steel:** Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.
1. Camber structural-steel members where indicated.
  2. Fabricate beams with rolling camber up.
  3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
  4. Mark and match-mark materials for field assembly.
  5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. **Thermal Cutting:** Perform thermal cutting by machine to greatest extent possible.
1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. **Bolt Holes:** Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- D. **Finishing:** Accurately finish ends of columns and other members transmitting bearing loads.
- E. **Cleaning:** Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 1, "Solvent Cleaning."
- F. **Shear Connectors:** Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.
- G. **Holes:** Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.
1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
  2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
  3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

## 2.6 SHOP CONNECTIONS

- A. **High-Strength Bolts:** Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

- B. **Weld Connections:** Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

## 2.7 SHOP PRIMING

- A. **Shop prime steel surfaces** except the following:
1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
  2. Surfaces to be field welded.
  3. Surfaces to be high-strength bolted with slip-critical connections.
  4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
  5. Galvanized surfaces.
- B. **Surface Preparation:** Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards unless noted otherwise in Division 09.
1. SSPC-SP 2, "Hand Tool Cleaning."
- C. **Priming:** Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

## 2.8 GALVANIZING

- A. **Hot-Dip Galvanized Finish:** Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.
1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.
  2. Galvanize lintels and shelf angles located in exterior walls.

## 2.9 SOURCE QUALITY CONTROL

- A. **Testing Agency:** Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.
1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- B. **Correct deficiencies in Work** that test reports and inspections indicate does not comply with the Contract Documents.
- C. **Bolted Connections:** Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

- D. **Welded Connections:** In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
1. Liquid Penetrant Inspection: ASTM E 165.
  2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
  3. Ultrasonic Inspection: ASTM E 164.
  4. Radiographic Inspection: ASTM E 94.
- E. **In addition to visual inspection,** shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
1. Bend tests will be performed if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
  2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. **Verify, with steel Erector present,** elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
- B. **Proceed with installation only after** unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. **Provide temporary shores, guys, braces, and other supports** during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

### 3.3 ERECTION

- A. **Set structural steel accurately** in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. **Base, Bearing and Leveling Plates:** Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
1. Set plates for structural members on wedges, shims, or setting nuts as required.
  2. Weld plate washers to top of baseplate.
  3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.

4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. **Maintain erection tolerances** of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- D. **Align and adjust various members** that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
  1. Level and plumb individual members of structure.
  2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. **Splice members** only where indicated.
- F. **Do not use thermal cutting** during erection.
- G. **Do not enlarge unfair holes** in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
- H. **Shear Connectors:** Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

### 3.4 FIELD CONNECTIONS

- A. **High-Strength Bolts:** Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
  1. Joint Type: Snug tightened typical, Pretensioned and moment frame and braced frame connections.
- B. **Weld Connections:** Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
  1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
  2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
  3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," for mill material.

### 3.5 FIELD QUALITY CONTROL

- A. **Special Inspections:** Owner will engage a qualified special inspector to perform the following special inspections:
  1. Verify structural-steel materials and inspect steel frame joint details.
  2. Verify weld materials and inspect welds.
  3. Verify connection materials and inspect high-strength bolted connections.



- B. **Testing Agency:** Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.
- C. **Bolted Connections:** Bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. **Welded Connections:** Field welds will be visually inspected according to AWS D1.1/D1.1M.
  - 1. In addition to visual inspection, field welds will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
    - a. Liquid Penetrant Inspection: ASTM E 165.
    - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
    - c. Ultrasonic Inspection: ASTM E 164.
    - d. Radiographic Inspection: ASTM E 94.
- E. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
  - 1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
  - 2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.
- F. **Correct deficiencies** in Work that test reports and inspections indicate does not comply with the Contract Documents.

### 3.6 REPAIRS AND PROTECTION

- A. **Galvanized Surfaces:** Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.
- B. **Touchup Painting:** Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

**END OF SECTION**

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## SECTION 05 31 00

### STEEL DECKING

#### 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. Roof deck.
- B. **Related Sections:**
  - 1. Section 03 3000 "Cast-in-Place Concrete".
  - 2. Section 05 1200 "Structural Steel".

##### 1.3 ACTION SUBMITTALS

- A. **Product Data:** For each type of deck, accessory, and product indicated.
- B. **Shop Drawings:**
  - 1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

##### 1.4 INFORMATIONAL SUBMITTALS

- A. **Welding certificates.**
- B. **Product Certificates:** For each type of steel deck.
- C. **Product Test Reports:** Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
  - 1. Power-actuated mechanical fasteners.
- D. **ICC Evaluation Reports:** For steel deck and decking attachments.
- E. **Field quality-control reports.**

## 1.5 QUALITY ASSURANCE

- A. **Testing Agency Qualifications:** Qualified according to ASTM E 329 for testing indicated.
- B. **Welding Qualifications:** Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. **Protect steel deck** from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. **Stack steel deck** on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.
  - 1. Protect and ventilate a coustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. **AISI Specifications:** Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."
- B. **Fire-Resistance Ratings:** Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
- C. **Recycled Content of Steel Products:** Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

### 2.2 ROOF DECK

- 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. ASC Profiles, Inc.; a Blue Scope Steel company.
  - 2. Nucor Corp.; Vulcraft Group.
  - 3. Verco Manufacturing Co.
- B. **Roof Deck:** Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
  - 1. Galvanized-Steel Sheet: ASTM A 653/A 653M or A1063, Grade 50, G90 (Z275) zinc coating
  - 2. Deck Profile: As indicated.

3. Profile Depth: As indicated.
4. Design Uncoated-Steel Thickness: As indicated.
5. Span Condition: As indicated.
6. Side Laps: As indicated.

## 2.3 ACCESSORIES

- A. **General:** Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. **Flexible Closure Strips:** Vulcanized, closed-cell, synthetic rubber.
- C. **Miscellaneous Sheet Metal Deck Accessories:** Steel sheet, minimum yield strength of 50,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- D. **Pour Stops and Girder Fillers:** Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 31 for overhang and slab depth.
- E. **Column Closures, End Closures, Z-Closures, and Cover Plates:** Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.
- F. **Flat Sump Plates:** Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.
- G. **Recessed Sump Pans:** Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck, with 3-inch- wide flanges and level recessed pans of 1-1/2-inch minimum depth. For drains, cut holes in the field.
- H. **Galvanizing Repair Paint:** ASTM A 780 or SSPC-Paint 20 or MIL-P-21035B, with dry film containing a minimum of 94 percent zinc dust by weight.
- I. **Repair Paint:** Manufacturer's standard rust-inhibitive primer of same color as primer.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. **Examine supporting frame and field conditions** for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. **Proceed with installation only after** unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION, GENERAL

- A. **Install deck panels and accessories** according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.

- B. **Install temporary shoring** before placing deck panels if required to meet deflection limitations.
- C. **Locate deck bundles** to prevent overloading of supporting members.
- D. **Place deck panels** on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
- E. **Place deck panels** flat and square and fasten to supporting frame without warp or deflection.
- F. **Cut and neatly fit deck panels** and accessories around openings and other work projecting through or adjacent to deck.
- G. **Provide additional reinforcement** and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- H. **Comply with AWS requirements** and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- I. **Mechanical fasteners** may be used in lieu of welding to fasten deck. Alternate means of deck attachment and fastening using screws, pins or other mechanical fastening methods are permitted with approval of the engineer. The contractor shall submit the proposed attachment system and the code evaluation report demonstrating the system has the strength to meet the required deck shears specified in the Drawings. The flexibility factor of the proposed deck attachment system shall be equal to or less than the flexibility factor for the specified welded deck attachment system. If the alternate attachment method is approved, it is the responsibility of the contractor to ensure that the deck type and profile is compatible with the fastening system being used.

### 3.3 ROOF-DECK INSTALLATION

- A. **Fasten roof-deck panels** to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:
  - 1. Weld Diameter: 3/4 inch, nominal.
  - 2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds as indicated and 12 inches apart in the field of roof and 6 inches apart in roof corners and perimeter, based on roof-area definitions in FMG Loss Prevention Data Sheet 1-28.
  - 3. Weld Washers: Install weld washers at each weld location.
- B. **Side-Lap and Perimeter Edge Fastening:** Fasten side laps and perimeter edges of panels between supports, at intervals as indicated and as follows:
  - 1. Fasten with a minimum of 1-1/2-inch- long welds.
- C. **End Bearing:** Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
  - 1. End Joints: Lapped 4 inches minimum.

- D. **Roof Sump Pans and Sump Plates:** Install over openings provided in roof deck and weld flanges to top of deck. Space welds not more than 12 inches (305 mm) apart with at least one weld at each corner.
- E. **Miscellaneous Roof-Deck Accessories:** Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.
  - 1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.
- F. **Flexible Closure Strips:** Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

### 3.4 FIELD QUALITY CONTROL

- A. **Testing Agency:** Owner will engage a qualified testing agency to perform tests and inspections.
- B. **Field welds** will be subject to inspection.
- C. **Testing agency** will report inspection results promptly and in writing to Contractor and Architect.
- D. **Remove and replace work** that does not comply with specified requirements.
- E. **Additional inspecting**, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

### 3.5 PROTECTION

- A. **Galvanizing Repairs:** Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. **Provide final protection** and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

**END OF SECTION**

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## SECTION 05 4000

### COLD-FORMED METAL FRAMING

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. **Section Includes:**
  - 1. Load-bearing wall framing.
  - 2. Exterior non-load-bearing wall framing.
  - 3. Interior non-load-bearing wall framing exceeding height limitations of standard, nonstructural metal framing.
  - 4. Ceiling joist framing.
  - 5. Soffit framing.
- B. **Related Requirements:**
  - 1. Section 05 5000 "**Metal Fabrications**" for miscellaneous steel shapes, masonry shelf angles, and connections used with cold-formed metal framing.
  - 2. Section 09 2216 "**Non-Structural Metal Framing**" for standard, interior non-load-bearing, metal-stud framing, with height limitations and ceiling-suspension assemblies.

##### 1.3 PREINSTALLATION MEETINGS

- A. **Preinstallation Conference:** Conduct conference at Project site.

##### 1.4 ACTION SUBMITTALS

- A. **Product Data:** For each type of product.
- B. **Shop Drawings:**
  - 1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
  - 2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

##### 1.5 INFORMATIONAL SUBMITTALS

- A. **Qualification Data:** For testing agency.
- B. Welding certificates.

- C. **Product Certificates:** For each type of code-compliance certification for studs and tracks.
- D. **Product Test Reports:** For each listed product, for tests performed by manufacturer and witnessed by a qualified testing agency
  1. Steel sheet.
  2. Expansion anchors.
  3. Power-actuated anchors.
  4. Mechanical fasteners.
  5. Vertical deflection clips.
  6. Horizontal drift deflection clips
  7. Miscellaneous structural clips and accessories.
- E. **Evaluation Reports:** For nonstandard cold-formed steel framing post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

## 1.6 QUALITY ASSURANCE

- A. **Testing Agency Qualifications:** Qualified according to ASTM E 329 for testing indicated.
- B. **Product Tests:** Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment, indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
- C. **Code-Compliance Certification of Studs and Tracks:** Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association the Steel Framing Industry Association or [the Steel Stud Manufacturers Association.
- D. **Welding Qualifications:** Qualify procedures and personnel according to the following:
  1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
  2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. **Acceptable Manufacturers:** Subject to compliance with requirements of Contract Documents, provide products by one of the following:
  1. CEMCO; California Expanded Metal Products Co.
  2. ClarkDietrich Building Systems.
  3. Nuconsteel, A Nucor Company.
  4. SCAFCO Steel Stud Company.
  5. The Steel Network, Inc.

### 2.2 COLD-FORMED STEEL FRAMING MATERIALS

- A. **Steel Sheet:** ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:
  1. Grade: ST50H.
  2. Coating: G60,

- B. **Steel Sheet for Vertical Deflection Clips:** ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
1. Grade: 50, Class 1
  2. Coating: G60

### 2.3 LOAD-BEARING WALL FRAMING

- A. **Steel Studs:** Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0428 inch
  2. Flange Minimum Width: 1-5/8 inches min.
  3. Section Properties: as required.
- B. **Steel Track:** Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0428 inch.
  2. Flange Width: 1-1/4 inches min.
- C. **Steel Box or Back-to-Back Headers:** Manufacturer's standard C-shapes used to form header beams, of web depths indicated, unpunched, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0428 inch. Flange widths may vary with application; coordinate with wall width.
  2. Flange Width: 1-5/8 inches min.
  3. Section Properties: as required
- D. **Steel Single- or Double-L Headers:** Manufacturer's standard L-shapes used to form header beams, of web depths indicated, and as follows:
1. Minimum Base-Metal Thickness: 0.0428 inch.
  2. Top Flange Width: 1-5/8 inches min.
  3. Section Properties: as required.

### 2.4 EXTERIOR NON-LOAD-BEARING WALL FRAMING

- A. **Steel Studs:** Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0329 inch.
  2. Flange Width: 1-5/8 inches min.
  3. Section Properties: as required
- B. **Steel Track:** Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0329 inch.
  2. Flange Width: 1-1/4 inches.
- C. **Vertical Deflection Clips:** Manufacturer's standard bypass or head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
- D. **Single Deflection Track:** Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
1. Minimum Base-Metal Thickness: 0.0428 inch.
  2. Flange Width: 1 inch plus the design gap for one-story structures and 1 inch plus twice the design gap for other applications.

- E. **Double Deflection Tracks:** Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
  - 1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
    - a. Minimum Base-Metal Thickness: 0.0329 inch.
    - b. Flange Width: 1 inch plus the design gap for one-story structures.
  - 2. Inner Track: Of web depth indicated, and as follows:
    - a. Minimum Base-Metal Thickness: 0.0428 inch
    - b. Flange Width: 1.5 inches.
- F. **Drift Clips:** Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

## 2.5 INTERIOR NON-LOAD-BEARING WALL FRAMING

- A. **Steel Studs:** Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
  - 1. Minimum Base-Metal Thickness: 0.0329 inch.
  - 2. Flange Width: 1-5/8 inches min.
  - 3. Section Properties: as required
- B. **Steel Track:** Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
  - 1. Minimum Base-Metal Thickness: 0.0329 inch.
  - 2. Flange Width: 1-1/4 inches.
- C. **Vertical Deflection Clips:** Manufacturer's standard bypass or head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
- D. **Single Deflection Track:** Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
  - 1. Minimum Base-Metal Thickness: 0.0428 inch.
  - 2. Flange Width: 1.5 inches
- E. **Double Deflection Tracks:** Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
  - 1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
    - a. Minimum Base-Metal Thickness: 0.0329 inch.
    - b. Flange Width: 1.5inches
  - 2. Inner Track: Of web depth indicated, and as follows:
    - a. Minimum Base-Metal Thickness: 0.0428 inch
    - b. Flange Width: 1.5 inches
- F. **Drift Clips:** Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

## 2.6 CEILING JOIST FRAMING

- A. **Steel Ceiling Joists:** Manufacturer's standard C-shaped steel sections, of web depths indicated, unpunched, punched with standard holes, punched with enlarged service holes, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0329 inch.
  2. Flange Width: 1-5/8 inches, minimum.
  3. Section Properties: as required BY DRAWINGS

## 2.7 SOFFIT FRAMING

- A. **Exterior Soffit Frame:** Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0329 inch.
  2. Flange Width: 1-5/8 inches, minimum.
  3. Section Properties: as required

## 2.8 FRAMING ACCESSORIES

- A. **Fabricate steel-framing accessories** from ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.
- B. **Provide accessories** of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
1. Supplementary framing.
  2. Bracing, bridging, and solid blocking.
  3. Web stiffeners.
  4. Anchor clips.
  5. End clips.
  6. Foundation clips.
  7. Gusset plates.
  8. Stud kickers and knee braces.
  9. Joist hangers and end closures.
  10. Hole-reinforcing plates.
  11. Backer plates.

## 2.9 ANCHORS, CLIPS, AND FASTENERS

- A. **Steel Shapes and Clips:** ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.
- B. **Anchor Bolts:** ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts, carbon-steel nuts, and flat, hardened-steel washers.
- C. **Post-Installed Anchors:** Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, as appropriate for the substrate.
1. Uses: Securing cold-formed steel framing to structure.
  2. Type: Torque-controlled expansion anchor Torque-controlled adhesive anchor or adhesive anchor.
  3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.

4. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.
- D. **Power-Actuated Anchors:** Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- E. **Mechanical Fasteners:** ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
  1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.
- F. **Welding Electrodes:** Comply with AWS standards.

## 2.10 MISCELLANEOUS MATERIALS

- A. **Galvanizing Repair Paint:** ASTM A 780/A 780M, MIL-P-21035B or SSPC-Paint 20.
- B. **Shims:** Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.
- C. **Sealer Gaskets:** Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

## 2.11 FABRICATION

- A. **Fabricate cold-formed steel framing and accessories** plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
  1. Fabricate framing assemblies using jigs or templates.
  2. Cut framing members by sawing or shearing; do not torch cut.
  3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
    - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    - b. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.
  4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.
- B. **Reinforce, stiffen, and brace framing assemblies** to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.
- C. **Tolerances:** Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet and as follows:
  1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
  2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. **Examine substrates, areas, conditions, and abutting structural framing** 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 PREPARATION

- A. **Before sprayed fire-resistive materials** are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
- B. **After applying sprayed fire-resistive materials**, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that required to obtain fire-resistance ratings indicated. Protect remaining fire-resistive materials from damage.
- C. **Install load-bearing shims** or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch (6 mm) to ensure a uniform bearing surface on supporting concrete or masonry construction.
- D. **Install sealer gaskets** at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

### 3.3 INSTALLATION, GENERAL

- A. **Cold-formed steel framing** may be shop or field fabricated for installation, or it may be field assembled.
- B. **Install cold-formed steel framing** according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.
- C. **Install shop- or field-fabricated**, cold-formed framing and securely anchor to supporting structure.
  - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.
- D. **Install cold-formed steel framing** and accessories plumb, square, and true to line, and with connections securely fastened.
  - 1. Cut framing members by sawing or shearing; do not torch cut.
  - 2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
    - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    - b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.

- E. **Install framing members** in one-piece lengths unless splice connections are indicated for track or tension members.
- F. **Install temporary bracing and supports** to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. **Do not bridge building expansion joints** with cold-formed steel framing. Independently frame both sides of joints.
- H. **Install insulation**, specified in Section 07 2100 "Building Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- I. **Fasten hole-reinforcing plate** over web penetrations that exceed size of manufacturer's approved or standard punched openings.

### 3.4 LOAD-BEARING WALL INSTALLATION

- A. **Install continuous top and bottom tracks** sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:
  - 1. Anchor Spacing: 32 inches.
- B. **Squarely seat studs** against top and bottom tracks, with gap not exceeding 1/8 inch between the end of wall-framing member and the web of track. Fasten both flanges of studs to top and bottom tracks. Space studs as follows:
  - 1. Stud Spacing: 16 inches maximum.
- C. **Set studs plumb**, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.
- D. **Align studs vertically** where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.
- E. **Align floor and roof framing** over studs according to AISI S200, Section C1. Where framing cannot be aligned, continuously reinforce track to transfer loads.
- F. **Anchor studs** abutting structural columns or walls, including masonry walls, to supporting structure.
- G. **Install headers** over wall openings wider than stud spacing. Locate headers above openings. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.
  - 1. Frame wall openings with not less than a double stud at each jamb of frame. Fasten jamb members together to uniformly distribute loads.
  - 2. Install tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.
- H. **Install supplementary framing**, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.
  - 1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.



- I. **Install horizontal bridging** in stud system, spaced vertically 48 inches maximum. Fasten at each stud intersection.
  - 1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of two screws into each flange of the clip angle for framing members up to 6 inches deep.
  - 2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges, and secure solid blocking to stud webs or flanges.
  - 3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- J. **Install steel sheet diagonal bracing straps** to both stud flanges; terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.
- K. **Install miscellaneous framing and connections**, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

### 3.5 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

- A. **Install continuous tracks** sized to match studs. Align tracks accurately and securely anchor to supporting structure.
- B. **Fasten both flanges** of studs to top and bottom track unless otherwise indicated. Space studs as follows:
  - 1. Stud Spacing: 16 inches maximum.
- C. **Set studs plumb**, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. **Isolate non-load-bearing steel framing** from building structure to prevent transfer of vertical loads while providing lateral support.
  - 1. Install single deep-leg deflection tracks and anchor to building structure.
  - 2. Install double deep-leg deflection tracks and anchor outer track to building structure.
  - 3. Connect vertical deflection clips to bypassing or infill studs and anchor to building structure.
  - 4. Connect drift clips to cold-formed steel framing and anchor to building structure.
- E. **Install horizontal bridging** in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
  - 1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
  - 2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
  - 3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. **Top Bridging for Single Deflection Track**: Install row of horizontal bridging within 18 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
  - 1. Install solid blocking at 96-inch centers maximum.

- G. **Install miscellaneous framing and connections**, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

### 3.6 INTERIOR NON-LOAD-BEARING WALL INSTALLATION

- A. **Install continuous tracks** sized to match studs. Align tracks accurately and securely anchor to supporting structure.
- B. **Fasten both flanges** of studs to top and bottom track unless otherwise indicated. Space studs as follows:
  - 1. Stud Spacing: 16 inches maximum.
- C. **Set studs plumb**, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. **Isolate non-load-bearing steel framing** from building structure to prevent transfer of vertical loads while providing lateral support.
  - 1. Install single deep-leg deflection tracks and anchor to building structure.
  - 2. Install double deep-leg deflection tracks and anchor outer track to building structure.
  - 3. Connect vertical deflection clips to studs and anchor to building structure.
  - 4. Connect drift clips to cold-formed steel metal framing and anchor to building structure.
- E. **Install horizontal bridging** in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
  - 1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
  - 2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
  - 3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. **Top Bridging for Single Deflection Track**: Install row of horizontal bridging within 18 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
  - 1. Install solid blocking at 96-inch centers maximum.
- G. **Install miscellaneous framing and connections**, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

### 3.7 ERECTION TOLERANCES

- A. **Install cold-formed steel framing** level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
  - 1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

### 3.8 FIELD QUALITY CONTROL

- A. **Testing:** Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. **Field and shop welds** will be subject to testing and inspecting.
- C. **Testing agency** will report test results promptly and in writing to Contractor and Architect.
- D. **Cold-formed steel framing** will be considered defective if it does not pass tests and inspections.
- E. **Additional testing and inspecting**, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

### 3.9 REPAIRS AND PROTECTION

- A. **Galvanizing Repairs:** Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780/A 780M and manufacturer's written instructions.
- B. **Provide final protection and maintain conditions**, in a manner acceptable to manufacturer and Installer, which ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

**END OF SECTION**

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## SECTION 05 5000

### METAL FABRICATIONS

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. This **Section includes** the following:
  - 1. Loose bearing and leveling plates.
  - 2. Loose steel lintels.
  - 3. Shelf angles.
  - 4. Steel framing and supports for applications where framing and supports are not specified in other Sections.
  - 5. Miscellaneous metal trim.
- B. **Related Sections:**
  - 1. Section 05 5123 "**Pipe and Tube Railings**" for galvanized railings at new entrance.

##### 1.3 SUBMITTALS

- A. **Product Data:** For the following:
  - 1. Paint products.
  - 2. Grout.
- B. **Shop Drawings General:** Detail fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
  - 1. Provide templates for anchors and bolts specified for installation under other Sections.
- C. **Welding Certificates:** Copies of certificates for welding procedures and personnel.
- D. **Qualification Data:** For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

##### 1.4 QUALITY ASSURANCE

- A. **Fabricator Qualifications:** A firm experienced in producing metal fabrications similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

- B. **Welding:** Qualify procedures and personnel according to the following:
1. AWS D1.1, "Structural Welding Code--Steel."
  2. AWS D1.2, "Structural Welding Code--Aluminum."
  3. AWS D1.3, "Structural Welding Code--Sheet Steel."
  4. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

## 1.5 PROJECT CONDITIONS

- A. **Field Measurements General:** Where metal fabrications are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
1. **Established Dimensions:** Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Allow for trimming and fitting.

## 1.6 COORDINATION

- A. **Coordinate installation of anchorages for metal fabrications.** Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

## PART 2 - PRODUCTS

### 2.1 METALS, GENERAL

- A. **Metal Surfaces, General:** For metal fabrications 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. Do not use steel sheet with variations in flatness exceeding those permitted by referenced standards for stretcher-leveled sheet.

### 2.2 FERROUS METALS

- A. **Steel Plates, Shapes, and Bars:** ASTM A 36/A 36M.
- B. **Steel Tubing:** Cold-formed steel tubing complying with ASTM A 500.
- C. **Steel Pipe:** ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.
- D. **Uncoated Hot-Rolled Steel Sheet:** Commercial quality, complying with ASTM A 569/A569M or structural quality, complying with ASTM A 570/A 570M, Grade 30, unless another grade is required by design loads.

- E. **Brackets, Flanges, and Anchors:** Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.
- F. **Slotted Channel Framing:** Cold-formed metal channels with flange edges returned toward web and with 9/16-inch- wide slotted holes in webs at 2 inches o.c.
  - 1. Width of Channels: 1-5/8 inches.
  - 2. Depth of Channels: 1-5/8 inches.
  - 3. Metal and Thickness: Uncoated steel complying with ASTM A 570, Grade 33; 14 gauge minimum thickness.
  - 4. Finish: Rust-inhibitive, baked-on, acrylic enamel.
- G. **Turnbuckles/Clevises:** C-1035, SA-182-F-11, Stainless steel, stub ends - hot rolled steel, galvanized finish. Provide clevis pins meeting load requirements of the rod.
  - 1. **Equal to:** Cleveland City Forge.
- H. **Malleable-Iron Castings:** ASTM A 47, Grade 32510 (ASTM A 47M, Grade 22010).
- I. **Gray-Iron Castings:** ASTM A 48, Class 30 (ASTM A 48M, Class 200), unless another class is indicated or required by structural loads.
- J. **Cast-in-Place Anchors in Concrete:** Anchors of type indicated below, fabricated from corrosion-resistant materials capable of sustaining, without failure, the load imposed within a safety factor of 4, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
  - 1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47 (ASTM A 47M) malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.
- K. **Welding Rods and Bare Electrodes:** Select according to AWS specifications for metal alloy welded.

## 2.3 PAINT

- A. **Shop Primer for Ferrous Metal:** Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664; selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.
  - 1. Refer to Section 09 9123 "Painting" for specific primer required on identified steel items.
- B. **Galvanizing Repair Paint:** High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
- C. **Bituminous Paint:** Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers, or cold-applied asphalt emulsion complying with ASTM D 1187.

## 2.4 FASTENERS

- A. **General:** Provide Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, where built into exterior walls. Select fasteners for type, grade, and class required.

- B. **Bolts and Nuts:** Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
- C. **Anchor Bolts:** ASTM F 1554, Grade 36.
- D. **Machine Screws:** ASME B18.6.3 (ASME B18.6.7M).
- E. **Lag Bolts:** ASME B18.2.1 (ASME B18.2.3.8M).
- F. **Wood Screws:** Flat head, carbon steel, ASME B18.6.1.
- G. **Plain Washers:** Round, carbon steel, ASME B18.22.1 (ASME B18.22M).
- H. **Lock Washers:** Helical, spring type, carbon steel, ASME B18.21.1 (ASME B18.21.2M).
- I. **Expansion Anchors:** Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency. See list of acceptable anchors in General Structural Notes.
  - 1. **Material:** Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
- J. **Toggle Bolts:** FS FF-B-588, tumble-wing type, class and style as needed.

## 2.5 GROUT

- A. **Nonshrink, Nonmetallic Grout:** Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

## 2.6 CONCRETE FILL

- A. **Concrete Materials and Properties:** Normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 4000 psi, unless otherwise indicated.
- B. **Welded Wire Fabric:** ASTM A 185, 6 by 6 inches-W1.4 by W1.4, unless otherwise indicated.

## 2.7 FABRICATION, GENERAL

- A. **Shop Assembly:** Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. **Shear and punch** metals cleanly and accurately. Remove burrs.
- C. **Ease exposed edges** to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.



- D. **Weld corners** and seams continuously to comply 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. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- E. **Provide for anchorage** of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- F. **Cut, reinforce, drill, and tap metal fabrications** as indicated to receive finish hardware, screws, and similar items.
- G. **Fabricate joints** that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.
- H. **Allow for thermal movement** resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening up of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. **Temperature Change** (Range): 120 degrees F, ambient; 180 degrees F, material surfaces.
- I. **Form exposed work true to line** and level with accurate angles and surfaces and straight sharp edges.
- J. **Remove sharp or rough areas** on exposed traffic surfaces.
- K. **Form exposed connections with hairline joints**, flush and smooth, using concealed fasteners where possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

## 2.8 LOOSE BEARING AND LEVELING PLATES

- A. **Provide loose bearing and leveling plates** for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. **Galvanize plates** after fabrication.

## 2.9 LOOSE STEEL LINTELS

- A. **Fabricate loose structural-steel lintels** from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.
- B. **Weld adjoining members** together to form a single unit where as required.
- C. **Size loose lintels** to provide bearing length at each side of openings equal to one-twelfth of clear span, but not less than 8 inches (200 mm), unless otherwise indicated.

- D. **Galvanize loose steel lintels** located in exterior walls.

## 2.10 SHELF ANGLES

- A. **Fabricate shelf angles** from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.
- B. **For cavity walls**, provide vertical channel brackets to support angles from backup masonry and concrete. Align expansion joints in angles with indicated control and expansion joints in cavity-wall exterior wythe.
- C. **Galvanize** shelf angles to be installed in exterior walls
- D. **Furnish wedge-type concrete inserts**, complete with fasteners, to attach shelf angles to cast-in-place concrete.

## 2.11 MISCELLANEOUS FRAMING AND SUPPORTS

- A. **General:** Provide steel framing and supports that are not a part of structural-steel framework as necessary to complete the Work.
- B. **Fabricate units** from structural-steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.
  - 1. Fabricate units from slotted channel framing where required for deflection.
  - 2. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors 1-1/4 inches wide by 1/4 inch thick by 8 inches long at 24 inches o.c., unless otherwise indicated.
  - 3. Furnish inserts if units must be installed after concrete is placed.
- C. **Galvanize** miscellaneous framing and supports in the following locations:
  - 1. Exterior locations and where miscellaneous items will be concealed from view.

## 2.12 MISCELLANEOUS STEEL TRIM

- A. **Unless otherwise indicated**, fabricate units from structural-steel shapes, plates, and bars of profiles shown with continuously welded joints, and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. **Provide cutouts, fittings, and anchorages as needed** to coordinate assembly and installation with other work. Provide anchors, welded to trim, for embedding in concrete or masonry construction, spaced not more than 6 inches from each end, 6 inches from corners, and 24 inches o.c., unless otherwise indicated.
- C. **Galvanize miscellaneous steel trim** in the following locations:
  - 1. Exterior.

## 2.13 FINISHES, GENERAL

- A. **Comply with NAAMM's** "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. **Finish metal fabrications after assembly.**

**2.14 STEEL AND IRON FINISHES**

- A. **Galvanizing:** Hot-dip galvanize items as indicated to comply with applicable standard listed below:
1. ASTM A 123, for galvanizing steel and iron products.
  2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
- B. **Preparation for Shop Priming:** Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed metal fabrications:
1. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."
- C. **Application:** Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.
1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

**PART 3 - EXECUTION**

**3.1 INSTALLATION, GENERAL**

- A. **Fastening to In-Place Construction:** Provide anchorage devices and fasteners where necessary for securing metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors.
- B. **Cutting, Fitting, and Placement:** Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- C. **Provide temporary bracing** or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- D. **Fit exposed connections accurately together to form hairline joints.** Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- E. **Field Welding:** Comply with the following requirements:
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. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

- F. **Corrosion Protection:** Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

### 3.2 SETTING BEARING AND LEVELING PLATES

- A. **Clean concrete and masonry bearing surfaces** of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. **Set bearing and leveling plates** on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
  - 1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.
  - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

### 3.3 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. **General:** Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings, if any.
- B. **Support steel girders on** concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.
  - 1. Where grout space under bearing plates is indicated at girders supported on concrete or masonry, install as specified above for setting and grouting bearing and leveling plates.

### 3.4 ADJUSTING AND CLEANING

- A. **Touchup Painting:** Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
  - 1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.
- B. **Galvanized Surfaces:** Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

**END OF SECTION**

## SECTION 05 5213

### PIPE AND TUBE RAILINGS

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. **Section Includes:**
  - 1. Galvanized steel pipe and tube railings.
- B. **Related Requirements:**
  - 1. Section 05 5000 **"Metal Fabrications."**
  - 2. Section 09 9100 **"Painting"** for painting of metal rails and other components.

##### 1.3 COORDINATION

- A. **Coordinate selection of shop primers** with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. **Coordinate installation of anchorages** for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete. Deliver such items to Project site in time for installation.
- C. **Schedule installation** so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

##### 1.4 ACTION SUBMITTALS

- A. **Product Data:** For the following:
  - 1. Manufacturer's product lines of mechanically connected railings.
  - 2. Railing brackets.
  - 3. Grout, anchoring cement, and paint products.
- B. **Samples:** For each type of exposed finish required.
  - 1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
  - 2. Fittings and brackets.
  - 3. Assembled Sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Sample need not be full height.
    - a. Show method of connecting and finishing members at intersections.
- C. **Delegated-Design Submittal:** For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation. Engineer must be licensed in the State of Utah.

## 1.5 INFORMATIONAL SUBMITTALS

- A. **Qualification Data:** For testing agency.
- B. **Welding certificates.**
- C. **Mill Certificates:** Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.
- D. **Product Test Reports:** For pipe and tube railings, for tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.
- E. **Evaluation Reports:** For post-installed anchors, from ICC-ES.

## 1.6 QUALITY ASSURANCE

- A. **Welding Qualifications:** Qualify procedures and personnel according to the following:
  - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
  - 2. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. **Protect mechanical finishes** on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. **Source Limitations:** Obtain each type of railing from single source from single manufacturer.

### 2.2 PERFORMANCE REQUIREMENTS

- A. **Delegated Design:** Engage a qualified professional engineer to design railings, including attachment to building construction. Engineer must be licensed in the State of Utah.
- B. **Structural Performance:** Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
  - 1. Handrails and Top Rails of Guards:
    - a. Uniform load of 50 lbf/ ft. applied in any direction.
    - b. Concentrated load of 200 lbf applied in any direction.
    - c. Uniform and concentrated loads need not be assumed to act concurrently.
    - d. Deflection limited to L/360 or 1/8 inch whichever is less.
  - 2. Infill of Guards:
    - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
    - b. Infill load and other loads need not be assumed to act concurrently.
    - c. Deflection limited to L/360 or 1/8 inch whichever is less.

- C. **Thermal Movements:** Allow for thermal movements from ambient and surface temperature changes.
  - 1. Temperature Change: 120 degrees F, ambient; 180 degrees F.

## 2.3 METALS, GENERAL

- A. **Metal Surfaces, General:** Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. **Brackets, Flanges, and Anchors:** Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.
  - 1. Provide type of bracket with predrilled hole for exposed bolt anchorage and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

## 2.4 STEEL AND IRON

- A. **Tubing:** ASTM A 500 (cold formed).
- B. **Pipe:** ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
  - 1. Provide galvanized finish for exterior installations and where indicated.
- C. **Plates, Shapes, and Bars:** ASTM A 36/A 36M.
- D. **Cast Iron:** Malleable iron, ASTM A 47/A 47M, Grade 32510, galvanized.

## 2.5 FASTENERS

- A. **General:** Provide the following:
  - 1. Hot-Dip Galvanized Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A 153/A 153M or ASTM F 2329 for zinc coating.
  - 2. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.
- B. **Fasteners for Anchoring Railings to Other Construction:** Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
- C. **Fasteners for Interconnecting Railing Components:**
  - 1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.
  - 2. Provide Phillips flat-head machine screws for exposed fasteners unless otherwise indicated.

- D. **Post-Installed Anchors:** Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
  2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 2 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

## 2.6 MISCELLANEOUS MATERIALS

- A. **Welding Rods and Bare Electrodes:** Select according to AWS specifications for metal alloy welded.
1. .
- B. **Galvanizing Repair Paint:** High-zinc-dust-content paint complying with SSPC-Paint 20, Type II-Organic, and the following:
1. Zinc Content: 95 percent, minimum.
  2. Solids: 52 percent by volume, minimum.
  3. Dry film thickness not less than 1.5 mils per coat.
  4. Color: Flat grey finish matching original hot-dipped galvanizing.
  5. Available Product: ZRC Cold Galvanizing Compound; ZRC Worldwide.
- C. **Bituminous Paint:** Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- D. **Nonshrink, Nonmetallic Grout:** Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

## 2.7 FABRICATION

- A. **General:** Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. **Shop assemble railings** to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. **Cut, drill, and punch metals cleanly and accurately.** Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. **Form work true to line** and level with accurate angles and surfaces.
- E. **Fabricate connections** that are exposed to weather in a manner that excludes water. Provide weep holes where water may accumulate.



- F. **Cut, reinforce, drill, and tap** as indicated to receive finish hardware, screws, and similar items.
- G. **Connections:** Fabricate railings with welded connections unless otherwise indicated.
- H. **Welded Connections:** Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
  - 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 flux immediately.
  - 4. At exposed connections, finish exposed surfaces at top rail or handrail smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces (NOMMA #1 finish). All other weld finishes shall be NOMMA #3.
- I. **Form changes in direction** by bending. Use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- I. **Close exposed ends** of railing members with prefabricated end fittings.
- J. **Provide wall returns** at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.
- K. **Brackets, Flanges, Fittings, and Anchors:** Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
  - 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
- L. **Provide inserts and other anchorage devices** for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.
- M. **For railing posts set in concrete**, provide stainless-steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.

## 2.8 STEEL AND IRON FINISHES

- A. **Galvanized Railings:**
  - 1. Hot-dip galvanize indicated steel railings, including hardware, after fabrication.
  - 2. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
  - 3. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.
  - 4. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
  - 5. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

- B. **For galvanized railings**, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
- C. **Preparing Galvanized Railings for Painting:** After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. **Examine plaster and gypsum board assemblies**, where reinforced to receive anchors, to verify that locations of concealed reinforcements are clearly marked for Installer. Locate reinforcements and mark locations if not already done.

### 3.2 INSTALLATION, GENERAL

- A. **Fit exposed connections together** to form tight, hairline joints.
- B. **Perform cutting, drilling, and fitting required** for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
  - 1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
  - 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
  - 3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- C. **Control of Corrosion:** Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
  - 1. Coat, with a heavy coat of bituminous paint, concealed surfaces of aluminum that are in contact with grout, concrete, masonry, wood, or dissimilar metals.
- D. **Adjust railings** before anchoring to ensure matching alignment at abutting joints.
- E. **Fastening to In-Place Construction:** Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction. Coordinate placement and types with waterproofing membrane.

### 3.3 RAILING CONNECTIONS

- A. **Welded Connections:** Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.
- B. **Expansion Joints:** Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches of post.

### 3.4 ANCHORING POSTS

- A. **Form or core-drill holes** not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. **Leave anchorage joint** exposed with 1/8-inch reveal in anchoring material. Seal with silicone joint sealant specified Section 07 9200 "Joint Sealants."
- C. **Anchor posts to metal surfaces** with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
  - 1. For stainless-steel pipe railings, weld flanges to post and bolt to supporting surfaces.
  - 2. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.

### 3.5 ATTACHING RAILINGS

- A. **Anchor railing ends** at walls with round flanges anchored to wall construction and welded to railing ends.
- B. **Anchor railing ends** to metal surfaces with flanges bolted to metal surfaces and welded to railing ends.
- C. **Attach railings to wall** with wall brackets. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- D. **Secure wall brackets and railing end flanges** to building construction as follows:
  - 1. For concrete anchorage, use drilled-in expansion shields and hanger or lag bolts.
  - 2. For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.

### 3.6 ADJUSTING AND CLEANING

- A. **Touchup Painting:** Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 9100 "Painting."
- B. **Galvanized Surfaces:** Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A 780/A 780M and galvanizing repair paint manufacturer's written instructions.

### 3.7 PROTECTION

- A. **Protect finishes of railings** from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

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## **DIVISION 06 – WOOD, PLASTICS, AND COMPOSITES**

Section 06 1000	Rough Carpentry
Section 06 1643	Gypsum Sheathing
Section 06 4023	Interior Architectural Woodwork

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## SECTION 06 1000

### ROUGH CARPENTRY

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. This **Section includes** the following:
1. Framing with dimension lumber.
  2. Framing with engineered wood products.
  3. Wood blocking and nailers.
    - a. Provide solid wood blocking at the following locations including, but not limited to:
      - 1) Door stops.
      - 2) Grab bars.
      - 3) Parapet Caps
      - 4) Wall mounted toilet accessories.
      - 5) Provide 2 rows each at base and upper cabinets and casework.
      - 6) TV brackets.
      - 7) Mirrors.
      - 8) Other wall mounted fixtures.
  4. Wood furring
  5. Plywood backing panels.

##### 1.3 DEFINITIONS

- A. **Rough Carpentry:** Carpentry work not specified in other Sections and not exposed, unless otherwise indicated.
- B. **Exposed Framing:** Dimension lumber not concealed by other construction.
- C. **Lumber grading agencies**, and the abbreviations used to reference them, include the following:
1. NLGA - National Lumber Grades Authority.
  2. WCLIB - West Coast Lumber Inspection Bureau.
  3. WWPA - Western Wood Products Association.

## 1.4 SUBMITTALS

- A. **Product Data:** For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
  - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used, net amount of preservative retained, and chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.
  - 2. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
- B. **Fastener Patterns:** Full-size templates for fasteners in exposed framing.
- C. **Material Certificates:** For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
- D. **Research/Evaluation Reports:** For the following, showing compliance with building code in effect for Project:
  - 1. Wood-preservative-treated wood.
  - 2. Engineered wood products.
  - 3. Power-driven fasteners.
  - 4. Powder-actuated fasteners.
  - 5. Expansion anchors.
  - 6. Metal framing anchors.

## 1.5 QUALITY ASSURANCE

- A. **Source Limitations for Engineered Wood Products:** Obtain each type of engineered wood product through one source from a single manufacturer.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. **Keep materials under cover and dry.** Protect from weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels. Provide for air circulation within and around stacks and under temporary coverings.
  - 1. For lumber and plywood pressure treated with waterborne chemicals, place spacers between each bundle to provide air circulation.

## PART 2 - PRODUCTS

### 2.1 WOOD PRODUCTS, GENERAL

- A. **Lumber:** DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review.
  - 1. Factory mark each piece of lumber with grade stamp of grading agency.
  - 2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by grading agency.



3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
  4. Provide dressed lumber, S4S, unless otherwise indicated.
  5. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal thickness or less, unless otherwise indicated.
- B. **Engineered Wood Products:** Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.
1. **Allowable Design Stresses:** Provide engineered wood products with allowable design stresses, as published by manufacturer, which meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

## 2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. **General:** Where lumber or plywood is indicated as preservative treated or is specified to be treated, comply with applicable requirements of AWPA C2 (lumber) and AWPA C9 (plywood). Mark each treated item with the Quality Mark Requirements of an inspection agency approved by ALSC's Board of Review.
1. Do not use chemicals containing chromium or arsenic.
  2. For exposed items indicated to receive stained finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.
- B. **Pressure treat aboveground items** with waterborne preservatives to a minimum retention of 0.25 lb/cu. ft. After treatment, kiln-dry lumber and plywood to a maximum moisture content of 19 and 15 percent, respectively. Treat indicated items and the following:
1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
  2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
- C. **Pressure treat wood members in contact with ground** or freshwater with waterborne preservatives to a minimum retention of 0.40 lb/cu. ft.

## 2.3 FIRE-RETARDANT TREATMENT BY PRESSURE PROCESS

- A. **General:** Where fire-retardant-treated wood is indicated, pressure impregnate lumber and plywood with fire-retardant chemicals to comply with AWPA C20 and C27, respectively, for treatment type indicated; identify "fire-retardant-treated wood" with appropriate classification marking of Underwriters Laboratories, Inc., U.S. Testing, Timber Products Inspection, Inc. or other testing and inspecting agency acceptable to authorities having jurisdiction.
1. **Current Evaluation/Research Reports:** Provide fire-retardant-treated wood for which a current model code evaluation/research report exists that is acceptable to authorities having jurisdiction and that evidences compliance of fire-retardant-treated wood for application indicated.

- B. **Interior Type A:** For interior locations use fire-retardant chemical formulation that produces treated lumber and plywood with the following properties under conditions present after installation:
  - 1. No reduction takes place in bending strength, stiffness, and fastener holding capacities below values published by manufacturer of chemical formulation that are based on tests by a qualified independent testing laboratory of treated wood products identical to those indicated for this Project under elevated temperature and humidity conditions simulating installed conditions.
  - 2. No other form of degradation occurs due to acid hydrolysis or other causes related to manufacture and treatment.
  - 3. No corrosion of metal fasteners results from their contact with treated wood.
- C. **Exterior Type:** Use for exterior locations and where indicated.
- D. **Inspection:** Inspect each piece of treated lumber or plywood after drying and discard damaged or defective pieces.
- E. **Products:** Subject to compliance with requirements, provide one of the following:
  - 1. Interior Type A Fire-Retardant-Treated Wood:
    - a. "Dricon" Hickson Corporation.
    - b. "Pyro-Guard" Hoover Treated Wood Products.
    - c. "Flameproof LHC-HTT" Osmose Wood Preserving Co, Inc.
  - 2. Exterior Type Fire-Retardant-Treated Wood:
    - a. "Exterior Fire-X" Hoover Treated Wood Products.

## 2.4 DIMENSION LUMBER

- A. **General:** Provide dimension lumber of grades indicated according to the American Lumber Standards Committee National Grading Rule provisions of the grading agency indicated.
- B. **Joists, Rafters, and Other Framing Not Listed Above:** Construction or No. 2 grade and any of the following species:
  - 1. Douglas fir-larch; WCLIB or WWPA.
  - 2. Provide dressed lumber, S4S, unless otherwise indicated.
  - 3. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal thickness or less, unless otherwise indicated.

## 2.5 MISCELLANEOUS LUMBER

- A. **General:** Provide lumber for support or attachment of other construction, including the following:
  - 1. Rooftop equipment bases and support curbs.
  - 2. Blocking.
  - 3. Nailers.
  - 4. Furring.
  - 5. Grounds.

- B. **For items of dimension lumber size**, provide Construction, Stud, or No. 2 grade lumber with 15 percent maximum moisture content and any of the following species:
  - 1. Hem-fir or Hem-fir (north); NLGA, WCLIB, or WWPA.
  - 2. Western woods; WCLIB or WWPA.
- C. **For concealed boards**, provide lumber with **15 percent** maximum moisture content and any of the following species and grades:
  - 1. Hem-fir or Hem-fir (north), Construction or 2 Common grade; NLGA, WCLIB, or WWPA.
  - 2. Western woods, Construction or No. 2 Common grade; WCLIB or WWPA.
- D. **For furring strips** for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

## 2.6 ENGINEERED WOOD PRODUCTS

- A. **Wood I-Joists:** Prefabricated units, I-shaped in cross section, made with solid or structural composite lumber flanges and wood-based structural panel webs, let into and bonded to flanges. Provide units complying with material requirements of and with structural capacities established and monitored according to ASTM D 5055.
  - 1. Web Material: Either oriented strand board or plywood, complying with DOC PS 1 or DOC PS 2, Exposure 1.
  - 2. Structural Properties: Provide units with depths and design values not less than those indicated on the Structural Drawings.

## 2.7 PLYWOOD BACKING PANELS

- A. **Telephone and Electrical Equipment Backing Panels:** DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2 inch thick.

## 2.8 FASTENERS

- A. **General:** Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
- B. **All nails, brad, anchors, bolts and other fasteners** shall be non-ferrous type, of sufficient strength to hold components securely. Verify acceptability of any product with Architect and Owner prior to proceeding with the Work.
  - 1. Verify compatibility of any fastener in contact with treated lumber.

## 2.9 METAL FRAMING ANCHORS

- A. **General:** Provide framing anchors made from metal indicated, of structural capacity, type, and size indicated, and as follows:
  - 1. **Research/Evaluation Reports:** Provide products acceptable to authorities having jurisdiction and for which model code research/evaluation reports exist that show compliance of metal framing anchors, for application indicated, with building code in effect for Project.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. **Set rough carpentry to required levels and lines**, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- B. **Do not use materials with defects** that impair quality of rough carpentry or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- C. **Apply field treatment** complying with **AWPA M4** to cut surfaces of preservative-treated lumber and plywood.
- D. **Securely attach rough carpentry work** to substrate by anchoring and fastening as indicated.

### 3.2 WOOD GROUND, BLOCKING, AND NAILER INSTALLATION

- A. **Install where indicated and where required** for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. **Attach items to substrates to support applied loading**. Recess bolts and nuts flush with surfaces, unless otherwise indicated. Build anchor bolts into masonry during installation of masonry work. Where possible, secure anchor bolts to formwork before concrete placement.
- C. **Provide permanent grounds** of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

### 3.3 WOOD FRAMING INSTALLATION, GENERAL

- A. **Framing Standard:** Comply with AFPA's "Manual for Wood Frame Construction," unless otherwise indicated.
- B. **Framing with Engineered Wood Products:** Install engineered wood products to comply with manufacturer's written instructions.
- C. **Do not splice** structural members between supports.

**END OF SECTION**

## SECTION 06 1643

### GYPSUM SHEATHING

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. This **Section includes** the following:
1. **Glass-mat** gypsum sheathing board.
- B. **Related Sections** include the following:
1. Section 05 4200 "**Cold-Formed Metal Framing**" for steel framing.
  2. Section 07 2713 "**Modified Bituminous Sheet Air and Vapor Barriers**" for barrier system applied to gypsum sheathing.
  3. Section 07 5323 "**Ethylene-Propylene-Diene-Monomer (EPDM) Roofing**" for gypsum substrates installed as part of the warranted roof assembly.
  4. Section 07 9200 "**Joint Sealants**" for sealants applied with gypsum sheathing.
  5. Section 09 2900 "**Gypsum Board**" for interior gypsum panels incorporated into assemblies with gypsum sheathing on the exterior.

##### 1.3 DEFINITIONS

- A. **Gypsum Board Construction Terminology Standard:** Refer to ASTM C 11 for definitions of terms for gypsum sheathing board construction not defined in this Section or in other referenced standards.

##### 1.4 SUBMITTALS

- A. **Product Data:** For each type of product indicated.

##### 1.5 QUALITY ASSURANCE

- A. **Fire-Test-Response Characteristics:** For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory."

##### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. **Store materials** protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, or other causes. Stack sheathing flat on leveled supports off the ground, under cover, and fully protected from weather.

- B. **Cementitious backer units:** Materials shall be delivered in their original unopened packages and stored in an enclosed shelter providing protection from damage and exposure to the elements.
  - 1. **WARNING:** Store all cementitious backer units flat. Panels are heavy and can fall over, causing serious injury or death. Do not move unless authorized.

## 1.7 COORDINATION

- A. **Glass-Mat Gypsum Sheathing Board:**
  - 1. Do not leave exposed to weather for more than 180 days.

## PART 2 - PRODUCTS

### 2.1 GYPSUM SHEATHING

- A. **Glass-Mat Gypsum Sheathing Board:** ASTM C 1177/C 1177M.
  - 1. Available Manufacturers: Subject to compliance with requirements of Contract Documents, manufacturers with products that may be incorporated into the Work include, but are not limited to:
    - a. G-P Gypsum, a Georgia Pacific company: "Dens-Glass Gold".
    - b. CertainTeed Corporation: "GlasRoc".
    - c. USG Corporation: "Securock Glass-Mat Sheathing".
  - 2. Type and Thickness: Type X, 5/8 inch thick.
  - 3. Size: Not less than 48 by 96 inches for vertical installation.

### 2.2 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

- A. **Glass-Mat Gypsum Sheathing Board:**
  - 1. Silicone Emulsion Sealant: ASTM C 834, compatible with sheathing tape and sheathing, recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.
  - 2. Glass-Fiber Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches wide, 10 by 10 or 10 by 20 threads/inch, of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing board and with a history of successful in-service use.

### 2.3 GYPSUM SHEATHING ACCESSORY MATERIALS

- A. **Fasteners:** Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
  - 1. For steel framing less than 0.0329 inch thick, attach sheathing with steel drill screws complying with ASTM C 1002.
  - 2. For steel framing from 0.033 to 0.112 inch thick, attach sheathing with drill screws complying with ASTM C 954.

## PART 3 - EXECUTION

### 3.1 GYPSUM SHEATHING INSTALLATION

- A. **Comply with GA-253** and manufacturer's written instructions.
- B. **Cut boards at penetrations**, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.
  - 1. Install boards with a 3/8-inch setback where non-load-bearing construction abuts structural elements.
  - 2. Install boards with a 1/4-inch setback where they abut masonry or similar materials that might retain moisture, to prevent wicking.
- C. **Coordinate sheathing installation with flashing** and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed exterior wall assembly.
- D. **Apply fasteners** so screw heads bear tightly against face of sheathing boards but do not cut into facing.
- E. **Do not bridge building expansion joints** with sheathing; cut and space edges to match spacing of structural support elements.
- F. **Installation:** Install board with edges centered over flanges of steel studs. Abut ends and edges of each board with those of adjacent boards. Screw-attach boards at perimeter and within field of board to each steel stud.
  - 1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.

### 3.2 SHEATHING JOINT-AND-PENETRATION TREATMENT

- A. **Seal sheathing joints** according to sheathing manufacturer's written recommendations.
  - 1. Apply elastomeric sealant on joints and fasteners and trowel flat. Apply sufficient quantity of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
  - 2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing board joints, and apply and trowel silicone emulsion sealant to embed sealant in entire face of tape. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

**END OF SECTION**

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## SECTION 06 4023

### INTERIOR ARCHITECTURAL WOODWORK

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. This **Section includes** the following but is not limited to the following:
  1. Custom millwork.
  2. Laminate-clad cabinets.
  3. Solid-surface material countertops

##### 1.3 DEFINITIONS

- A. **Interior architectural woodwork includes** wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction prior to woodwork installation.

##### 1.4 SUBMITTALS

- A. **Product Data:** Product data for each type of product and process specified and incorporated into items of architectural woodwork during fabrication, finishing, and installation.
- B. **Shop Drawings:** Provide shop drawings showing location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
  1. Show details full size.
  2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcing specified in other Sections.
- C. **Samples for verification of the following:**
  1. Plastic-laminate-clad panel products, 8 by 10 inches, for each type, color, pattern, and surface finish.
  2. Thermoset decorative-overlay surfaced panel products, 8 by 10 inches, for each type, color, pattern, and surface finish.
  3. Exposed cabinet hardware, one unit for each type and finish.

##### 1.5 QUALITY ASSURANCE

- A. **AWS Quality Standard:** Comply with applicable requirements of Architectural Woodwork Standards (AWS) - 2nd Edition, October 1, 2014, except as otherwise indicated.
- B. **Installer Qualifications:** Arrange for installation of architectural woodwork by a firm which can demonstrate successful experience in installing architectural woodwork items similar in type and quality to those required for this project.

- C. **Measurements:** Before proceeding with fabrication of woodwork required to be fitted to other construction, obtain field measurements and verify dimensions and shop drawing details as required for accurate fit.
- D. **Casework Integrity**
  - 1. All cabinets shall satisfy the AWS Appendix A testing standards: Structural Integrity Test, Concentrated Load Test, Torsion Test, Door Durability Test, Door Impact Test, Door Hinge Test, Drawer Bottom Impact Test, Drawer Support Test, Drawer And Door Pull Test, Drawer Rolling Load Test and Shelf Load Test.
- E. **Testing**
  - 1. Owner reserves the right to take random sampling of casework components to verify that the materials and construction are as specified. In the event that one such sampling proves to be inferior to that which is specified, the entire installation shall become suspect of being inferior. The supplier shall, at his own expense, replace all components deemed of being inferior, or the supplier shall provide the quality of casework to the satisfaction of the Owner.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. **Protect woodwork during transit,** delivery, storage, and handling to prevent damage, soilage, and deterioration.
- B. **Do not deliver woodwork** until painting and similar operations that could damage, soil, or deteriorate woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas whose environmental conditions meet requirements specified in "Project Conditions."

## 1.7 PROJECT CONDITIONS

- A. **Environmental Limitations:** Do not deliver or install woodwork until building is enclosed, wet-work is completed, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. **Field Measurements:** Where woodwork is indicated to be fitted to other construction, check actual dimensions of other construction by accurate field measurements before fabrication, and show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
  - 1. Verify locations of concealed framing, blocking, reinforcements, and furring that support woodwork by accurate field measurements before being enclosed. Record measurements on final shop drawings.
  - 2. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site and coordinate construction to ensure that actual dimensions correspond to guaranteed dimensions.

## 1.8 COORDINATION

- A. **Coordinate sizes and locations of framing,** blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

## PART 2 - PRODUCTS

### 2.1 WOODWORK FABRICATORS

- A. **Fabricators:** Subject to compliance with requirements of Contract Documents, provide interior architectural woodwork by one of the following:
1. Boswell Wasatch Mill
  2. Huetter Mill and Cabinet Company.
  3. Granite Mill and Fixture Company.
  4. Swainston Mill.
  5. Johnson Brothers.
  6. Pacific Cabinets, Inc. of Ferdinand, ID.
  7. Fondell Woodwork.
  8. Artistic Mill
  9. Masterpiece Commercial Millwork
  10. Other mills may submit for approval no later than 10 days before the date for receipt of bids. Mills need not be members of AWI or WI to receive consideration, however, quality shall conform to levels outlined in these specifications.
- B. **Acceptable Laminate Manufacturers:** Subject to compliance with requirements of Contract Documents, provide products listed below. If not listed, submit as a substitution according to Conditions of the Contract and the requirements of Division 1 Sections.
1. Wilsonart
  2. Formica.

### 2.2 MATERIALS

- A. **General:** Provide materials that comply with requirements of the AWI quality standard for each type of woodwork and quality grade indicated and, where the following products are part of interior woodwork, with requirements of the referenced product standards that apply to product characteristics indicated:
1. Hardboard: AHA A135.4.
  2. Particleboard: ANSI A208.1, Grade M-2, made with phenol-formaldehyde resins (no urea formaldehyde).
  3. Softwood Plywood: PS 1.
  4. Hardwood Plywood and Face Veneers: HPVA HP-1.
    - a. Select white maple, plain sliced.
- B. **High-Pressure Decorative Laminate:** NEMA LD 3, grades as indicated, or if not indicated, as required by woodwork quality standard.
- C. **Adhesive for Bonding Plastic Laminate:** Contact cement.
- D. **Thermoset Decorative Overlay:** Decorative surface of thermally fused polyester or melamine-impregnated web, bonded to specified substrate and complying with ALA 1992.
1. Substrate: Medium-density particleboard.

## 2.3 MANUFACTURED UNITS

### A. Cabinets:

1. Quality Standard: Comply with AWS Section 10, Custom grade, flush overlay design and the following:
2. Vertical Surface High Pressure Plastic Laminate:
  - a. High pressure plastic laminate for exterior surfaces shall be NEMA vertical grade 0.028 inch thickness, satin finish. Colors are to be selected from manufacturer's full color selection, including polished mirror types. Cabinet fronts for each individual cabinet shall be one color only.
  - b. Balancing sheet on inside of doors, drawer fronts and finished ends shall be high pressure plastic laminate cabinet liner matching cabinet interior.
3. Horizontal Surface High Pressure Plastic Laminate: High pressure plastic laminate for countertops and other horizontal surfaces shall be post-forming grade 0.039 inch thickness, satin finish. Colors to be selected from manufacturer's full color selection.
4. Thermo-Fused Melamine to Particle Board:
  - a. Melamine thermo-fused to a 45 pound density, or better particle board substrate. Color shall be almond.
  - b. Almond colored melamine shall be standard for all cabinet interiors whether exposed or semi-exposed.
5. Hardboard:
  - a. Hardboard for dividers shall be 1/4 inch tempered hardboard smooth both sides. Color shall be dark brown.
  - b. Hardboard exposed one side for cabinet backs and drawer bottoms shall be 1/4 inch thick and pre-finished one side to match cabinet interiors.
6. Laminate Grade for Exposed Surfaces: Provide laminate cladding complying with the following requirements for type of surface and grade.
  - a. Horizontal Surfaces Other Than Tops: GP-50 (0.050 inch nominal thickness).
  - b. Postformed Surfaces: PF-42 (0.039 inch nominal thickness).
  - c. Colors: As indicated on Finish Schedule, Sheet A501.
7. Edge-banding:
  - a. Edge-banding for cabinet body parts shall be purified 0.020 inch PVC, applied with hot melt glue by automatic edge-banding equipment. Color shall be as selected by Architect from manufacturers full color range.
  - b. Edge-banding for door and drawer fronts shall be purified 3 mm PVC applied with hot melt glue by automatic edge-banding equipment. Edges and corners shall be rounded with a 3mm radius and scraped free from machining or chatter marks. Color shall be as selected by Architect from manufacturers full color range.

## 2.4 MISCELLANEOUS MATERIALS

- A. **Adhesives, General:** Adhesives shall not contain urea formaldehyde.

## 2.5 CABINET HARDWARE AND ACCESSORY MATERIALS

- A. **General:** Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 8 Section "Door Hardware." Hardware shall match existing.
- B. **Finish Hardware:**
1. **Hinges:** Salice, Series 200, 165 degree, self-closing hinges.
    - a. Doors under 48 inches in height: 2 hinges per door.
    - b. Doors over 48 inches in height: 3 hinges per door.
  2. **Drawer Slides:** KV Tru-Trac 100, full extension ball-bearing slides; 100 pound class.
  3. **Pulls:** Sugatsune/Lamp MRB-L, 24 mm D x 21 mm H; satin nickel finish.
  4. **Adjustable Shelf Supports:** KV 255 pilaster standards; KV 256 shelf supports, vertically adjustable in 1/2 inch increments; zinc finish.
  5. **Locks:** CompX National disc tumbler cylinder cam locks; overlay configuration; coordinate keying system with Owner.
  6. **Shelf Standards and Brackets:**
    - a. Standards - KV 87 heavy duty; anochrome finish.
    - b. Brackets - KV 187 heavy duty; anochrome finish.
    - c. Sizes: As shown on Drawings.
  7. **Workstation and Countertop Brackets:** A & M Hardware, sizes as shown on Drawings; finish as selected by Owner.
  8. **Screws:** Reed and Prince square drive screws. Standard wood screws and sheet metal screws are not acceptable.
  9. **Cable Grommets:** American Hardware Supply, Inc., "Round Economy Grommet with Cover; 48 mm bore hole, 15 mm D, 60 mm overall; textured black finish.

## 2.6 INSTALLATION MATERIALS

- A. **Furring, Blocking, Shims, and Hanging Strips:** Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.
- B. **Screws:** Select material, type, size, and finish required for each use. Comply with ASME B18.6.1 for applicable requirements.
  1. For metal framing supports, provide screws as recommended by metal-framing manufacturer.
- B. **Nails:** Select material, type, size, and finish required for each use. Comply with FS FF-N-105 for applicable requirements.
- D. **Anchors:** Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed steel or lead expansion bolt devices for drilled-in-place anchors.

## 2.7 FABRICATION

- A. **General:**
1. **Wood Moisture Content:** Comply with requirements of referenced quality standard for moisture content of lumber at time of fabrication and for relative humidity conditions in the installation areas.
  2. **Dimensions and profiles:** Fabricate woodwork to dimensions, profiles, and details indicated with openings and mortises precut, where possible, to receive hardware and other items and work.
  3. **Edges:** Ease edges to a 1/16 inch radius, for corners of cabinets and edges of solid wood (lumber) members less than 1 inch in nominal thickness, 1/8 inch

- radius for edges of rails and similar members over 1 inch in nominal thickness.
4. Pre-assembly: Complete fabrication, assembly, finishing, hardware application, and other work before shipment to project site to maximum extent possible. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
  5. Pre-Cut Openings: Fabricate architectural woodwork with pre-cut openings, where possible, to receive hardware, appliances, plumbing fixtures, electrical work and similar items. Locate openings accurately and use templates or roughing-in diagrams for proper size and shape. Smooth edges of cutoffs and, where located in countertops and similar exposures seal edges of cutouts with a water-resistant coating.
  6. Door and drawer fronts: Doors, drawer fronts, and false fronts shall be flush overlay. They shall align vertically and horizontally and be on the same plane as one another. Shall be installed free of: warp, twisting, cupping, and/or bowing that cannot be held true; open joints, visible machine marks, cross-sanding, tear-outs, nicks, chips, and/or scratches

## 2.8 COMPONENT CONSTRUCTION

- A. **Toe Kicks:** Fixed cabinet bases shall be constructed of 3/4 inch exterior grade oriented strand board with 2x fir stringers height as shown on the drawings. Bases shall be leveled and anchored to the floor in continuing lengths to ensure straight and true lines of casework. Rubber, vinyl, or other finished base shall be furnished and installed by others.
- B. **Core Material:**
  1. Particleboard: Premium grade board of balanced construction with a density of 45 lbs. per cubic foot and moisture content of 8 percent or less. Face screw holding shall be a minimum of 320 lbs. withdrawal.

C. **Case Body:**

1. **Ends:** Case ends shall be 3/4 inch fused melamine laminated to thermo-fused melamine to core material with phenolic backer on concealed side. Exposed exterior cabinet ends shall be laminated with vertical grade high pressure plastic laminate. Exposed edges shall be edges with 0.020 inch PVC edge-banding. Holes shall be drilled for adjustable shelf supports at 32mm (1 1/4 inch) centers.
2. **Cabinet Top and Bottom:**
  - a. Base and tall cabinet top and bottom shall be 3/4 inch thick with melamine thermo-fused to core material and phenolic backer sheets on concealed sides when semi-exposed. Provide plastic laminate if exposed to view.
  - b. Wall cabinet top and bottom shall be 3/4 inch thick except as noted below. Melamine thermo-fused to core material when semi-exposed. Provide plastic laminate if exposed to view.
    - 1) Provide bottoms of upper cabinets with a 50 lb per sq ft load capacity.
    - 2) Provide with thickness of 1 inch minimum when made with particleboard core and are 42 inch and over in length.
  - c. All exposed edges shall be banded with 0.020 inch PVC edge-banding.
3. **Adjustable Shelves:**
  - a. Load is the total applied weight, uniformly dispersed on an individual shelf, not to exceed 200 lbs on any one shelf. Provide, per the AWS standards, the following load capacities:
    - 1) 50 lbs per sq ft for school, hospital, and library or book shelving.
    - 2) 40 lbs per sq ft for all other shelving
  - b. Deflection is the measured distance from a straight line that a shelf will deflect under load.
    - 1) L/144 (the length of the shelf divided by 144) is the industry standard for the maximum acceptable deflection of a shelf, which permits 1/4 inch deflection in a 36 inch shelf.
  - c. Adjustable shelves shall be 3/4 inch thick with melamine thermo-fused to core material on both sides for shelves up to 30 inch in width, and 1 inch thick for shelves over 30 inch in width.
  - d. Adjustable shelves in exposed or semi-exposed millwork shall be 3/4 inch thick with high pressure plastic laminate on exterior surface on both sides for shelves up to 30 inch in width, and 1 inch thick for shelves over 30 inch in width.
  - e. All exposed edges shall be banded with 0.020 inch thick PVC.
  - f. All shelves to be adjustable on 32mm, 1 1/4 inch centers.
4. **Cabinet Backs:**
  - a. Cabinet backs shall be 1/4 inch thick pre-finished hardboard for use in semi-exposed cabinets. The 1/4 inch is backed up with 4 inch x 3/4 inch hanging cleats on the back side.
  - b. Exposed back shall be 1/2 inch thick with melamine thermo-fused to core material on interior, and high pressure plastic laminate on exterior surface. The 1/2 inch is backed up with 4 inch x 1/2 inch hanging cleats on the back side.
  - c. Cabinet backs shall be dadoed or plowed in into top, bottom and sides, with a minimum shoulder of 3/8 inch, shall be securely nailed or stapled to the case body at a maximum of 4 inch on center.
  - d. Hanging cleats will be mounted on backs for installation purposes, one top and one bottom in wall and base cabinets. Three rails will be used for all tall cabinets.

- D. **Doors and Drawer Fronts:**
1. Plastic Laminate Doors and Drawer Fronts: Plastic laminate doors and drawer fronts shall be 3/4 inch thick for all hinged and sliding doors with vertical grade high pressure plastic laminate exterior face and color cabinet liner on interior face white.
    - a. Core material to be 11/16 inch thick.
- E. **Drawers:**
1. Drawer box sides, backs, and sub-fronts shall be 5/8 inch thick with melamine thermo-fused to 45 lb density particle board. Exposed edges of box shall be banded with 0.020 inch thick PVC.
  2. Drawer bottoms shall be 1/4 inch thick pre-finished hardboard shall be dadoed or plowed in into the sides, back and sub-front.
  3. File and Paper storage drawers shall be fitted with a hood at back for paper retainage, and shall have a 1/2 inch thick reinforced bottom dadoed or plowed in into the sides, back and sub-front.
  4. Drawer fronts shall be mounted with an adjusting mechanism to allow full adjustability and alignment in field.
  5. Vertical and Horizontal Dividers:
    - a. Vertical and horizontal dividers shall be 1/4 inch tempered hardboard smooth both sides or 3/4 inch thermo-fused melamine mounted to 45 lb density particle board as required by cabinet construction requirements
- F. **Joinery:**
1. All parts shall be accurately machined and fit for square and true, within a tolerance not to exceed 1/32 inch difference in measurement at top versus bottom, and 1/16 inch diagonally.
  2. Cabinet components shall be doweled into ends using 10mm hardwood dowels 4 inch on center maximum, securely glued. First dowel to be spaced a maximum of 1-15/16 inch from each edge or end.
  3. Drawer bodies shall be box type construction with detachable drawer fronts. Joints shall be securely fastened with hardwood dowels and glue.

## 2.9 SOLID-SURFACING-MATERIAL COUNTERTOPS

- A. **Quality Standard:** Comply with AWS Section 11 requirements for countertops.
1. Grade: Premium.
- B. **Solid-Surfacing-Material Thickness:** 1/2 inch.
- C. **Colors, Patterns, and Finishes:** Provide materials and products that result in colors of solid-surfacing material complying with the following requirements:
1. As indicated on Legend-Finish Schedule or, if not indicated, as selected by Architect from manufacturer's full range including colors and patterns from all price ranges.
- D. **Fabricate tops in one piece,** unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.
1. Fabricate tops with shop-applied edges of materials and configuration indicated.
  2. Fabricate tops with shop-applied backsplashes.



## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. **Condition** **woodwork** to average prevailing humidity conditions in installation areas before installing.
- B. **Before installing architectural woodwork**, examine shop-fabricated work for completion and complete work as required, including back priming and removal of packing.

### 3.2 INSTALLATION

- A. **Install woodwork plumb**, level, true, and straight with no distortions. Shim as required with concealed shims. Install to a tolerance of 1/8 inch in 96 inches for plumb and level (including tops).
- B. **Scribe and cut woodwork** to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.
- C. **Anchor woodwork to anchors** or blocking built in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork and matching final finish where transparent finish is indicated.
- D. **Cabinets:** Install without distortion so that doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete the installation of hardware and accessory items as indicated.
  - 1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
- E. **Tops:** Anchor securely to base units and other support systems as indicated. Calk space between backsplash and wall with specified sealant.
  - 1. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
  - 2. Secure backsplashes to tops with concealed metal brackets at 16 inches o.c.
- F. **Complete the finishing** work specified in this Section to the extent not completed at shop or before installation of woodwork.

### 3.3 ADJUSTING AND CLEANING

- A. **Repair damaged and defective woodwork** where possible to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. **Clean, lubricate, and adjust** hardware.
- C. **Clean woodwork** on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

### 3.4 PROTECTION

- A. **Provide final protection** and maintain conditions in a manner acceptable to fabricator and Installer that ensures that woodwork is without damage or deterioration at the time of Substantial Completion.

**END OF SECTION**

## **DIVISION 07 - THERMAL AND MOISTURE PROTECTION**

Section 07 2100	Building Insulation
Section 07 2400	Exterior Insulation and Finish System (EIFS)
Section 07 2713	Modified Bituminous Sheet Air & Vapor Barriers
Section 07 4213	Aluminum Composite Material Wall Panels
Section 07 5423	Thermoplastic Polyolefin (TPO) Roofing
Section 07 6200	Sheet Metal Flashing and Trim
Section 07 9200	Joint Sealants

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## SECTION 07 2100

### BUILDING INSULATION

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. **This Section includes** the following:
  - 1. Concealed building insulation.
  - 2. Sound attenuation blankets.

##### 1.3 SUBMITTALS

- A. **Product Data:** Provide product data for each type of insulation product specified.
- B. **Product Test Reports:** Provide product test reports from and based on tests performed by a qualified independent testing agency evidencing compliance of insulation products with specified requirements including those for thermal resistance, fire-test-response characteristics, water-vapor transmission, water absorption, and other properties, based on comprehensive testing of current products.

##### 1.4 QUALITY ASSURANCE

- A. **Single-Source Responsibility for Insulation Products:** Obtain each type of building insulation from a single source with resources to provide products complying with requirements indicated without delaying the Work.
- B. **Fire-Test-Response Characteristics:** Provide insulation and related materials with the fire-test-response characteristics indicated on Drawings or specified elsewhere in this Section as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
  - 1. Surface-Burning Characteristics: ASTM E 84.
  - 2. Fire-Resistance Ratings: ASTM E 119.
  - 3. Combustion Characteristics: ASTM E 136.

##### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. **Protection:** Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. **Available Manufacturers:** Subject to compliance with requirements of Contract Documents, manufacturers offering insulation products that may be incorporated in the Work include, but are not limited to, the following:
1. **Glass-Fiber Insulation:**
    - a. CertainTeed Corporation.
    - b. Knauf Fiber Glass GmbH.
    - c. Owens-Corning Fiberglas Corporation.
    - d. Johns Manville Corporation.

### 2.2 INSULATING MATERIALS

- A. **General:** Provide insulating materials that comply with requirements and with referenced standards.
- B. **Unfaced Mineral-Fiber Blanket Insulation:** (blankets without membrane facing). Thermal insulation combining mineral fibers of type described below with thermosetting resins to comply with ASTM C 665, Type I.
1. Mineral-Fiber Type: Fibers manufactured from glass.
  2. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indices of 25 and 50, respectively.
  3. At 3 5/8 inch steel stud walls provide R-13 blankets, at 6 inch steel stud walls provide R-19 blankets and provide R-38 blankets at soffits, overhangs and roof exterior.
- C. **Sound Attenuation Blankets:**
1. ASTM C 665, Type I; semi rigid mineral fiber blanket without membrane, Class 25 flame spread.
  2. Thickness: Provide a thickness equal to the full thickness of the wall cavity; thickness above ceilings: 6 inches minimum.

### 2.3 AUXILIARY INSULATING MATERIALS

- A. **Adhesive for Bonding Insulation:** Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. **Examine substrates** and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and to determine if other conditions affecting performance of insulation are satisfactory. Do not proceed with installation until unsatisfactory conditions have been corrected. The Architect shall examine the installation of the insulation prior to insulation being covered by other work. If insulation is covered prior to Architects examination, Contractor shall remove other work, at contractor's expense to allow for Architect's examination.

### 3.2 PREPARATION

- A. **Clean substrates** of substances harmful to insulations or vapor retarders, including removing projections capable of puncturing vapor retarders or that interfere with insulation attachment.

### 3.3 INSTALLATION, GENERAL

- A. **Comply with insulation manufacturer's written instructions** applicable to products and application indicated.
- B. **Install insulation** that is undamaged, dry, unsoiled, and has not been exposed at any time to ice and snow.
- C. **Extend insulation** in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. **Apply single layer of insulation** to produce thickness indicated, unless multiple layers are otherwise shown or required to make up total thickness.

### 3.4 INSTALLATION OF GENERAL BUILDING INSULATION (ABOVE GRADE)

- A. **Apply insulation** units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. **Install mineral-fiber blankets** in cavities formed by framing members according to the following requirements:
  - 1. Use blanket widths and lengths that fill cavities formed by framing members. Where more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
  - 2. Place blankets in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
  - 3. Insulation is to extend from floor to deck, typical.
- C. **Stuff glass-fiber loose-fill insulation** into miscellaneous voids and cavity spaces. Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb./cubic foot.

### 3.5 PROTECTION

- A. **General:** Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

**END OF SECTION**

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## SECTION 07 2400

### EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)

#### (WATER DRAINAGE)

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. **Section includes** water-drainage exterior insulation and finish system (EIFS) applied over water-resistive coating over sheathing.
- B. **Related Sections:**
  - 1. Section 06 1643 "**Gypsum Sheathing**" for sheathing.
  - 2. Section 07 2713 "**Modified Bituminous Sheet Air and Vapor Barriers**" for weather-resistant membrane under the insulation.
  - 3. Section 07 9200 "**Joint Sealants**" for sealing joints in EIFS with elastomeric joint sealants.

##### 1.3 SYSTEM DESCRIPTION

- A. **Class PB EIFS:** A non-load-bearing, exterior wall cladding system that consists of an insulation board attached adhesively, mechanically, or both to the substrate; an integrally reinforced base coat; and a textured protective finish coat.
- B. **Water-Drainage EIFS:** EIFS with a means that allows water entering into an EIFS assembly to drain to the exterior.

##### 1.4 PERFORMANCE REQUIREMENTS

- A. **EIFS Performance:** Comply with the following:
  - 1. **Bond Integrity:** Free from bond failure within EIFS components or between system and supporting wall construction, resulting from exposure to fire, wind loads, weather, or other in-service conditions.
  - 2. **Weather-tightness:** Resistant to water penetration from exterior into water-drainage EIFS and assemblies behind it or through them into interior of building that results in deterioration of thermal-insulating effectiveness or other degradation of EIFS and assemblies behind it, including substrates, supporting wall construction, and interior finish, and including a means that allows water entering into an EIFS assembly to drain to the exterior.
- B. **Class PB EIFS:** Provide EIFS having physical properties and structural performance that comply with the following:
  - 1. **Abrasion Resistance:** Sample consisting of 1-inch- thick EIFS mounted on 1/2-inch- thick gypsum board; cured for a minimum of 28 days; and showing no cracking, checking, or loss of film integrity after exposure to 528 quarts of sand when tested per ASTM D 968, Method A.

2. Absorption-Freeze Resistance: No visible deleterious effects and negligible weight loss after 60 cycles per EIMA 101.01.
3. Accelerated Weathering: Five samples per ICC-ES AC235 showing no cracking, checking, crazing, erosion, rusting, blistering, peeling, delamination, or other characteristics that might affect performance as a wall cladding after testing for 2000 hours when viewed under 5 times magnification per ASTM G 153 or ASTM G 155.
4. Freeze-Thaw: No surface changes, cracking, checking, crazing, erosion, rusting, blistering, peeling, or delamination, or indications of delamination between components when viewed under 5 times magnification after 10 cycles per ICC-ES AC235.
5. Mildew Resistance of Finish Coat: Sample applied to 2-by-2-inch (50.8-by-50.8-mm) clean glass substrate, cured for 28 days, and showing no growth when tested per ASTM D 3273 and evaluated according to ASTM D 3274.
6. Salt-Spray Resistance: No deleterious effects when tested according to ICC-ES AC235.
7. Tensile Adhesion: No failure in the EIFS, adhesive, base coat, or finish coat when tested per ICC-ES AC235.
8. Water Penetration: Sample consisting of 1-inch- thick EIFS mounted on 1/2-inch- thick gypsum board, cured for 28 days, and showing no water penetration into the plane of the base coat to expanded polystyrene board interface of the test specimen after 15 minutes at 6.24 lbf/sq. ft. of air pressure difference or 20 percent of positive design wind pressure, whichever is greater, across the specimen during a test period when tested per EIMA 101.02.
9. Water Resistance: Three samples, each consisting of 1-inch- thick EIFS mounted on 1/2-inch- thick gypsum board; cured for 28 days; and showing no cracking, checking, crazing, erosion, rusting, blistering, peeling, or delamination after testing for 14 days per ASTM D 2247.
10. Impact Resistance: Sample consisting of 1-inch- thick EIFS when constructed, conditioned, and tested per EIMA 101.86; and meeting or exceeding the following:
  - a. Standard Impact Resistance: 25 to 49 inch-lb.
  - b. High Impact Resistance: 90 to 150 inch-lb.
11. Drainage: According to ICC-ES AC235.
12. Structural Performance Testing: EIFS assembly and components shall comply with ICC-ES AC235 when tested per ASTM E 330.

## 1.5 SUBMITTALS

- A. **Product Data:** For each type and component of EIFS indicated.
- B. **Shop Drawings:** For EIFS. Include plans, elevations, sections, details of components, details of penetration and termination, flashing details, joint locations and configurations, fastening and anchorage details including mechanical fasteners, and connections and attachments to other work.
- C. **Samples for Selection:** For each type of finish-coat color and texture indicated.
  1. Include similar Samples of joint sealants and exposed accessories involving color selection.
- D. **Qualification Data:** For Installer.

- E. **Manufacturer Certificates:** Signed by manufacturers certifying that EIFS and joint sealants comply with requirements.
- F. **Material or Product Certificates:** For each insulation and joint sealant, from manufacturer.
- G. **Product Test Reports:** Based on evaluation of comprehensive tests performed by a qualified testing agency, for each water-/weather-resistive barrier, insulation, reinforcing mesh, joint sealant, and coating.
- H. **Compatibility and Adhesion Test Reports:** For joint sealants from sealant manufacturer indicating the following:
  1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
  2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- I. **Evaluation Reports:** For exterior-board sheathing, fasteners, adhesive membrane flashing and EIFS (including insulation), from International Building Code.
- J. **Maintenance Data:** For EIFS to include in maintenance manuals.

## 1.6 QUALITY ASSURANCE

- A. **Installer Qualifications:** An installer who is certified in writing by EIFS manufacturer as qualified to install manufacturer's system using trained workers.
- B. **Source Limitations:** Obtain EIFS from single source from single EIFS manufacturer and from sources approved by EIFS manufacturer as compatible with system components.
- C. **Fire-Test-Response Characteristics:** Provide EIFS and system components with the following fire-test-response characteristics as determined by testing identical EIFS and system components per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.
  1. Fire-Resistance Characteristics: Provide materials and construction tested for fire resistance per ASTM E 119.
  2. Radiant Heat Exposure: No ignition of EIFS when tested according to NFPA 268.
  3. Potential Heat: Acceptable level when tested according to NFPA 259.
  4. Surface-Burning Characteristics: Provide insulation board, adhesives, base coats, and finish coats with flame-spread index of 25 or less and smoke-developed index of 450 or less, per ASTM E 84/UBC Standard 8-1.
- D. **Mockups:** Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution and set quality standards for fabrication and installation.
  1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

- E. **Pre-installation Conference:** Conduct conference at Project site to include ALL trades working on the wall and EIFS manufacturer representative to review details, drawings and interfacing.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. **Deliver materials** in original, unopened packages with manufacturers' labels intact and clearly identifying products.
- B. **Store materials** inside and under cover; keep them dry and protected from weather, direct sunlight, surface contamination, aging, corrosion, damaging temperatures, construction traffic, and other causes.
  - 1. Stack insulation board flat and off the ground.
  - 2. Protect plastic insulation against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
  - 3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

## 1.8 PROJECT CONDITIONS

- A. **Weather Limitations:** Maintain ambient temperatures above 40 degrees F for a minimum of 24 hours before, during, and after adhesives or coatings are applied. Do not apply EIFS adhesives or coatings during rainfall. Proceed with installation only when existing and forecasted weather conditions and ambient outdoor air, humidity, and substrate temperatures permit EIFS to be applied, dried, and cured according to manufacturers' written instructions and warranty requirements.

## 1.9 COORDINATION

- A. **Coordinate installation of EIFS with related Work** specified in other Sections to ensure that wall assemblies, including sheathing, weather-resistant sheathing paper, flashing, trim, joint sealants, windows, and doors, are protected against damage from the effects of weather, age, corrosion, moisture, and other causes. Do not allow water to penetrate behind flashing and drainage plane that is behind water-drainage EIFS.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. **Basis of Design:** Contract Documents are based on system specified below to establish a standard of quality. Other manufacturers offering systems with equivalent characteristics may be considered, provided deviations are minor and design concept as expressed in the Contract Documents is not changed, as judged by the Architect.
  - 1. Manufacturer: Dryvit Systems, Inc.
  - 2. System: Outsulation Plus with Reflectit coating.
    - a. Provide manufacturer's 12 Year Single Source Warranty covering the entire wall when installed over ASTM C-1177 sheathing and manufacturer's approved sealant.

- B. **Available Manufacturers:** Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Senergy, BASF Wall Systems, Inc.
  2. Sto Corp.
  4. Parex/Lahabra.

## 2.2 MATERIALS

- A. **Compatibility:** Provide water-resistive coating, adhesive, fasteners, board insulation, reinforcing meshes, base- and finish-coat systems, sealants, and accessories that are compatible with one another and with substrates and approved for use by EIFS manufacturer for Project.
- B. **Water-Resistive Coatings:** EIFS manufacturer's standard formulation and accessories for use as water/weather-resistive barriers, compatible with substrate, and complying with physical and performance criteria of ICC-ES AC212.
1. Sheathing Joint Compound and Tape: Type recommended by EIFS manufacturer for sealing joints between and penetrations through sheathing.
- C. **Primer/Sealer:** EIFS manufacturer's standard substrate conditioner designed to seal substrates from moisture penetration and to improve the bond between substrate of type indicated and adhesive used for application of insulation.
- D. **Flexible-Membrane Flashing:** Cold-applied, fully self-adhering, self-healing, rubberized-asphalt and polyethylene-film composite sheet or tape and primer; EIFS manufacturer's standard or product recommended in writing by EIFS manufacturer.
- E. **Insulation Adhesive:** EIFS manufacturer's standard formulation designed for indicated use, compatible with substrate, and complying with one of the following:
1. Job-mixed formulation of Portland cement complying with ASTM C 150, Type I, and polymer-based adhesive specified for base coat.
  2. Factory-blended dry formulation of Portland cement, dry polymer admixture, and fillers specified for base coat.
  3. Factory-mixed non-cementitious formulation designed for adhesive attachment of insulation to substrates of type indicated, as recommended by EIFS manufacturer.
  4. Adhesive shall be applied in vertical notched trowel configuration.
- F. **Molded, Rigid Cellular Polystyrene Board Insulation:** Comply with ASTM C 578, Type I; EIFS manufacturer's requirements; and EIMA's "EIMA Guideline Specification for Expanded Polystyrene (EPS) Insulation Board" for most stringent requirements for material performance and qualities of insulation, including dimensions and permissible variations, and the following:
1. Aging: Before cutting and shipping, age insulation in block form by air drying for not less than six weeks or by another method approved by EIMA that produces equivalent results.
  2. Flame-Spread and Smoke-Developed Indexes: 25 and 450 or less, respectively, per ASTM E 84.
  3. Dimensions: Provide insulation boards not more than 24 by 48 inches and in thickness indicated but not more than 4 inches thick or less than thickness allowed by ASTM C 1397.
  4. Foam Shapes: Provide with profiles and dimensions indicated on Drawings.

- G. **Reinforcing Mesh:** Balanced, alkali-resistant, open-weave, glass-fiber mesh treated for compatibility with other EIFS materials, made from continuous multi-end strands with retained mesh tensile strength of not less than 120 lbf/in. per ASTM E 2098/EIMA 105.01; complying with ASTM D 578 and the following:
1. Standard-Impact Reinforcing Mesh: Not less than 4.0 oz./sq. yd.
  2. High-Impact Reinforcing Mesh: Not less than 15 oz./sq. yd.
  3. Heavy-Duty Reinforcing Mesh: Not less than 20 oz./sq. yd.
  4. Strip Reinforcing Mesh: Not less than 3.75 oz./sq. yd.
  5. Detail Reinforcing Mesh: Not less than 4.0 oz./sq. yd.
  6. Corner Reinforcing Mesh: Not less than 7.2 oz./sq. yd.
- H. **Base-Coat Materials:** EIFS manufacturer's standard mixture complying with the following requirements:
1. Job-combined formulation of manufacturer's standard polymer-emulsion adhesive and manufacturer's standard dry mix containing Portland cement.
- I. **Finish-Coat Materials:** EIFS manufacturer's acrylic-based coating providing a glossy, pearlescent finish and complying with the following:
1. Factory-mixed formulation of polymer-emulsion binder, colorfast mineral pigments, sound stone particles, and fillers.
  2. Colors: As selected by Architect, Deep Tones.
- J. **Water:** Potable.
- K. **Trim Accessories:** Type as designated or required to suit conditions indicated and to comply with EIFS manufacturer's written instructions; manufactured from UV-stabilized PVC; and complying with ASTM D 1784, manufacturer's standard Cell Class for use intended, and ASTM C 1063.
1. Casing Bead: Prefabricated, one-piece type for attachment behind insulation, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg.
  2. Drip Screed/Track: Prefabricated, one-piece type for attachment behind insulation with face leg extended to form a drip, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg.
  3. Weep Screed/Track: Prefabricated, one-piece type for attachment behind insulation with perforated face leg [extended to form a drip] and weep holes in track bottom, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg; designed to drain incidental moisture that gets into wall construction to the exterior at terminations of EIFS with drainage.
  4. Expansion Joint: Prefabricated, one-piece V profile; designed to relieve stress of movement.
  5. Window Sill Flashing: Prefabricated type for both flashing and sloping sill over framing beneath windows; with end and back dams; designed to direct water to exterior.

## 2.3 ELASTOMERIC SEALANTS

- A. **Elastomeric Sealant Products:** Provide EIFS manufacturer's listed and recommended chemically curing, elastomeric sealant that is compatible with joint fillers, joint substrates, and other related materials, and complies with requirements for products and testing indicated in ASTM C 1481 and with requirements in Division 7 Section "Joint Sealants" for products corresponding to description indicated below:
1. Multicomponent, non-sag urethane sealant.
  2. Tremco Spectrum 3 Low Modulus Sealant (for Single Source Warranty from Dryvit Systems, Inc.).
- B. **Sealant Color:** As selected by Architect from manufacturer's full range.

## 2.4 MIXING

- A. **General:** Comply with EIFS manufacturer's requirements for combining and mixing materials. Do not introduce admixtures, water, or other materials except as recommended by EIFS manufacturer. Mix materials in clean containers. Use materials within time period specified by EIFS manufacturer or discard.

## 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 EIFS.
- B. **Examine roof edges,** wall framing, flashings, openings, substrates, and junctures at other construction for suitable conditions where EIFS will be installed.
- C. **Proceed with installation** only after unsatisfactory conditions have been corrected.
1. Begin coating application only after surfaces are dry.
  2. Application of coating indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. **Protect contiguous work** from moisture deterioration and soiling caused by application of EIFS. Provide temporary covering and other protection needed to prevent spattering of exterior finish coats on other work.
- B. **Protect EIFS,** substrates, and wall construction behind them from inclement weather during installation. Prevent penetration of moisture behind drainage plane of EIFS and deterioration of substrates.
- C. **Prepare and clean substrates** to comply with EIFS manufacturer's written instructions to obtain optimum bond between substrate and adhesive for insulation.

### 3.3 EIFS INSTALLATION, GENERAL

- A. **Comply with EIFS manufacturer's written instructions** for installation of EIFS as applicable to each type of substrate indicated.

### 3.4 SUBSTRATE PROTECTION APPLICATION

- A. **Primer/Sealer:** Apply over gypsum sheathing substrates to protect substrates from degradation and where required by EIFS manufacturer for improving adhesion of insulation to substrate.
- B. **Flexible-Membrane Flashing:** Install over weather-resistive barrier, applied and lapped to shed water; seal at openings, penetrations, terminations, and where indicated by EIFS manufacturer's written instructions to protect wall assembly from degradation. Prime substrates, if required, and install flashing to comply with EIFS manufacturer's written instructions and details.

### 3.5 TRIM INSTALLATION

- A. **Trim:** Apply trim accessories at perimeter of EIFS, at expansion joints, at window sills, and elsewhere as indicated, according to EIFS manufacturer's written instructions. Coordinate with installation of insulation.
  - 1. **Weep Screed/Track:** Use at bottom termination edges, at window and door heads, and at floor line expansion joints of water-drainage EIFS unless otherwise indicated.
  - 2. **Window Sill Flashing:** Use at windows unless otherwise indicated.
  - 3. **Expansion Joint:** Use where indicated on Drawings.
  - 4. **Casing Bead:** Use at other locations.

### 3.6 INSULATION INSTALLATION

- A. **Board Insulation:** Adhesively attach insulation to substrate in compliance with ASTM C 1397, EIFS manufacturer's written instructions, and the following:
  - 1. Apply adhesive to insulation by notched-trowel method in a manner that results in coating the entire surface of sheathing with adhesive once insulation is adhered to sheathing unless EIFS manufacturer's written instructions specify using primer/sealer with ribbon-and-dab method. Apply adhesive to a thickness of not less than 1/4 inch for factory mixed and not less than 3/8 inch for field mixed, measured from surface of insulation before placement.
  - 2. Apply adhesive to ridges on back of insulation by notched-trowel method in a manner that results in full adhesive contact over the entire surface of ridges, leaving channels free of adhesive once insulation is adhered to substrate.
  - 3. Press and slide insulation into place. Apply pressure over the entire surface of insulation to accomplish uniform contact, high initial grab, and overall level surface.



4. Allow adhered insulation to remain undisturbed for period recommended by EIFS manufacturer, but not less than 24 hours, before beginning rasping and sanding insulation, or applying base coat and reinforcing mesh.
5. Begin first course of insulation from screed/track and work upward. Work from perimeter casing beads toward interior of panels if possible.
6. Stagger vertical joints of insulation boards in successive courses to produce running bond pattern. Locate joints so no piece of insulation is less than 12 inches wide or 6 inches high. Offset joints not less than 6 inches from corners of window and door openings and not less than 4 inches from aesthetic reveals.
  - a. Adhesive Attachment: Offset joints of insulation not less than 6 inches from horizontal and 4 inches from vertical joints in sheathing.
7. Place insulation with adhesive strips and channels, slots, or waves aligned in the vertical position for drainage. Align drainage channels, slots, or waves with channels, slots, or waves in insulation boards above and below.
8. Interlock ends at internal and external corners.
9. Abut insulation tightly at joints within and between each course to produce flush, continuously even surfaces without gaps or raised edges between boards. If gaps greater than 1/16 inch occur, fill with insulation cut to fit gaps exactly; insert insulation without using adhesive or other material.
10. Cut insulation to fit openings, corners, and projections precisely and to produce edges and shapes complying with details indicated.
11. Rasp or sand flush entire surface of insulation to remove irregularities projecting more than 1/32 inch from surface of insulation and to remove yellowed areas due to sun exposure; do not create depressions deeper than 1/16 inch.
12. Cut aesthetic reveals in outside face of insulation with high-speed router and bit configured to produce grooves, rabbets, and other features that comply with profiles and locations indicated. Do not reduce insulation thickness at aesthetic reveals to less than 3/4 inch.
13. Install foam shapes and attach to sheathing.
14. Interrupt insulation for expansion joints where indicated.
15. Install insulation closure blocks using ribbon-and-dab method to create air zones where indicated.
16. Form joints for sealant application with back-to-back casing beads for joints within EIFS and with perimeter casing beads at dissimilar adjoining surfaces. Make gaps between casing beads and between perimeter casing beads and adjoining surfaces of width indicated.
17. After installing insulation and before applying field-applied reinforcing mesh, fully wrap board edges. Cover edges of board and extend encapsulating mesh not less than 2-1/2 inches over front and back face unless otherwise indicated on Drawings.
18. Treat exposed edges of insulation as follows:
  - a. Except for edges forming substrates of sealant joints, encapsulate with base coat, reinforcing mesh, and finish coat.
  - b. Encapsulate edges forming substrates of sealant joints within EIFS or between EIFS and other work with base coat and reinforcing mesh.
  - c. At edges trimmed by accessories, extend base coat, reinforcing mesh, and finish coat over face leg of accessories.
19. Coordinate installation of flashing and insulation to produce wall assembly that does not allow water to penetrate behind flashing and water-/weather-resistive barrier.

- B. **Expansion Joints:** Install at locations indicated, where required by EIFS manufacturer, and as follows:
1. At expansion joints in substrates behind EIFS.
  2. Where EIFS adjoin dissimilar substrates, materials, and construction, including other EIFS.
  3. At floor lines in multilevel wood-framed construction.
  4. Where wall height or building shape changes.
  5. Where EIFS manufacturer requires joints in long continuous elevations.

### 3.7 BASE-COAT INSTALLATION

- A. **Base Coat:** Apply to exposed surfaces of insulation and foam shapes in minimum thickness recommended in writing by EIFS manufacturer, but not less than 1/16-inch dry-coat thickness.
- B. **Reinforcing Mesh:** Embed type indicated below in wet base coat to produce wrinkle-free installation with mesh continuous at corners and overlapped not less than 2-1/2 inches or otherwise treated at joints to comply with ASTM C 1397 and EIFS manufacturer's written instructions. Do not lap reinforcing mesh within 8 inches of corners. Completely embed mesh, applying additional base-coat material if necessary, so reinforcing-mesh color and pattern are not visible.
1. Standard-impact reinforcing mesh above ten (10) feet above grade.
  2. High-impact reinforcing mesh below ten (10) feet above grade and elsewhere as indicated.
  3. Heavy-duty reinforcing mesh where indicated.
- C. **Double-Layer Reinforcing Mesh Application:** Where indicated, apply second base coat and second layer of standard-impact reinforcing mesh, overlapped not less than 2-1/2 inches or otherwise treated at joints to comply with ASTM C 1397 and EIFS manufacturer's written instructions in same manner as first application. Do not apply until first base coat has cured.
- D. **Additional Reinforcing Mesh:** Apply strip reinforcing mesh around openings extending 4 inches beyond perimeter. Apply additional 9-by-12-inch strip reinforcing mesh diagonally at corners of openings (re-entrant corners). Apply 8-inch- wide strip reinforcing mesh at both inside and outside corners unless base layer of mesh is lapped not less than 4 inches on each side of corners.
1. At aesthetic reveals, apply strip reinforcing mesh not less than 8 inches wide.
  2. Embed strip reinforcing mesh in base coat before applying first layer of reinforcing mesh.
- E. **Foam Shapes:** Fully embed reinforcing mesh in base coat.
- F. **Double Base-Coat Application:** Where indicated, apply second base coat in same manner and thickness as first application except without reinforcing mesh. Do not apply until first base coat has cured.

### 3.8 FINISH-COAT INSTALLATION

- A. **Primer:** Apply over dry base coat according to EIFS manufacturer's written instructions.
- B. **Finish Coat:** Apply over dry primed base coat, maintaining a wet edge at all times for uniform appearance, in thickness required by EIFS manufacturer to produce a uniform finish of color and texture matching approved sample and free of cold joints, shadow lines, and texture variations.
  - 1. **Color/Texture:** As selected by Architect from manufacturer's full range or paint manufacturers fan deck.
  - 2. Provide control sample of color/texture required for Project Manual prior to bid.

### 3.9 INSTALLATION OF JOINT SEALANTS

- A. **Prepare joints and apply sealants**, of type and at locations indicated, to comply with applicable requirements in Division 7 Section "Joint Sealants" and in ASTM C 1481.
  - 1. Apply joint sealants after base coat has cured but before applying finish coat.
  - 2. Clean surfaces to receive sealants to comply with indicated requirements and EIFS manufacturer's written instructions.
  - 3. Apply primer recommended in writing by sealant manufacturer for surfaces to be sealed.
  - 4. Install sealant backing to control depth and configuration of sealant joint and to prevent sealant from adhering to back of joint.
  - 5. Apply masking tape to protect areas adjacent to sealant joints. Remove tape immediately after tooling joints, without disturbing joint seal.
  - 6. Recess sealant sufficiently from surface of EIFS so an additional sealant application, including cylindrical sealant backing, can be installed without protruding beyond EIFS surface.

### 3.10 FIELD QUALITY CONTROL

- A. **Special Inspections:** Owner will engage a qualified special inspector to perform the following special inspections:
  - 1. According to ICC-ES AC235.
- B. **Remove and replace** EIFS where test results indicate that EIFS do not comply with specified requirements.
- C. **Prepare test** and inspection reports.

### 3.11 CLEANING AND PROTECTION

- A. **Remove temporary covering** and protection of other work. Promptly remove coating materials from window and door frames and other surfaces outside areas indicated to receive EIFS coatings.

**END OF SECTION**

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## SECTION 07 2713

### MODIFIED BITUMINOUS SHEET AIR AND VAPOR BARRIERS

#### 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** self-adhering, vapor-barrier, modified bituminous sheet air and water barrier membrane assembly within exterior wall assemblies as indicated on Drawings. System is to stop passage of air through exterior walls, joints between exterior walls and roof, and joints around frames of openings in exterior walls.
- B. **Related Requirements:**
  - 1. Section 06 1643 "**Gypsum Sheathing**" for wood wall sheathings and wall sheathing joint-and-penetration treatments.
  - 2. Section 07 9200 "**Joint Sealants**" for sealant materials and installation techniques.

##### 1.3 DEFINITIONS

- A. **Air and Vapor Barrier Material:** A primary element that provides a continuous barrier to the movement of air and water vapor.
- B. **Air and Vapor Barrier Accessory:** A transitional component of the air and vapor barrier that provides continuity.
- C. **Air and Vapor Barrier Assembly:** The collection of air and vapor barrier materials and accessory materials applied to an opaque wall, including joints and junctions to abutting construction, to control air and water vapor movement through the wall.
- D. **Vapor Barrier:** Air-tight barrier made of material that is air and water vapor impermeable, both to the degree specified, with sealed seams and with sealed joints to adjacent surfaces

##### 1.4 PREINSTALLATION MEETINGS

- A. **Preinstallation Conference:** Conduct conference at Project site.
  - 1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.

##### 1.5 ACTION SUBMITTALS

- A. **Product Data:** For each type of product.
  - 1. Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of products.

- B. **Shop Drawings:** For air-barrier assemblies.
  - 1. Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
  - 2. Include details of interfaces with other materials that form part of air barrier.

## 1.6 INFORMATIONAL SUBMITTALS

- A. **Submittals prior to contract award:**
  - 1. Letter from the primary roofing manufacturer stating that the proposed application will comply with the Manufacturer's requirements in order to qualify the project for the specified guarantee.
  - 2. Certification that air barrier systems are compatible with curtainwall and storefront systems and do not void or otherwise impact curtainwall and storefront warranties.
  - 3. Certification that air barrier systems are compatible with curtainwall and storefront sealant systems.
- B. **Qualification Data:** For Installer. Include list of ABAA-certified installers and supervisors employed by the Installer, who work on Project. Provide evidence of licensing and certification under the ABAA Quality Assurance Program.
- C. **Product Certificates:** From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with air barrier. Application of barrier shall not impact warranty of curtainwall or storefront systems.
- D. **Product Test Reports:** For each air-barrier assembly, for tests performed by a qualified testing agency.

## 1.7 QUALITY ASSURANCE

- A. **Installer Qualifications:** An entity that employs installers and supervisors who are trained and approved by manufacturer.
  - 1. Installer shall be licensed by ABAA according to ABAA's Quality Assurance Program and shall employ ABAA-certified installers and supervisors on Project.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. **Remove and replace liquid materials** that cannot be applied within their stated shelf life.
- B. **Protect stored materials** from direct sunlight.

## 1.9 FIELD CONDITIONS

- A. **Environmental Limitations:** Apply air barrier within the range of ambient and substrate temperatures recommended by air-barrier manufacturer.
  - 1. Protect substrates from environmental conditions that affect air and vapor barrier performance.
  - 2. Do not apply air and vapor barrier to a damp or wet substrate or during snow, rain, fog, or mist.

## PART 2 - PRODUCTS

### 2.1 MATERIALS, GENERAL

- A. **Source Limitations:** Obtain primary air and vapor barrier materials and air and vapor barrier accessories from single source from single manufacturer.
- B. **VOC Content:** 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and complying with VOC content limits of authorities having jurisdiction.

### 2.2 PERFORMANCE REQUIREMENTS

- A. **General:** Air and vapor barrier shall be capable of performing as a continuous vapor-barrier and air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
- B. **Air and Vapor Barrier Assembly Air Leakage:** Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., when tested according to ASTM E 283 or ASTM E 783.

### 2.3 SELF-ADHERING SHEET AIR AND VAPOR BARRIER

- A. **Modified Bituminous Sheet:** 40-mil- thick, self-adhering sheet consisting of 36 mils (0.9 mm) of rubberized asphalt laminated to a 4-mil- (0.1-mm-) thick, cross-laminated polyethylene film with release liner on adhesive side and formulated for application with primer that complies with VOC limits of authorities having jurisdiction.
  - 1. **Basis of Design:** Contract Documents are based on products specified below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept as expressed in the Contract Documents is not changed, as judged by the Architect.
    - a. **Manufacturer:** Carlisle Coatings and Waterproofing Inc.
    - b. **Product:** CCW-705
  - 2. **Acceptable Manufacturers:** Subject to compliance with requirements of Contract Documents, provide one of the following. If not listed, submit as a substitution according to the Conditions of the Contract and provisions of Division 1 sections.
    - a. Carlisle Coatings & Waterproofing Inc.; CCW-705.
    - b. GCP Applied Technologies.; Perm-A-Barrier Wall Membrane.
    - c. Henry Company; Blueskin SA or Blueskin SA LT.
    - d. W.R. Meadows, Inc.; SealTight Air-Shield.
    - e. Tremco Incorporated, an RPM company; ExoAir 110/110LT.
  - 3. **Physical and Performance Properties:**
    - a. **Air Permeance:** Maximum 0.000 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
    - b. **Tensile Strength:** Minimum 500 psi ASTM D 412, Die C.
    - c. **Ultimate Elongation:** Minimum 300 percent; ASTM D 412, Die C.
    - d. **Puncture Resistance:** Minimum 50 lbf; ASTM E 154.
    - e. **Water Absorption:** Maximum 0.12 percent weight gain after 48-hour immersion at 70 degrees F ASTM D 570.
    - f. **Vapor Permeance:** Maximum 0.05 perm; ASTM E 96/E 96M, Water Method.

## 2.4 ACCESSORY MATERIALS

- A. **General:** Accessory materials recommended by air-barrier manufacturer to produce a complete air-barrier assembly and compatible with primary air-barrier membrane.
- B. **Primer:** Liquid waterborne primer recommended for substrate by air-barrier material manufacturer.
- C. **Counterflashing Strip:** Modified bituminous 40-mil- thick, self-adhering sheet consisting of 32 mils of rubberized asphalt laminated to an 8-mil- thick, cross-laminated polyethylene film with release liner backing.
- D. **Butyl Strip:** Vapor retarding, 30 to 40 mils thick, self-adhering; polyethylene-film-reinforced top surface laminated to layer of butyl adhesive, with release liner backing.
- E. **Modified Bituminous Strip:** Vapor retarding, 40 mils thick, smooth surfaced, self-adhering; consisting of 36 mils of rubberized asphalt laminated to a 4-mil- thick, cross-laminated polyethylene film with release liner backing.
- F. **Termination Mastic:** Air and vapor barrier manufacturer's standard cold fluid-applied elastomeric liquid; trowel grade.
- G. **Substrate-Patching Membrane:** Manufacturer's standard trowel-grade substrate filler.
- H. **Adhesive and Tape:** Air and vapor barrier manufacturer's standard adhesive and pressure-sensitive adhesive tape.
- I. **Stainless-Steel Sheet:** ASTM A 240, Type 304, 0.0250 inch thick, and Series 300 stainless-steel fasteners.
- J. **Sprayed Polyurethane Foam Sealant:** One- or two-component, foamed-in-place, polyurethane foam sealant, 1.5- to 2.0-lb/cu. ft. density; flame-spread index of 25 or less according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.
- K. **Modified Bituminous Transition Strip:** Vapor retarding, 40 mils thick, smooth surfaced, self-adhering; consisting of 36 mils of rubberized asphalt laminated to a 4-mil-thick polyethylene film with release liner backing.
- L. **Joint Sealant:** ASTM C 920, single-component, neutral-curing silicone; Class 100/50 (low modulus), Grade NS, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O. Comply with Section 07 9200 "Joint Sealants."



## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. **Examine substrates, areas, and conditions**, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
  - 1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
- B. **Proceed with installation only after** unsatisfactory conditions have been corrected.

### 3.2 SURFACE PREPARATION

- A. **Clean, prepare, and treat substrate** according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air and vapor barrier application.
- B. **Mask off adjoining surfaces** not covered by air and vapor barrier to prevent spillage and overspray affecting other construction.
- C. **Remove** grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. **Remove fins, ridges, mortar, and other projections** and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.
- E. **Remove excess mortar** from masonry ties, shelf angles, and other obstructions.
- F. **Prepare, fill, prime, and treat joints and cracks** in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.
  - 1. Install modified bituminous strips and center over treated construction and contraction joints and cracks exceeding a width of 1/16 inch.
- G. **Bridge and cover isolation joints**, expansion joints and discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with overlapping modified bituminous strips.
- H. At changes in substrate plane, **apply sealant or termination mastic beads** at sharp corners and edges to form a smooth transition from one plane to another.
- I. **Cover gaps in substrate plane** and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

### 3.3 INSTALLATION

- A. **General:** Install modified bituminous sheets and accessory materials according to air and vapor barrier manufacturer's written instructions and according to recommendations in ASTM D 6135.
  - 1. When ambient and substrate temperatures range between 25 and 40 degrees F, install self-adhering, modified bituminous air-barrier sheet produced for low-temperature application. Do not install low-temperature sheet if ambient or substrate temperature is higher than 60 degrees F.

- B. **Corners:** Prepare, prime, and treat inside and outside corners according to ASTM D 6135.
1. Install modified bituminous strips centered over vertical inside corners. Install 3/4-inch fillets of termination mastic on horizontal inside corners.
- C. **Prepare, treat, and seal** vertical and horizontal surfaces at terminations and penetrations with termination mastic and according to ASTM D 6135.
- D. **Apply primer** to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier sheet on same day. Reprime areas exposed for more than 24 hours.
1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.
- E. **Apply and firmly adhere** modified bituminous sheets horizontally over area to receive air barrier. Accurately align sheets and maintain uniform 2-1/2-inch- minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure airtight installation.
1. Apply sheets in a shingled manner to shed water without interception by any exposed sheet edges.
  2. Roll sheets firmly to enhance adhesion to substrate.
- F. **Apply continuous modified bituminous sheets** over modified bituminous strips bridging substrate cracks, construction, and contraction joints.
- G. **Seal top of through-wall flashings to air-barrier sheet** with an additional 6-inch- wide, modified bituminous or counterflashing strip.
- H. **Seal exposed edges of sheet** at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
- I. **Install air-barrier sheet and accessory materials** to form a seal with adjacent construction and to maintain a continuous air barrier.
1. Coordinate air-barrier installation with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
  2. Install butyl or modified bituminous strip (as approved by roofing manufacturer) on roofing membrane or base flashing so that a minimum of 3 inches (75 mm) of coverage is achieved over each substrate.
- J. **Connect and seal exterior wall air-barrier membrane** continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
- K. **Wall Openings:** Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply modified bituminous transition strip so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames with not less than 1 inch of full contact.
1. Modified Bituminous Transition Strip: Roll firmly to enhance adhesion.
- L. **Fill gaps in perimeter frame surfaces** of windows, curtain walls, storefronts, doors, and miscellaneous penetrations of air-barrier membrane with foam sealant.

- M. At end of each working day, **seal top edge of air-barrier material to substrate** with termination mastic.
- N. **Apply joint sealants** forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- O. **Repair punctures**, voids, and deficient lapped seams in air barrier. Slit and flatten fishmouths and blisters. Patch with air-barrier sheet extending 6 inches (150 mm) beyond repaired areas in all directions.
- P. **Do not cover air barrier** until it has been tested and inspected by Owner's testing agency.
- Q. **Correct deficiencies** in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

### 3.4 FIELD QUALITY CONTROL

- A. **Testing Agency:** Owner will engage a qualified testing agency to perform tests and inspections.
- B. **Inspections:** Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:
  - 1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
  - 2. Continuous structural support of air-barrier system has been provided.
  - 3. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
  - 4. Site conditions for application temperature and dryness of substrates have been maintained.
  - 5. Maximum exposure time of materials to UV deterioration has not been exceeded.
  - 6. Surfaces have been primed.
  - 7. Laps in sheet materials have complied with the minimum requirements and have been shingled in the correct direction (or mastic applied on exposed edges), with no fishmouths.
  - 8. Termination mastic has been applied on cut edges.
  - 9. Air barrier has been firmly adhered to substrate.
  - 10. Compatible materials have been used.
  - 11. Transitions at changes in direction and structural support at gaps have been provided.
  - 12. Connections between assemblies (membrane and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
  - 13. All penetrations have been sealed.

- C. **Tests:** As determined by Owner's testing agency from among the following tests:
1. Qualitative Air-Leakage Testing: Air-barrier assemblies will be tested for evidence of air leakage according to ASTM E 1186, smoke pencil with pressurization or depressurization or ASTM E 1186, chamber pressurization or depressurization with smoke tracers.
  2. Quantitative Air-Leakage Testing: Air-barrier assemblies will be tested for air leakage according to ASTM E 783.
  3. Adhesion Testing: Air-barrier assemblies will be tested for minimum air-barrier adhesion of 16 lbf/sq. in. according to ASTM D 4541 for each 600 sq. ft. of installed air barrier or part thereof.
- D. **Air barriers will be considered defective if** they do not pass tests and inspections.
1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
  2. Remove and replace deficient air-barrier components for retesting as specified above.
- E. **Repair damage** to air barriers caused by testing; follow manufacturer's written instructions.

### 3.5 CLEANING AND PROTECTION

- A. **Protect air-barrier system** from damage during application and remainder of construction period, according to manufacturer's written instructions.
1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. If exposed to these conditions for more than 30 days, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed membrane according to air-barrier manufacturer's written instructions.
  2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.
- B. **Clean spills, stains, and soiling** from construction that would be exposed in the completed Work, using cleaning agents and procedures recommended by manufacturer of affected construction.

**END OF SECTION**

## SECTION 07 42 13

### ALUMINUM COMPOSITE MATERIAL WALL PANELS

#### 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. Pre-finished, aluminum-faced composite exterior wall panel system.
- B. **Related Sections:**
  - 1. Section 05 4100 "**Structural Metal Stud Framing**" for cold-formed metal framing supporting metal wall panel assemblies.
  - 2. Section 07 6200 "**Sheet Metal Flashing and Trim**", for field-formed flashings and other sheet metal work not part of metal wall panel assemblies.

##### 1.3 DEFINITION

- A. **Aluminum Composite Metal Wall Panel Assembly:** Aluminum-faced composite wall panels, attachment system components, miscellaneous metal subframing framing system, and accessories necessary for a complete weathertight wall system.

##### 1.4 COORDINATION

- A. **Coordinate metal wall panel assemblies** with rain drainage work, flashing, trim, and construction of studs, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

##### 1.5 PREINSTALLATION MEETINGS

- A. **Preinstallation Conference:** Conduct conference at Project site.
  - 1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, metal wall panel Installer, metal wall panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects panels including installers of doors, windows, and louvers.
  - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  - 3. Review methods and procedures related to metal wall panel installation, including manufacturer's written instructions.

4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.
6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
7. Review temporary protection requirements for metal wall panel assembly during and after installation.
8. Review metal wall panel observation and repair procedures after installation.

## 1.6 ACTION SUBMITTALS

- A. **Product Data:** For each type of product indicated. Include construction details, material descriptions, installation instructions, dimensions of individual components and profiles, and finishes for each type of metal wall panel and accessory.
- B. **Shop Drawings:**
1. Submit large scale, dimensioned drawings showing materials, profiles, joints, finishes, and anchorage details.
  2. Provide elevation drawings of each plane showing panel layouts, fastener spacing, details of edge conditions, joints, corners, supports, anchorages, trim, flashings, closures and other pertinent data.
  3. Label individual components and indicate material gages, weights, design loads, required clearances, and method of field installation.
  4. Identify sealants by product name.
  5. Detail interface with adjacent materials. For interface between components with different profiles, and conditions difficult to illustrate in 2 dimensions, furnish isometric drawings.
- C. **Samples:**
1. Submit minimum 12-inch by actual panel width samples, showing panel color, finish texture and variations to be expected in the work.
  2. Submit minimum 24-inch square panel assemblies, complete and with corner condition, mounted on plywood and including all components to be installed under this Section for each assembly sample.
  3. Provide samples of fasteners.
- D. **Delegated-Design Submittal:** For metal wall panel assemblies indicated, to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

## 1.7 INFORMATIONAL SUBMITTALS

- A. **Coordination Drawings:** Exterior elevations, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Metal wall panels and attachments.
  2. Girts and stud framing.
  3. Wall-mounted items including doors, windows, louvers, and lighting fixtures.
  4. Penetrations of wall by pipes and utilities.
- B. **Qualification Data:** For Installer, professional engineer, and testing agency.

- C. **Test Reports:**
  - 1. Product Test Reports: Submit reports from a qualified testing agency indicating panels comply with specified requirements based on comprehensive testing of current products.
  - 2. Sealant Compatibility and Adhesion Test Reports:
    - a. Submit reports from the sealant manufacturer indicating that materials forming joint substrates and joint sealant backings have been tested for compatibility and adhesion with sealants.
    - b. Include sealant manufacturer's interpretation of test results for sealant performance and recommendations for primers and substrate preparation needed for adhesion.
- D. **Field quality-control reports.**
- E. **Warranties:** Sample of special warranties.

## 1.8 CLOSEOUT SUBMITTALS

- A. **Maintenance Data:** For metal wall panels to include in maintenance manuals.

## 1.9 QUALITY ASSURANCE

- A. **Flashing and Trim Installation Standard:** Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual."
- B. **Fabricator/Installer's Qualifications:**
  - 1. Firm and individuals with a minimum of 5 consecutive years' experience in the fabrication and installation of specified products on projects similar in material, design, complexity and extent to this Project, and whose work has resulted in applications with a record of successful in-service performance.
  - 2. Only a firm authorized, certified, licensed, or otherwise qualified by the panel manufacturer as having the necessary experience, staff, and training to fabricate and install panels from manufacturer's products shall install composite metal panel materials.
- C. **Professional Engineer Qualifications:**
  - 1. Professional engineer legally qualified to practice in the State where the Project is located, and experienced in providing engineering services of the kind indicated.
  - 2. Engineering services are defined as those performed for installations of wall systems that are similar to those indicated for the Project in material, design, and extent.
- D. **Preconstruction Compatibility and Adhesion Testing:** Submit samples of materials that will contact joint sealants to joint-sealant manufacturers for testing indicated below:
  - 1. Use manufacturer's standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
  - 2. Submit no fewer than nine pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.

3. Schedule enough time for testing and analyzing results to prevent delaying the Work.
  4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including use of specially formulated primers.
- E. **Mockup:** Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
1. Mockup size shall be 3 panels wide minimum by full height of wall, including corner, transition details at adjoining glazed framing, supports, attachments, and accessories, and typical conditions to be found in the finished work.
  2. Indicate joint sizes, sealant application, fastener locations and spacing, color and texture variation.
  3. Build mockups in presence of metal wall panel manufacturer's factory authorized representative.
  4. Testing of Metal Wall Panel Assembly: As specified in Division 01 Section Mockup Requirements.

#### 1.10 DELIVERY, STORAGE, AND HANDLING

- A. **Deliver components**, metal wall panels, and other manufactured items so as not to be damaged or deformed. Package panels for protection during transportation and handling.
- B. **Unload, store, and erect** metal wall panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. **Stack metal wall panels horizontally** on platforms or pallets, covered with suitable weathertight and ventilated covering. Store panels to ensure dryness, with positive slope for drainage of water. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. **Retain strippable protective covering** on metal wall panel for period of installation.

#### 1.11 FIELD CONDITIONS

- A. **Weather Limitations:** Proceed with installation only when existing and forecasted weather conditions permit assembly of metal wall panels to be performed according to manufacturer's written instructions and warranty requirements.
- B. **Field Measurements:** Verify locations of structural members and wall opening dimensions by field measurements before metal wall panel fabrication and indicate measurements on Shop Drawings.

#### 1.12 WARRANTIES

- A. **Special Fabricator's Warranty:** Fabricator agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
  1. Failures include, but are not limited to, the following:
    - a. Structural failures including rupturing, cracking, or puncturing.
    - b. Deterioration of metals and other materials beyond normal weathering.
  2. Warranty Period: Five years from date of Substantial Completion.



- B. **Special Materials Manufacturers' Warranty:** Repair or replace defective materials that fail in materials or workmanship within warranty period.
  - 1. Warranty Period: Two years from date of Substantial Completion.
- C. **Special Materials Installer's Warranty:** Repair or replace defective materials that fail in materials or workmanship within warranty period.
  - 1. Warranty Period: Two years from date of Substantial Completion.
- D. **Special Warranty on Panel Finishes:** Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
  - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
    - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
    - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
    - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
  - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCEREQUIREMENTS

- A. **General Performance:** Comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. **Delegated Design:** Design metal wall panel assembly, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- C. **Wall Design:** Pressure-equalized rain screen, pressure equalized air space behind panel, self-draining assembly with reveal joints; moisture barrier and sheathing behind, as specified in other Division 7 Sections.
  - 1. Design system so panels can be removed without removing or disrupting adjacent panels or materials.
  - 2. Not Permitted: Noise or vibration created by thermal and structural movement and wind; loosening or weakening of fasteners, attachments, and other components; sealant failure.
- D. **Structural Performance:**
  - 1. Provide metal wall panel assemblies capable of withstanding the effects of loads and stresses as prescribed by applicable code, within limits and under conditions indicated, based on testing according to ASTM E 330, and as follows:
    - a. Wind Loads: Uniform pressure of not less than 20 lbf/sq. ft, acting inward or outward, and not less than 30 lbf/sq. ft on parapet and corner panels.
    - b. Deflection Limits: For wind loads, no greater than 1/240 of the span.
  - 2. Connections to structural frame shall not impose eccentric loading, or induce twisting or warping.
  - 3. Design clips, fasteners, and clip spacing capable of withstanding a load equal to 300 percent of the design negative uplift pressure, without failure.

- E. **Air Infiltration:** Provide panels with permanent resistance to air leakage of not more than 0.06 cfm/square foot of fixed wall area when tested according to ASTM E 283 at a static air pressure difference of 1.57 psf.
- F. **Water Penetration under Static Pressure:** No water penetration after 15 minutes of exposure when tested according to ASTM E 331 at minimum inward static differential pressure of 6.24 lbf/sq. ft and not more than 6.24 lbf/sq. ft.
- G. **Pressure Equalized Rain Screen Performance:** Provide panel system designed to have no streaming water or droplets/mist on more than 5 percent of the cavity moisture barrier, when tested to AAMA 508-07 which includes static and dynamic testing with imperfect air barriers.
- H. **Seismic Performance:** Metal wall panel assemblies, including anchorage, shall withstand the effects of earthquake motions determined according to applicable code.
- I. **Interstory Drift:** Accommodate design displacement of adjacent stories indicated.
- J. **Thermal Movements:** Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change (Range): 120 degrees F, ambient; 180 degrees F material surfaces.
  - 2. Fasteners: Provide fasteners that resist rotation and avoid shear stress as a result of thermal movements.

## 2.2 MATERIALS – GENERAL

- A. **Source Limitations:** Obtain each type of metal wall panel from single source from single manufacturer.

## 2.3 PANEL MANUFACTURERS

- A. **Basis of Design - Panel Products:** Contract Documents are based on products specified below to establish a standard of quality. Other manufacturers offering products with equivalent characteristics may be considered, provided deviations are minor and design concept as expressed in the Contract Documents is not changed, as judged by the Architect.
  - 1. Manufacturer: 3A Composites USA.
  - 2. Product: Alucobond panels.
- B. **Acceptable Manufacturers:** Subject to compliance with requirements of Contract Documents, provide products from one of the following:
  - 1. 3A Composites USA; Alucobond ACM panels.
  - 2. Mitsubishi Chemical Composites America, Inc.; Alpolic ACM panels.
  - 3. Arconic Architectural Products LLC; Reynobond PE Aluminum Composite Material panels.

## 2.4 FABRICATORS

- A. **Aluminum Composite Material Panel System:** Subject to conformance with requirements provide aluminum composite material wall panel system by one of the following:
1. Custom Metal Contracting Ltd.
  2. Elward Systems.
  3. LCG Facades.
  4. North Clad Rainscreen Solutions.
  5. ProCLAD Inc.

## 2.5 ALUMINUM-FACED COMPOSITE WALL PANEL SYSTEMS

- A. **Wall Panels:** Provide factory-formed, finished and assembled, aluminum-faced composite wall panels fabricated from two aluminum sheet facings that are bonded to a solid, extruded thermoplastic core; formed into profile for installation method indicated. Include attachment assembly components, and accessories required for weathertight system.
1. Core: Standard.
  2. Panel Joint Design: Rout and return dry seal, unless otherwise indicated.
  3. Panel Thickness: As required to comply with performance requirements.
  4. Panel Bow Tolerance: Not greater than 0.8 percent of panel dimension in width and in length for 72-inch panel.
  5. Exterior Finish: Coil-coated, high-performance organic fluoropolymer finish.
- B. **Attachment Assembly:** Aluminum extrusions consisting of panel retention members including perimeter extrusions with integral weather stripping, clips, angles or panel hangers, and anchor channels, as applicable.
1. Aluminum Extrusions: ASTM B221M, alloy and temper and shape as recommended by manufacturer for type of use and finish indicated, to meet or exceed performance criteria specified.
  2. Provide internal drainage system that allows individual panels to be installed and removed without disturbing adjacent panels.

## 2.6 MISCELLANEOUS MATERIALS

- A. **Miscellaneous Metal Subframing and Furring:** ASTM C 645, cold-formed, metallic-coated steel sheet, ASTM A 792/A 792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.
- B. **Panel Accessories:** Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
- C. **Flashing and Trim:** Provide flashing and trim formed from same material and finish as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers.
1. Exposed Flashing and Closures: Aluminum sheet, minimum 0.03 inches thick, alloy and temper selected by the fabricator.
  2. Sills in Touch Zones, and Copings: Aluminum extrusions, minimum 0.078 inches thick, alloy and temper selected by the fabricator.

- D. **Panel Fasteners:** Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
- E. **Assembly Perimeter Sealant:** ASTM C 920; silicone sealant; of type, grade, class, and use classifications required to seal joints and remain weathertight; and as recommended in writing by metal panel manufacturer. Provide sealant types that are compatible with panel materials, are nonstaining, and do not damage panel finish.
- F. **Gaskets:** As recommended by the panel manufacturer to meet or exceed performance criteria.
  - 1. Color: As selected by Architect from manufacturer's standard product range.
- G. **Dissimilar Metal Protection:** Provide dissimilar metal protection, resilient butyl rubber gaskets as recommended by the panel manufacturer for application indicated.

## 2.7 FABRICATION

- A. **General:** Fabricate and finish metal composite panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. **Fabricate metal composite panels** in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.
- C. **Metal Composite Panels:** Fabricate panels as required to comply with deflection limits. Weld and grind panel corners smooth. Fabricate panels to the following dimensional tolerances:
  - 1. Length and Width: Plus or minus 0.032 inch up to 48 inches; 0.064 inch more than 48 inches.
  - 2. Diagonal: Plus or minus 0.1875 inch.
  - 3. Panel Bow: Not more than 0.2 percent of panel width or length up to 0.1875 inch maximum.
  - 4. Thickness: Plus or minus 0.008 inch.
  - 5. Squareness: 0.1875-inch difference between diagonal measurements.
  - 6. Camber: 0.032 inch.
- D. **Sheet Metal Flashing and Trim:** Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
  - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
  - 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
  - 3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
  - 4. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.

5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal composite panel manufacturer.
  - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal composite panel manufacturer for application, but not less than thickness of metal being secured.

## 2.8 FINISHES

### A. Aluminum Panels and Accessories:

1. Comply with the requirements of the National Association of Architectural Metal Manufacturers (NAAMM) publication AMP 501 for applying and designating finishes.
2. Exposed Aluminum Components: High-performance fluoropolymer finish; same specification as specified for aluminum mullions, in Division 08 Section Aluminum Entrances and Storefronts.
  - a. Colors: Match existing.
3. Concealed Finish: Manufacturer's standard.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. **Examine substrates, areas, and conditions**, with Installer present, for compliance with requirements for installation tolerances, metal composite panel supports, and other conditions affecting performance of the Work.
  1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal composite panel manufacturer.
  2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal composite panel manufacturer.
  3. Verify that air or weather barrier has been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. **Examine roughing-in** for components and systems penetrating metal composite panels to verify actual locations of penetrations relative to seam locations of panels before installation.
- C. **For the record**, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. **Proceed with installation only after** unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. **Miscellaneous Framing**: Install subgirts, base angles, sills, furring, and other miscellaneous panel support members and anchorage according to ASTM C 754 and panel manufacturer's written instructions.

### 3.3 ALUMINUM COMPOSITE PANEL INSTALLATION

- A. **General:** Install metal composite panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to supports unless otherwise indicated. Anchor panels and other components of the Work securely in place, with provisions for thermal and structural movement.
1. Commence metal composite panel installation and install minimum of 300 sq. ft. in presence of factory-authorized representative.
  2. Shim or otherwise plumb substrates receiving metal composite panels.
  3. Flash and seal metal composite panels at perimeters of openings. Do not begin installation until air or weather barrier and flashings that will be concealed by panels are installed.
  4. Install flashing and trim as metal composite panel work proceeds.
  5. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
  6. Align bottoms of metal composite panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
  7. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated or, if not indicated, as necessary for waterproofing.
  8. Provide weathertight escutcheons for pipe and conduit penetrating exterior walls.
- B. **Fasteners:** Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior and aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
- C. **Metal Protection:** Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by metal composite panel manufacturer.
- D. **Attachment Assembly:** Install attachment system required to support metal composite panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.
1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.
- E. **Accessory Installation:** Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal composite panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal composite material panel manufacturer; or, if not indicated, provide types recommended in writing by metal composite material panel manufacturer.
- F. **Flashing and Trim:** Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.

2. **Expansion Provisions:** Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1-inch deep, filled with mastic sealant (concealed within joints).

### 3.4 ERECTION TOLERANCES

- A. **Installation Tolerances:** Shim and align metal composite panel units within installed tolerance of 1/4 inch in 20 feet, noncumulative, on level, plumb, and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

### 3.5 FIELD QUALITY CONTROL

- A. **Field Quality-Control Testing and Inspections:** Owner will engage a qualified testing agency to perform field tests and inspections.
  1. Notify Architect and Owner, in writing, a minimum of 14 days prior to conducting the field-testing.
  2. **Water-Spray Test:** Test on a completed installation of 75-foot- by-2-story minimum area of metal composite panel assembly, for water penetration, according to AAMA 501.2.
- B. **Manufacturer's Field Service:** Engage a factory-authorized service representative to inspect, test, and adjust completed metal composite panel installation, including accessories.
- C. **Remove, and replace with new,** metal composite panels where tests and inspections indicate that they do not comply with specified requirements.
- D. **Additional tests and inspections,** at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- E. **Prepare test and inspection reports.**

### 3.6 CLEANING AND PROTECTION

- A. **Remove temporary protective coverings** and strippable films, if any, as metal composite panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal composite panel installation, clean finished surfaces as recommended by panel manufacturer. Maintain in a clean condition during construction.
- B. **After metal composite panel installation,** clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. **Replace metal composite panels** that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

**END OF SECTION**

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## SECTION 07 5423

### THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. This **Section includes** the following:
1. Mechanically fastened thermoplastic polyolefin (TPO) roofing system.
  2. Roof insulation.
  3. Gypsum board cover board.
- B. **Related Sections** include the following:
1. Section 06 1000 "**Rough Carpentry**" for wood nailers, curbs, and blocking.
  2. Section 07 6200 "**Sheet Metal Flashing and Trim**" for metal roof penetration flashings, flashings, and counterflashings.
  3. Section 07 9200 "**Joint Sealants**."
  4. Section 23 2116 "**Plumbing Specialties**" for roof drains.

##### 1.3 DEFINITIONS

- A. **Roofing Terminology:** Refer to ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.
- B. **Design Uplift Pressure:** The uplift pressure, calculated according to procedures in SPRI's "Wind Load Design Guide for Fully Adhered and Mechanically Fastened Roofing Systems," before multiplication by a safety factor.
- C. **Factored Design Uplift Pressure:** The uplift pressure, calculated according to procedures in SPRI's "Wind Load Design Guide for Fully Adhered and Mechanically Fastened Roofing Systems," after multiplication by a safety factor.

##### 1.4 PERFORMANCE REQUIREMENTS

- A. **General:** Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.
- B. **Material Compatibility:** Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience.

- C. **FMG Listing:** Provide roofing membrane, base flashings, and component materials that comply with requirements in FMG 4450 and FMG 4470 as part of a membrane roofing system and that are listed in FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.
  - 1. Design Wind Speed: 100 miles per hour.
  - 2. Hail Resistance: SH.

## 1.5 SUBMITTALS

- A. **Product Data:** For each type of product indicated.
- B. **Shop Drawings:** For roofing system. Include plans, elevations, sections, details, and attachments to other Work.
  - 1. Base flashings and membrane terminations.
  - 2. Tapered insulation, including slopes.
  - 3. Insulation fastening patterns.
- D. **Samples for Verification:** For the following products:
  - 1. 12-by-12-inch square of sheet roofing, of color specified, including T-shaped side and end lap seam.
- E. **Installer Certificates:** Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.
- F. **Manufacturer Certificates:** Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
  - 1. Submit evidence of meeting performance requirements.
- G. **Qualification Data:** For Installer and manufacturer.
- H. **Product Test Reports:** Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of roofing system.
- I. **Maintenance Data:** For roofing system to include in maintenance manuals.
- J. **Warranties:** Special warranties specified in this Section.
- K. **Inspection Report:** Copy of roofing system manufacturer's inspection report of completed roofing installation.

## 1.6 QUALITY ASSURANCE

- A. **Installer Qualifications:** A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's warranty.
- B. **Manufacturer Qualifications:** A qualified manufacturer that has FMG approval for membrane roofing system identical to that used for this Project.

- C. **Source Limitations:** Obtain components for membrane roofing system from or approved by roofing membrane manufacturer.
- D. **Fire-Test-Response Characteristics:** Provide membrane roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.
1. Exterior Fire-Test Exposure: Class A; ASTM E 108, for application and roof slopes indicated.
  2. Fire-Resistance Ratings: ASTM E 119, for fire-resistance-rated roof assemblies of which roofing system is a part.
- E. **Preliminary Roofing Conference:** Before starting roof deck construction, conduct conference at Project site. Comply with requirements for preinstallation conferences in Division 1 Section "Project Management and Coordination." Review methods and procedures related to roof deck construction and roofing system including, but not limited to, the following:
1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing including installers of roof accessories and roof-mounted equipment.
  2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
  3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
  5. Review structural loading limitations of roof deck during and after roofing.
  6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
  7. Review governing regulations and requirements for insurance and certificates if applicable.
  8. Review temporary protection requirements for roofing system during and after installation.
  9. Review roof observation and repair procedures after roofing installation.

- F. **Preinstallation Conference:** Conduct conference at Project site. Comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to roofing system including, but not limited to, the following:
1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing including installers of roof accessories and roof-mounted equipment.
  2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
  3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
  5. Review structural loading limitations of roof deck during and after roofing.
  6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
  7. Review governing regulations and requirements for insurance and certificates if applicable.
  8. Review temporary protection requirements for roofing system during and after installation.
  9. Review roof observation and repair procedures after roofing installation.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. **Deliver roofing materials** to Project site **in original containers** with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.
- B. **Store liquid materials in their original undamaged containers** in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. **Protect roof insulation materials** from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. **Handle and store roofing materials** and place equipment in a manner to avoid permanent deflection of deck.

## 1.8 PROJECT CONDITIONS

- A. **Weather Limitations:** Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

## 1.9 WARRANTY

- A. **Special Warranty:** Manufacturer's standard form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period. Failure includes roof leaks.
1. Special warranty includes roofing membrane, base flashings, roofing membrane accessories, roof insulation, fasteners, cover boards, walkway products and other components of membrane roofing system.
  2. Warranty Period: 20 years from date of Substantial Completion.
- B. **Special Project Warranty:** Submit roofing Installer's warranty against all leaks, on warranty form at end of this Section, signed by Installer, covering Work of this Section, including all components of membrane roofing system such as roofing membrane, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, and walkway products, for the following warranty period:
1. Warranty Period: Two years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. **Basis of Design:** Contract Documents are based on system specified below to establish a standard of quality. Other manufacturers offering systems with equivalent characteristics may be considered, provided deviations are minor and design concept as expressed in the Contract Documents is not changed, as judged by the Architect.
1. Manufacturer: Firestone Building Products Company.
  2. System: UltraPly TPO Single Ply Roofing:
    - a. Vapor Barrier: Firestone V-Force.
    - b. Substrate and Cover Boards: Georgia-Pacific DensDeck® Roof Board.
    - c. Membrane: 60 mil white TPO.
    - d. Attachment System: Firestone Invisiweld induction welding.
- B. **Available Manufacturers:** Subject to compliance with requirements of Contract Documents, manufacturers offering systems which may be incorporated into the Work include, but are not limited to, the following:
1. Carlisle SynTec Incorporated.
  2. Firestone Building Products Company.
  3. GAF Materials Corp.
  4. GenFlex Roofing Systems.
  5. Johns Manville International, Inc.
- C. **Fabric-Reinforced Thermoplastic Polyolefin Sheet:** Uniform, flexible sheet formed from a thermoplastic polyolefin, internally fabric or scrim reinforced, and as follows:
1. Thickness: 60 mils, nominal.
  2. Exposed Face Color: White.
  3. Physical Properties:
    - a. Breaking Strength: 390 lbf; ASTM D 751, grab method.
    - b. Elongation at Break: 25 percent; ASTM D 751.
    - c. Tearing Strength: 120 lbf minimum; ASTM D 751, Procedure B.
    - d. Brittleness Point: Passes at minus 40 degrees F.
    - e. Ozone Resistance: Passes; ASTM D 1149.

- f. Resistance to Heat Aging: 90 percent minimum retention of breaking strength, elongation at break, and tearing strength after 166 hours at 240 degrees F; ASTM D 573.
- g. Water Absorption: Less than 3 percent mass change after 166 hours' immersion at 158 degrees F; ASTM D 471.
- h. Linear Dimension Change: Less than 1 percent; ASTM D 1204.

## 2.2 AUXILIARY MATERIALS

- A. **General:** Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.
  - 1. Liquid-type auxiliary materials shall meet VOC limits of authorities having jurisdiction.
- B. **Sheet Flashing:** Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as PVC sheet membrane.
- C. **Bonding Adhesive:** Manufacturer's standard solvent-based bonding adhesive for membrane, and solvent-based bonding adhesive for base flashings.
- D. **Slip Sheet:** Manufacturer's recommended slip sheet, of type required for application.
- E. **Metal Termination Bars:** Manufacturer's standard predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.
- F. **Metal Battens:** Manufacturer's standard aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick, prepunched.
- G. **Fasteners:** Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.
- H. **Miscellaneous Accessories:** Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, termination reglets, cover strips, and other accessories.
- I. **Vapor Barrier Membrane:** SBS modified bitumen adhesive, factory-laminated to a tri-laminate woven, high-density polyethylene top surface with a polymeric release liner.
  - a. Primer: Manufacturer's standard solvent-based product.
- J. **Cover Board:**
  - 1. Basis of Design: Contract Documents are based on product specified below to establish a standard of quality. Other manufacturers offering products with equivalent characteristics may be considered, provided deviations are minor and design concept as expressed in the Contract Documents is not changed, as judged by the Architect.
    - a. Manufacturer: Georgia-Pacific Gypsum, LLC.
    - b. Product: DensDeck® Roof Board.

2. Properties:
  - a. Thickness: 1/2 inch.
  - b. Width: 4 feet.
  - c. Weight: 2.0 lb/sq. ft.
  - d. Surfacing: Primed Fiberglass Mat.
  - e. Flexural Strength, Parallel (ASTM C473): 80 lbf, minimum.
  - f. Flute Span (ASTM E661): 5 inches.
  - g. Permeance (ASTM E96): Greater than 23 perms.
  - h. R-Value (ASTM C518): 0.56.
  - i. Water Absorption (ASTM C473): Less than 5 percent of weight.
  - j. Surface Water Absorption (ASTM C473): Nominal 1.0 grams.
  - k. Compressive Strength (Applicable Sections of ASTM C472): Nominal 900 pounds per square inch.
  - l. Flame Spread/ Smoke Development (ASTM E84): Not more than 0 Flame Spread, 0 Smoke Development
  - m. Combustibility (ASTM E136): Noncombustible
  - n. Fire resistance rating (UL 790 and ASTM E108): Class A
  - o. Mold Resistance (ASTM D3273): Scored a 10

### 2.3 ROOF INSULATION

- A. **General:** Provide preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and of thicknesses indicated. Insulation shall be approved by roofing manufacturer and included in overall roofing system warranty.
- B. **Molded-Polystyrene Board Insulation:** Where tapered insulation, crickets, saddles, tapered edge strips, or other insulation shapes are indicated or required provide molded-polystyrene board insulation complying with ASTM C 578 Type IX, 1.8-lb/cu. ft. minimum density.
  1. **Available Manufacturers:**
    - a. Manufacturers with a third-party certification program satisfying model building code mandatory requirements for foam plastics and that produce FMG-approved molded polystyrene.
- C. **Polyisocyanurate Board Insulation:** ASTM C 1289, Type II, felt or glass-fiber mat facer on both major surfaces. Provide in thickness as required to achieve a completed minimum certified 'aged' value of R-30, when tested according to LTTR-CAN/ULC-S770.
- D. **Tapered Insulation:** Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48), unless otherwise indicated.
- E. **Provide preformed saddles,** crickets, tapered edge strips, and other insulation shapes as required and where indicated for sloping to drain. Fabricate to slopes indicated.
- F. **Install polyisocyanurate insulation in two (2) layers** with the total thickness meeting the minimum specified R-Value. Where molded-polystyrene tapered insulation, crickets, saddles, tapered edge strips, or other insulation shapes are indicated, the molded-polystyrene board shall be placed between the layers of polyisocyanurate insulation.

## 2.4 INSULATION ACCESSORIES

- A. **General:** Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.
- B. **Fasteners:** Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

## 2.5 WALKWAYS

- A. **Flexible Walkways:** Factory-formed, nonporous, heavy-duty, solid-rubber, slip-resisting, surface-textured walkway pads or rolls, approximately 3/16 inch (5 mm) thick, and acceptable to membrane roofing system manufacturer.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. **Examine substrates**, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
  - 1. Verify roof openings and penetrations are in place and set and braced and roof drains are securely clamped in place.
  - 2. Verify wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and nailers match thicknesses of insulation.
  - 3. Verify surface plane flatness and fastening of steel roof deck comply with requirements in Division 5 Section "Steel Deck."
  - 4. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. **Clean substrate** of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. **Prevent materials from entering and clogging roof drains** and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. **Complete terminations and base flashings** and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
- D. **Substrate Board:** Install in accordance with manufacturer's written instructions.



### 3.3 VAPOR-RETARDER INSTALLATION

- A. **Self-Adhering-Sheet Vapor Retarder:** Prime substrate. Install self-adhering-sheet vapor retarder over area to receive vapor retarder, side and end lapping each sheet a minimum of 3-1/2 inches and 6 inches, respectively. Seal laps by rolling. Support membrane end lap between metal flutes with 6 x 42 inch metal plate.
- B. **Completely seal vapor retarder** at terminations, obstructions, and penetrations to prevent air movement into roofing system

### 3.4 INSULATION INSTALLATION

- A. **Coordinate** installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
- B. **Comply** with membrane roofing system manufacturer's written instructions for installing roof insulation.
- C. **Install tapered insulation** under area of roofing to conform to slopes indicated.
- D. **Install two or more layers of insulation under area** of roofing to achieve required thickness. Where overall insulation thickness is 2 inches (50 mm) or greater, install 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.
- E. **Trim surface of insulation** where necessary at roof drains so completed surface is flush and does not restrict flow of water.
- F. **Install insulation with long joints** of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.
  - 1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
- G. **Mechanically Fastened Insulation:** Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
  - 1. Fasten insulation according to requirements in FMG's "Approval Guide" for specified Windstorm Resistance Classification.
  - 2. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.
- H. **Install recovery/cover board** over insulation; mechanically attach board to deck per roofing manufacturer's written instructions.

### 3.5 SUBSTRATE AND COVER BOARD INSTALLATION

- A. **Apply only as many roof boards as can be covered** by a roof membrane system in the same day.
- B. **Tightly butt board edges and ends together;** do not gap edges or ends.

- C. **Adhesive Installation** over thermal Insulation, under single-ply roofing system:
1. Stagger roof board end and edge joints minimum 12" over installed insulation layers.
  2. Stagger roof board end and edge joints minimum 6".
  3. Adhere roof boards over installed insulation using adhesive as recommended by roofing system manufacturer's product data.
  4. Apply overall pressure to ensure full adhesion. Do not slide into place.

### 3.5 MECHANICALLY FASTENED ROOFING MEMBRANE INSTALLATION

- A. **Install roofing membrane** over area to receive roofing according to roofing system manufacturer's written instructions. Unroll roofing membrane and allow to relax before installing.
1. Install sheet according to ASTM D 5082.
- B. **Start installation** of roofing membrane in presence of roofing system manufacturer's technical personnel.
- C. **Accurately align roofing membranes** and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- D. **Welding Plates:**
1. Place plates in grid pattern on roof insulation in accordance with PVC roofing manufacturer's recommendations.
  2. Install required number of plates and fasteners per 4-foot by 8-foot insulation to achieve membrane roofing manufacturer's required FM rating.
  3. Install plates in straight rows in at least 1 direction in accordance with membrane roofing manufacturer's prescriptive fastening patterns for roof field, perimeter, and corners.
  4. Secure plates in accordance with membrane roofing manufacturer's instructions using specified fasteners.
  5. Do not overdrive fasteners on plates.
  6. Install plates and fasteners tight and flat to roof insulation with no dimpling of surface.
- E. **Lay membrane roofing over roof insulation and fastened plates** in accordance with thermoplastic membrane roofing section. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps. Apply membrane roofing with side laps shingled with slope of roof deck where possible.
1. Tack welding for purpose of temporary restraint is not permitted.
- F. **Overlap adjoining sheets of membrane roofing** and join together by heat welding in accordance with thermoplastic membrane roofing section. Clean seam areas, overlap membrane roofing, and hot-air weld side and end laps of membrane roofing and sheet flashings according to manufacturer's written instructions to ensure a watertight seam installation.
1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet membrane.
  2. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
  3. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.

- G. **Calibration of Induction Welding Tools:**
1. Calibrate each induction welding tool in accordance with membrane roofing manufacturer's instructions to appropriate level for site conditions.
  2. Adjust induction welding tools to achieve maximum bond strength based on ambient temperature from 0 to 120 degrees F.
  3. Recalibrate induction welding tools whenever ambient temperature changes up or down by 15 degrees F.
  4. Adjust energy level of induction welding tools in accordance with membrane roofing manufacturer's instructions to produce optimal bond.
  5. Optimal Bond: 100 percent bond.
- H. **Bonding Membrane Roofing:**
1. Operate calibrated induction welding tools and magnetic cooling clamps in accordance with membrane roofing manufacturer's instructions.
  2. Ensure induction welding tools are centered over plates.
  3. Create 100 percent bond between underside of membrane roofing and top of plates.
  4. Ensure total, even, consistent adhesion of membrane roofing to top of plates.
  5. Partial Bond of Membrane Roofing to Plates: Not acceptable.
- I. **Mechanically or adhesively** fasten roofing membrane securely at terminations, penetrations, and perimeter of roofing.
- J. **Apply roofing membrane with side laps shingled** with slope of roof deck where possible.
- K. **Seams:** Clean seam areas, overlap roofing membrane, and hot-air weld side and end laps of roofing membrane according to manufacturer's written instructions to ensure a watertight seam installation.
1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roofing membrane.
  2. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
  3. Repair tears, voids, and lapped seams in roofing membrane that does not meet requirements.
- L. **Spread sealant or mastic bed over deck drain flange** at deck drains and securely seal roofing membrane in place with clamping ring.
- M. **Install roof system to assure positive drainage from all areas.** No ponding or standing water will be accepted on completed roof installation.

### 3.6 BASE FLASHING INSTALLATION

- A. **Install sheet flashings** and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.
- B. **Apply solvent-based bonding adhesive** to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.
- C. **Flash penetrations** and field-formed inside and outside corners with sheet flashing.

- D. **Clean seam areas** and overlap and firmly roll sheet flashings into the adhesive. Weld side and end laps to ensure a watertight seam installation.
- E. **Terminate and seal top** of sheet flashings and mechanically anchor to substrate through termination bars.

### 3.7 WALKWAY INSTALLATION

- A. **Flexible Walkways:** Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

### 3.8 FIELD QUALITY CONTROL

- A. **Final Roof Inspection:** Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.
  - 1. Notify Architect or Owner 48 hours in advance of date and time of inspection.
- B. **Repair or remove and replace** components of membrane roofing system where test results or inspections indicate that they do not comply with specified requirements.
- C. **Additional testing and inspecting**, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

### 3.9 PROTECTING AND CLEANING

- A. **Protect membrane roofing system** from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. **Correct deficiencies** in or remove membrane roofing system that does not comply with requirements, repair substrates, and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. **Clean overspray** and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

**Roofing installation warranty follows on next page.**

**3.9 ROOFING INSTALLER'S WARRANTY**

- A. WHEREAS \_\_\_\_\_ of \_\_\_\_\_, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:
  - 1. Owner: \_\_\_\_\_
  - 2. Address: \_\_\_\_\_
  - 3. Building Name/Type: \_\_\_\_\_
  - 4. Address: \_\_\_\_\_
  - 5. Area of Work: \_\_\_\_\_
  - 6. Acceptance Date: \_\_\_\_\_
  - 7. Warranty Period: \_\_\_\_\_
  - 8. Expiration Date: \_\_\_\_\_
  
- B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
  
- C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.
  
- D. This Warranty is made subject to the following terms and conditions:
  - 1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
    - a. lightning;
    - b. wind speed exceeding 100 mph;
    - c. fire;
    - d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
    - e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
    - f. vapor condensation on bottom of roofing; and
    - g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
  - 2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
  - 3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.

4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_\_.

Authorized Signature: \_\_\_\_\_  
 Name: \_\_\_\_\_  
 Title: \_\_\_\_\_

**END OF SECTION**

## SECTION 07 6200

### SHEET METAL FLASHING AND TRIM

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. This **Section includes** the following sheet metal flashing and trim:
  - 1. Formed wall flashing and trim.
- B. **Related Sections** include the following:
  - 1. Section 06 1000 "**Rough Carpentry**" for wood nailers, curbs, and blocking.
  - 2. Section 07 9200 "**Joint Sealants**" for field-applied sheet metal flashing and trim sealants.

##### 1.3 PERFORMANCE REQUIREMENTS

- A. **General:** Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.
- B. **Thermal Movements:** Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change (Range): 120 degrees F, ambient; 180 degrees F, material surfaces.
- C. **Water Infiltration:** Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

##### 1.4 SUBMITTALS

- A. **Product Data:** For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

- B. **Shop Drawings:** Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop- and field-assembled work. Include the following:
  - 1. Identify material, thickness, weight, and finish for each item and location in Project.
  - 2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
  - 3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.
  - 4. Details of expansion-joint covers, including showing direction of expansion and contraction.
  
- C. **Samples for Selection:** For each type of sheet metal flashing and trim indicated with factory-applied color finishes.
  - 1. Include similar Samples of trim and accessories involving color selection.

## 1.5 QUALITY ASSURANCE

- A. **Sheet Metal Flashing and Trim Standard:** Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.
  
- B. **Pre-installation Conference:** Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."
  - 1. Meet with Owner, Architect, Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories, unit skylights, and roof-mounted equipment.
  - 2. Review methods and procedures related to sheet metal flashing and trim.
  - 3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
  - 4. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. **Deliver** sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.
  
- B. **Unload, store, and install** sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.
  
- C. **Stack materials** on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

## 1.7 COORDINATION

- A. **Coordinate installation** of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.



## 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. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
  2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

### 2.2 SHEET METALS

- A. **Lead Sheet:** ASTM B 749, Type L51121, copper-bearing lead sheet.
- B. **Zinc Sheet:** Electrolytic, 99 percent pure zinc alloyed with 1 percent titanium and copper.
1. Finish: Bright rolled.

### 2.3 UNDERLAYMENT MATERIALS

- A. **Polyethylene Sheet:** 6-mil- thick polyethylene sheet complying with ASTM D 4397.
- B. **Slip Sheet:** Rosin-sized paper, minimum 3 lb/100 sq. ft.

### 2.4 MISCELLANEOUS MATERIALS

- A. **General:** Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.
- B. **Fasteners:** Non-ferrous wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.
1. Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory-applied coating.
  2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.
  3. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
  4. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
- C. **Solder for Zinc:** ASTM B 32, 60 percent lead and 40 percent tin with low antimony, as recommended by manufacturer.
- D. **Sealing Tape:** Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

- E. **Elastomeric Sealant:** ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- F. **Butyl Sealant:** ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.
- G. **Bituminous Coating:** Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

## 2.5 MANUFACTURED SHEET METAL FLASHING AND TRIM

- A. **Reglets:** Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory- mitered and -welded corners and junctions.
  - 1. Available Manufacturers:
    - a. Fry Reglet Corporation.
  - 2. Material: Galvanized steel, 24 gauge.
  - 3. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
  - 4. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
    - a. Available Manufacturers:
      - 1) Cheney Flashing Company, Inc., Type B Snap Lock.
  - 5. Flexible Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
  - 6. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.

## 2.6 FABRICATION, GENERAL

- A. **General:** Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.
- B. **Fabricate** sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
- C. **Fabricate** sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
  - 1. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- D. **Sealed Joints:** Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.

- E. **Seams:** Comply with SMACNA "Architectural Sheet Metal Manual", (**Sixth Edition**, September 2003) Figure no. 3-2 and 3-3 as applicable to specific installations.
- F. **Expansion Provisions:** Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.
- G. **Conceal fasteners** and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.
- H. **Fabricate cleats** and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
  - 1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" for application but not less than thickness of metal being secured.

## 2.7 WALL SHEET METAL FABRICATIONS

- A. **Through-Wall Flashing:** Fabricate continuous flashings in minimum 96-inch- long, but not exceeding 12 foot long, sections, under copings, at shelf angles, and where indicated. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings. Form with 2-inch- high end dams. Fabricate from the following material:
  - 1. Zinc: 15 gauge thick.
- B. **Openings Flashing in Frame Construction:** Fabricate head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch- high end dams. Fabricate from the following material:
  - 1. Prepainted, aluminum or other non-ferrous metal: 15 gauge.

## 2.8 FINISHES

- A. **Comply** with NAAMM's "**Metal Finishes Manual for Architectural and Metal Products**" for recommendations for applying and designating finishes.
- B. **Protect mechanical and painted finishes** on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. **Appearance of Finished Work:** Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. **Examine substrates**, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.
1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
  2. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION, GENERAL

- A. **General:** Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
1. Torch cutting of sheet metal flashing and trim is not permitted.
- B. **Metal Protection:** Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.
1. Coat side of sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
  2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene underlayment.
  3. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.
- C. **Install exposed sheet metal flashing** and trim without excessive oil canning, buckling, and tool marks.
- D. **Install sheet metal flashing** and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric sealant.
- E. **Install flashing** and trim so that **any edge that can be seen** will not reveal the **back side** of the flashing.
- F. **Install sheet metal flashing and trim** to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
1. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
- G. **Expansion Provisions:** Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch) deep, filled with elastomeric sealant concealed within joints.

- H. **Fasteners:** Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
  - 1. Use stainless-steel fasteners or other non-ferrous/non-magnetic fasteners.
  
- I. **Seal joints** with elastomeric sealant as required for watertight construction.
  - 1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 degrees F, set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 degrees F.
  - 2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."
  
- J. **Soldered Joints:** Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches except where pretinned surface would show in finished Work.
  - 1. Do not solder prepainted, metallic-coated steel sheet.
  - 2. Pretinning is not required for lead.
  - 3. Where surfaces to be soldered are lead coated, do not tin edges, but wire brush lead coating before soldering.
  - 4. Do not use open-flame torches for soldering. Heat surfaces to receive solder and flow solder into joints. Fill joints completely. Completely remove flux and spatter from exposed surfaces.

### 3.3 ROOF DRAINAGE SYSTEM INSTALLATION

- A. **General:** Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.
  
- B. **Expansion-Joint Covers:** Install expansion-joint covers at locations and of configuration indicated. Lap joints a minimum of 4 inches in direction of water flow.

### 3.4 WALL FLASHING INSTALLATION

- A. **General:** Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
  
- B. **Openings Flashing in Frame Construction:** Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.

### 3.5 CLEANING AND PROTECTION

- A. **Clean exposed metal surfaces** of substances that interfere with uniform oxidation and weathering.
  
- B. **Clean and neutralize flux materials.** Clean off excess solder and sealants.

- C. **Remove temporary protective coverings** and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.
  
- D. **Replace sheet metal flashing** and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

**END OF SECTION**

## SECTION 07 9200

### JOINT SEALANTS

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. **This Section includes** sealants for the following applications, including those specified by reference to this Section:
  - 1. Exterior joints as indicated.
  - 2. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:
    - a. Control and expansion joints on exposed interior surfaces of exterior walls
    - b. Perimeter joints of exterior openings where indicated.
    - c. Control and expansion joints in ceiling and overhead surfaces.
    - d. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
    - e. Joints between plumbing fixtures and adjoining walls, floors, and counters.
    - f. Joints between interior partitions and concrete floors.
    - g. Other joints as indicated.
  - 3. All joints between dissimilar materials.
- B. **Related Sections** include the following:
  - 1. Section 09 2900 "**Gypsum Board**" for sealing perimeter joints of gypsum board partitions to reduce sound transmission.
  - 2. Section 09 5100 "**Acoustical Ceilings**" for sealing edge moldings at perimeters of acoustical ceilings.

##### 1.3 PERFORMANCE REQUIREMENTS

- A. **Provide elastomeric joint sealants** that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

##### 1.4 SUBMITTALS

- A. **Product Data:** For each joint-sealant product indicated.
- B. **Samples for Selection:** Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. **Product Certificates:** Signed by manufacturers of joint sealants certifying that products furnished comply with requirements and are suitable for the use indicated.

## 1.5 QUALITY ASSURANCE

- A. **Installer Qualifications:** An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.
- B. **Source Limitations:** Obtain each type of joint sealant through one source from a single manufacturer.
- C. **Preconstruction Compatibility and Adhesion Testing:** Submit to joint sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
  - 1. Use manufacturers standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
    - a. Perform tests under environmental conditions replicating those that will exist during installation.
  - 2. Submit not fewer than nine pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
  - 3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
  - 4. For materials failing tests, obtain joint sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.
  - 5. Testing will not be required if joint sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. **Deliver materials** to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.
- B. **Store and handle materials** in compliance with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

## 1.7 PROJECT CONDITIONS

- A. **Environmental Limitations:** Do not proceed with installation of joint sealants under the following conditions:
  - 1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer.
  - 2. When joint substrates are wet.
- B. **Joint-Width Conditions:** Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
- C. **Joint-Substrate Conditions:** Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.



## 1.8 WARRANTY

- A. **Special Installer's Warranty:** Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
  - 1. Warranty Period: Three years from date of Substantial Completion.
  
- B. **Special warranties** specified in this Article **exclude** deterioration or failure of elastomeric joint sealants from the following:
  - 1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
  - 2. Disintegration of joint substrates from natural causes exceeding design specifications.
  - 3. Mechanical damage caused by individuals, tools, or other outside agents.
  - 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

## PART 2 - PRODUCTS

### 2.1 MATERIALS, GENERAL

- A. **Compatibility:** Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
  
- B. **Colors of Exposed Joint Sealants:** All colors shall be custom as selected by Architect.

### 2.2 ELASTOMERIC JOINT SEALANTS

- A. **Elastomeric Sealant Standard:** Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant in the Elastomeric Joint-Sealant Schedule at the end of Part 3, including those referencing ASTM C 920 classifications for type, grade, class, and uses.
  
- B. **Additional Movement Capability:** Where additional movement capability is specified in the Elastomeric Joint-Sealant Schedule, provide products with the capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, to withstand the specified percentage change in the joint width existing at the time of installation and remain in compliance with other requirements of ASTM C 920 for uses indicated.
  
- C. **Suitability for Contact with Food:** Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

### 2.3 SOLVENT-RELEASE JOINT SEALANTS

- A. **Acrylic-Based Solvent-Release Joint-Sealant Standard:** Comply with ASTM C 1311 for each product of this description indicated in the Solvent-Release Joint-Sealant Schedule at the end of Part 3.

- B. **Butyl-Rubber-Based Solvent-Release Joint-Sealant Standard:** Comply with ASTM C 1085 for each product of this description indicated in the Solvent-Release Joint-Sealant Schedule at the end of Part 3.

## 2.4 LATEX JOINT SEALANTS

- A. **Latex Sealant Standard:** Comply with ASTM C 834 for each product of this description indicated in the Latex Joint-Sealant Schedule at the end of Part 3.

## 2.5 ACOUSTICAL JOINT SEALANTS

- A. **Acoustical Sealant for Exposed and Concealed Joints:** For each product of this description indicated in the Acoustical Joint-Sealant Schedule at the end of Part 3, provide manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and the following:
  1. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

## 2.6 JOINT-SEALANT BACKING

- A. **General:** Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. **Cylindrical Sealant Backings:** ASTM C 1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
- C. **Type C:** Closed-cell material with a surface skin.
- D. **Elastomeric Tubing Sealant Backings:** Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 degrees F. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.
- E. **Bond-Breaker Tape:** Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

## 2.7 MISCELLANEOUS MATERIALS

- A. **Primer:** Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. **Cleaners for Nonporous Surfaces:** Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants with joint substrates.

- C. **Masking Tape:** Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. All joints of **dissimilar materials** to receive joint sealant.
- B. **Examine joints** to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- C. **Proceed with installation** only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. **Surface Cleaning of Joints:** Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions and the following requirements:
  1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
  2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include concrete, masonry or unglazed surfaces of ceramic tile.
  3. Remove laitance and form-release agents from concrete.
  4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants to metal, glass, porcelain enamel or glazed surfaces of ceramic tile.
- B. **Joint Priming:** Prime joint substrates where recommended in writing by joint sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. **Masking Tape:** Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

### 3.3 INSTALLATION OF JOINT SEALANTS

- A. **General:** Comply with joint sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. **Sealant Installation Standard:** Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

- C. **Acoustical Sealant Application Standard:** Comply with recommendations of ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.
- D. **Install sealant backings** of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
  - 1. Do not leave gaps between ends of sealant backings.
  - 2. Do not stretch, twist, puncture, or tear sealant backings.
  - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- E. **Install bond-breaker tape** behind sealants where sealant backings are not used between sealants and back of joints.
- F. **Install sealants** by proven techniques to comply with the following and at the same time backings are installed:
  - 1. Place sealants so they directly contact and fully wet joint substrates.
  - 2. Completely fill recesses provided for each joint configuration.
  - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
  - 4. Seal abutting joint at all dissimilar materials.
- G. **Tooling of Nonsag Sealants:** Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
  - 1. Remove excess sealants from surfaces adjacent to joint.
  - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
  - 3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
  - 4. Provide flush joint configuration, per Figure 5B in ASTM C 1193, where indicated.
  - 5. Provide recessed joint configuration, per Figure 5C in ASTM C 1193, of recess depth and at locations indicated.
    - a. Use masking tape to protect adjacent surfaces of recessed tooled joints.

### 3.4 CLEANING

- A. **Clean off excess sealants** or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

### 3.5 PROTECTION

- A. **Protect joint sealants** during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from the original work.

### 3.6 ELASTOMERIC JOINT-SEALANT SCHEDULE

- A. **Medium-Modulus Neutral-Curing Silicone Sealant:** Where joint sealants of this type are indicated, provide products complying with the following:
1. Products:
    - a. 795; Dow Corning.
    - b. PSI-631; Polymeric Systems, Inc.
    - c. Masterseal NP 150, BASF
    - d. Spectrem 2; Tremco.
  2. Type and Grade: S (single component) and NS (nonsag).
  3. Class: 25.
  4. Use Related to Exposure: NT (nontraffic).
  5. Uses Related to Joint Substrates: M (masonry), G (glass), A (aluminum), and, as applicable to joint substrates indicated, O (other).
    - a. Use O Joint Substrates: Coated glass, color anodic aluminum, aluminum coated with a high-performance coating, galvanized steel, brick and masonry, ceramic tile, and wood.
  6. Stain-Test-Response Characteristics: Nonstaining to porous substrates per ASTM C 1248.
  7. Applications: Exterior and interior joints in vertical surfaces of concrete; between metal and concrete and mortar; perimeter of metal frames in exterior walls; overhead or ceiling joints.

### 3.7 LATEX JOINT-SEALANT SCHEDULE

- A. **Latex Sealant:** Where joint sealants of this type are indicated, provide products complying with the following:
1. Products:
    - a. AC-20; Pecora Corporation.
    - b. Sonolac; BASF
    - c. Tremflex 834; Tremco.
  2. Applications: Interior joints in field-painted vertical and overhead surfaces at hollow metal door frames, gypsum drywall, and concrete; and all other interior locations not indicated otherwise.

### 3.8 ACOUSTICAL JOINT-SEALANT SCHEDULE

- A. **Acoustical Sealant for Exposed and Concealed Joints:** Where joint sealants of this type are indicated, provide products complying with the following:
1. Products:
    - a. AC-20 FTR Acoustical and Insulation Sealant; Pecora Corporation.
    - b. SHEETROCK Acoustical Sealant; USG Corp., United States Gypsum Co.
  2. Applications: Use in locations of sound walls and in locations indicated.

**END OF SECTION**

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## **DIVISION 08 – OPENINGS**

Section 08 1113	Hollow Metal Doors and Frames
Section 08 1416	Flush Wood Doors
Section 08 3100	Access Doors and Frames
Section 08 4113	Aluminum Entrances and Storefronts
Section 08 4329	Sliding Automatic Entrance Doors
Section 08 7100	Door Hardware
Section 08 8000	Glazing

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## SECTION 08 1113

### HOLLOW METAL DOORS AND FRAMES

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. **Section Includes:**
1. Steel doors.
  2. Hollow metal door frames.
  3. Fire rated doors and frame assemblies.
- B. **Related Sections**
1. Section 08 1416 "**Flush Wood Doors**" for wood doors installed in steel frames.
  2. Section 08 1423 "**Clad Wood Doors**" for doors with plastic laminate faces.
  3. Section 08 7100 "**Door Hardware**" for door hardware for hollow metal doors.
  4. Section 08 8000 "**Glazing**" for glass in glazed openings.
  5. Section 09 2900 "**Gypsum Board**" for spot grouting frames installed in steel framed gypsum board partitions
  6. Section 09 9123 "**Painting**" for field painting hollow metal doors and frames.

##### 1.3 DEFINITIONS

- A. **Minimum Thickness:** Minimum thickness of base metal without coatings.
- B. **Standard Hollow Metal Work:** Hollow metal work fabricated according to ANSI/SDI A250.8.

##### 1.4 SUBMITTALS

- A. **Product Data:** For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance rating, temperature-rise ratings, and finishes.
- B. **Shop Drawings:** Include the following:
1. Elevations of each door and window frame design.
  2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
  3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
  4. Locations of reinforcement and preparations for hardware.
  5. Details of each different wall opening condition.
  6. Details of anchorages, joints, field splices, and connections.
  7. Details of accessories.
  8. Details of moldings, removable stops, and glazing.

- D. **Other Action Submittals:**
  - 1. **Schedule:** Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.
- E. **Oversize Construction Certification:** For assemblies required to be fire rated and exceeding limitations of labeled assemblies.
- F. **Product Test Reports:** Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of hollow metal door and frame assembly.

## 1.5 QUALITY ASSURANCE

- A. **Source Limitations:** Obtain hollow metal work from single source from single manufacturer.
- B. **Fire-Rated Door Assemblies:** Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252.
  - 1. **Oversize Fire-Rated Door Assemblies:** For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
  - 2. **Temperature-Rise Limit:** Where indicated, but not limited to, vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 degrees F above ambient after 30 minutes of standard fire-test exposure.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. **Deliver** hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
  - 1. Provide additional protection to prevent damage to finish of factory-finished units.
- B. **Deliver welded frames** with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. **Store hollow metal work under cover at Project site.** Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch-high wood blocking. Do not store in a manner that traps excess humidity.
  - 1. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

## 1.7 PROJECT CONDITIONS

- A. **Field Measurements:** Verify actual dimensions of openings by field measurements before fabrication.

## 1.8 COORDINATION

- A. **Coordinate installation of anchorages** for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. **Available Manufacturers:** Subject to compliance with requirements of Contract Documents, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Amweld Building Products, LLC.
  2. Ceco Door Products; an Assa Abloy Group company.
  3. Curries Company; an Assa Abloy Group company.
  4. Pioneer Industries, Inc.
  5. Steelcraft; an Allegion company.
  6. Republic Doors.
  7. Security Metal Products Corp.

### 2.2 MATERIALS

- A. **Cold-Rolled Steel Sheet:** ASTM A 1008, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. **Hot-Rolled Steel Sheet:** ASTM A 1011, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. **Metallic-Coated Steel Sheet:** ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A40 metallic coating.
- D. **Frame Anchors:** ASTM A 591/A 591M, Commercial Steel (CS), 40Z (12G) coating designation; mill phosphatized.
1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- E. **Inserts, Bolts, and Fasteners:** Hot-dip galvanized according to ASTM A 153/A 153M.
- F. **Powder-Actuated Fasteners in Concrete:** Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.
- G. **Grout:** ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143.
- H. **Mineral-Fiber Insulation:** ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

- I. **Glazing:** Comply with requirements in Division 8 Section "Glazing."
- J. **Bituminous Coating:** Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

## 2.3 STANDARD HOLLOW METAL DOORS

- A. **General:** Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.
  - 1. Design: Flush panel.
  - 2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core.
    - a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
    - b. Thermal-Rated (Insulated) Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 12.3 degrees F x h x sq. ft./Btu when tested according to ASTM C 1363.
      - 1) Locations: All exterior doors and interior doors where indicated.
  - 3. Vertical Edges for Single-Acting Doors: Beveled edge.
    - a. Beveled Edge: 1/8 inch in 2 inches.
  - 4. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- thick, end closures or channels of same material as face sheets.
  - 5. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
- B. **Interior Doors:** Face sheets fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
  - 1. Level 2 and Physical Performance Level A (Heavy Duty), Model 2 (Seamless) (18 gauge face).
- C. **Hardware Reinforcement:** Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- D. **Fabricate concealed stiffeners** and hardware reinforcement from either cold- or hot-rolled steel sheet.

## 2.4 STANDARD HOLLOW METAL FRAMES

- A. **General:** Comply with ANSI/SDI A250.8 and with details indicated for type and profile.
- B. **Interior Frames:** Fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated.
  - 1. Fabricate frames with mitered or coped corners.
  - 2. Fabricate frames as face welded unless otherwise indicated.
  - 3. Frames for Level 2 Steel Doors: 16 gauge (0.053-inch-) thick steel sheet.
  - 4. Frames for Wood Doors: 16 gauge (0.053-inch-) thick steel sheet.
  - 5. Frames for Borrowed Lights: 16 gauge (0.053-inch-) thick steel sheet.

- C. **Hardware Reinforcement:** Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.
- D. **Fire-Rated Frames:** Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.

## 2.5 FRAME ANCHORS

- A. **Jamb Anchors:**
  - 1. **Masonry Type:** Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 19 gauge (0.042 inch) thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 26 gauge (0.177 inch) thick.
  - 2. **Stud-Wall Type:** Designed to engage stud, welded to back of frames; not less than 19 gauge (0.042 inch) thick.
  - 3. **Postinstalled Expansion Type for In-Place Concrete or Masonry:** Minimum 3/8-inch- diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
- B. **Floor Anchors:** Formed from same material as frames, not less than 19 gauge (0.042 inch) thick, and as follows:
  - 1. **Monolithic Concrete Slabs:** Clip-type anchors, with two holes to receive fasteners.

## 2.6 LOUVERS

- A. **Metal Louvers:** Door manufacturer's standard metal louvers unless otherwise indicated.
  - 1. **Blade Type:** Vision proof inverted V or inverted Y.
  - 2. **Metal and Finish:** Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.
- B. **Louvers for Fire Rated Doors:** Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire protection rating of 1-1/2 hours and less.
  - 1. **Manufacturers:** Subject to compliance with requirements, provide door manufacturers standard louver to meet rating indicated.
  - 2. **Metal and Finish:** Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.

## 2.7 STOPS AND MOLDINGS

- A. **Stops and Moldings:** Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator's shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.
- B. **Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames:** Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.

- C. **Fixed Frame Moldings:** Formed integral with hollow metal frames, a minimum of 5/8 inch high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames.
- D. **Preformed Metal Frames for Light Openings:** Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.

## 2.8 ACCESSORIES

- A. **Mullions and Transom Bars:** Join to adjacent members by welding or rigid mechanical anchors.
- B. **Ceiling Struts:** Minimum 1/4-inch-thick by 1-inch- wide steel.
- C. **Grout Guards:** Formed from same material as frames, not less than 0.016 inch thick.

## 2.8 FABRICATION

- A. **Fabricate hollow metal work** to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. **Tolerances:** Fabricate hollow metal work to tolerances indicated in SDI 117.
- C. **Hollow Metal Doors:**
  - 1. **Glazed Lites:** Factory cut openings in doors.
  - 2. **Astragals:** Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
- D. **Hollow Metal Frames:** Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
  - 1. **Welded Frames:** Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
  - 2. **Sidelight Frames:** Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
  - 3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
  - 4. **Grout Guards:** Weld guards to frame at back of hardware mortises in frames to be grouted.
  - 5. **Floor Anchors:** Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.

6. Jamb Anchors: Provide number and spacing of anchors as follows:
  - a. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
    - 1) Three anchors per jamb up to 60 inches high.
    - 2) Four anchors per jamb from 60 to 90 inches high.
    - 3) Five anchors per jamb from 90 to 96 inches high.
    - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
    - 5) Two anchors per head for frames above 42 inches (1066 mm) wide and mounted in metal-stud partitions.
  - b. Compression Type: Not less than two anchors in each jamb.
  - c. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.
7. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.
  - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
  - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

E. **Fabricate concealed stiffeners**, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.

F. **Hardware Preparation:** Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 8 Section "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive non-templated, mortised and surface-mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.
5. Provide auxiliary hinge reinforcement at all hinge locations on every frame.

G. **Stops and Moldings:** Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of hollow metal work.
5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

## 2.9 STEEL FINISHES

- A. **Prime Finish:** Apply manufacturer's standard primer immediately after cleaning and pretreating.
  - 1. **Shop Primer:** Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

## 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 embedded and built-in anchors to verify actual locations before frame installation.
- C. **For the record, prepare written report,** endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. **Proceed with installation** only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. **Remove welded-in shipping spreaders** installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. **Prior to installation,** adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:
  - 1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
  - 2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
  - 3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
  - 4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.
- C. **Drill and tap doors and frames** to receive non-templated, mortised, and surface-mounted door hardware.

### 3.3 INSTALLATION

- A. **General:** Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.



- B. **Hollow Metal Frames:** Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.
1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
    - a. At fire-protection-rated openings, install frames according to NFPA 80.
    - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
    - c. Install frames with removable glazing stops located on secure side of opening.
    - d. Install door silencers in frames before grouting.
    - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    - f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
    - g. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.
  2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
    - a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
  3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
  4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
  5. Concrete Walls: Solidly fill space between frames and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
  6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
  7. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
  8. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.
  9. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
    - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
    - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

- C. **Hollow Metal Doors:** Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
  - 1. Non-Fire-Rated Standard Steel Doors:
    - a. Jamb and Head: 1/8 inch plus or minus 1/16 inch.
    - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
    - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
    - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
  - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
  
- D. **Glazing:** Comply with installation requirements in Division 8 Section "Glazing" and with hollow metal manufacturer's written instructions.
  - 1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches) o.c. and not more than 2 inches o.c. from each corner.

### 3.4 ADJUSTING AND CLEANING

- A. **Final Adjustments:** Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
  
- B. **Remove grout** and other bonding material from hollow metal work immediately after installation.
  
- C. **Prime-Coat Touchup:** Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
  
- D. **Metallic-Coated Surfaces:** Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

**END OF SECTION**

**SECTION 08 1416**  
**FLUSH WOOD DOORS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. This **Section includes** the following:
1. Solid-core doors with wood-veneer faces.
  2. Factory finishing flush wood doors.
- B. **Related Sections** include the following:
1. Section 08 1213 "**Hollow Metal Frames**" for conventional frames.
  2. Section 08 3616.13 "**Barn (Sliding) Doors**" for wood doors to be finished to match flush wood doors.
  2. Section 08 7100 "**Door Hardware**" for hardware on standard swing doors.

**1.3 SUBMITTALS**

- A. **Product Data:** For each type of door. Include details of core and edge construction, louvers, and trim for openings. Include factory-finishing specifications.
- B. **Shop Drawings:** Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
1. Dimensions and locations of mortises and holes for hardware.
  2. Dimensions and locations of cutouts.
  3. Undercuts.
  4. Requirements for veneer matching.
  5. Doors to be factory finished and finish requirements.
  6. Indicate fire protection ratings for fire rated doors.
- C. **Samples for Selection:** Color charts consisting of actual materials in small sections for the following:
1. Faces of Factory-Finished Doors: Show the full range of colors available for stained finishes; provide samples to demonstrate match to existing door finish..

**1.4 QUALITY ASSURANCE**

- A. **Source Limitations:** Obtain flush wood doors through one source from a single manufacturer.

- B. **Fire Rated Wood Doors:** Doors complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing at positive pressure according to NFPA 252 (neutral pressure at 40 inches above sill) or UL 10C.
  - 1. Oversize Fire Rated Door Assemblies: For units exceeding sizes of tested assemblies provide manufacturer's construction label, indicating compliance to independent 3<sup>rd</sup> party certification agency's procedure, except for size.
  - 2. Temperature Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 degrees F above ambient after 30 minutes of standard fire test exposure.
  - 3. Smoke Control Door Assemblies: Comply with NFPA 105.
    - a. Smoke "S" Label: Doors to bear "S" label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.
  
- C. **Quality Standard:** Comply with AWI/AWMAC/WI "Architectural Woodwork Standards, Edition 2."
  - 1. Provide AWI Quality Certification Labels or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. **Comply** with requirements of referenced standard and manufacturer's written instructions.
  
- B. **Package doors individually** in plastic bags or cardboard cartons.
  
- C. **Mark each door on top and bottom rail** with opening number used on Shop Drawings. Do not mark tops of doors where visible from above.

## 1.6 PROJECT CONDITIONS

- A. **Environmental Limitations:** Do not deliver or install doors until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

## 1.7 WARRANTY

- A. **Special Warranty:** Manufacturer's standard form, signed by manufacturer, Installer, and Contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship, have warped (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section, or show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
  - 1. Warranty shall be in effect during the following period of time from date of Substantial Completion:
    - a. Solid-Core Interior Doors: Life of installation.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. **Basis of Design:** Contract Documents are based on products specified below to establish a standard of quality. Other available manufacturers may be considered, provided deviations are minor and design concept as expressed in the Contract Documents is not changed, as judged by the Architect.
1. Manufacturer: Oshkosh Door Company.
- B. **Available Manufacturers:** Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Eggers Industries; Architectural Door Division.
  2. Assa Abloy; Graham/Maiman.
  3. Oshkosh Door Company.
  4. VT Industries Inc.
  5. Masonite Architectural/Marshfield-Algoma.

### 2.2 DOOR CONSTRUCTION, GENERAL

- A. **Low-Emitting Materials:** Fabricate doors with adhesives and composite wood products that do not contain urea formaldehyde.
- B. **WDMA I.S.1-A Performance Grade:** Extra Heavy Duty; Aesthetic Grade: Premium.
- C. **Particleboard Core Doors:**
1. Particleboard: ANSI A208.1, Grade M-2.
  2. Wood Stiles and Rails: As required to meet Extra Heavy Duty Performance level.
  3. Blocking: As required to meet Extra Heavy Duty Performance level.
- D. **Mineral Core Doors:**
1. Core: Non-combustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire protection rating indicated.
  2. Edge Construction: At hinge stiles, provide laminated edge construction with improved screw holding capability and split resistance with outer stile matching polymer edging.
- E. **Fire Rated Doors:** Provide construction and core specified above as needed to provide fire ratings indicated.
1. Category A Edge Construction: Provide fire rated door edge construction with intumescent seals concealed by outer stile (Category A) at 45, 60, and 90 minute rated doors. Comply with specified requirements for exposed edges.
  2. Category B Edge Construction: Provide 20 minute fire rated doors as Category B, with smoke and fire seals (supplied by seal manufacturer) applied to frame.
  3. Pairs: Provide fire retardant stiles that are listed and labeled for applications indicated without formed steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
    - a. Where required or specified, provide formed steel edges and astragals with intumescent seals. Finish steel edges and astragals with baked enamel.

- F. **Doors for Transparent Finish:**
1. Grade: Premium, with Grade AA faces.
  2. Species and Cut: Match existing (plain sliced clear white maple).
  3. Match between Veneer Leaves: Pleasing match.
  4. Assembly of Veneer Leaves on Door Faces: Running match.
  5. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
  6. Room Match: Provide door faces of compatible color and grain within each separate room or area of building.
  7. Stiles: Same species as faces.

## 2.3 FABRICATION

- A. **Fabricate doors** in sizes indicated for Project-site fitting.
1. Comply with clearance requirements of referenced quality standard for fitting.

## 2.4 FACTORY FINISHING

- A. **General:** Comply with AWI/WI/AWMAC's "Architectural Woodwork Standards" for factory finishing.
- B. **Finish doors at factory.**
- C. **Transparent Finish:**
1. Grade: Premium.
  2. Finish: AWS TR6:600
  3. Staining: Oshkosh #9081M (match existing).
  4. Effect: Open-grain finish.
  5. Sheen: Satin, 30-50 gloss.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. **Examine doors** and installed door frames before hanging doors.
1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
  2. Reject doors with defects.
- B. **Proceed with installation** only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. **Hardware:** For installation, see Division 8 Section "Door Hardware."
- B. **Manufacturer's Written Instructions:** Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.

- C. **Job-Fitted Doors:** Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal cut surfaces after fitting and machining.
1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold.
    - a. Comply with NFPA 80 for fire-rated doors.
  2. Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.
  3. Bevel fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock edge; trim stiles and rails only to extent permitted by labeling agency.
- D. **Factory-Finished Doors:** Restore finish before installation if fitting or machining is required at Project site.

### 3.3 ADJUSTING

- A. **Operation:** Rehang or replace doors that do not swing or operate freely.
- B. **Finished Doors:** Replace doors that are damaged or do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

**END OF SECTION**

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## SECTION 08 3100

### ACCESS DOORS AND FRAMES

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. This **Section includes** the following:
1. **Wall access** doors and frames.
  2. **Ceiling access** doors and frames.
- B. **Related Sections** include the following:
1. Section 08 7100 "**Door Hardware**" for mortise or rim cylinder locks and master keying.
  2. Section 09 2900 "**Gypsum Board**" for gypsum board walls and ceilings.
  3. Section 22 1430 "**Plumbing Specialties**" for connection of floor door drainage couplings to drains.
  4. Section 23 3300 "**Ductwork and Accessories**" for heating and air-conditioning duct access doors.

##### 1.3 SUBMITTALS

- A. **Product Data:** For each type of door and frame indicated. Include construction details relative to materials, individual components and profiles, finishes, and fire ratings (if required) for access doors and frames.
- B. **Shop Drawings:** Show fabrication and installation details of customized doors and frames. Include plans, elevations, sections, details, and attachments to other Work.
- C. **Schedule:** Provide complete door and frame schedule, including types, general locations, sizes, construction details, latching or locking provisions, and other data pertinent to installation.
- D. **Coordination Drawings:** Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items with concealed framing, suspension systems, piping, ductwork, and other construction. Show the following:
1. Method of attaching door frames to surrounding construction.
  2. Ceiling-mounted items including access doors and frames, lighting fixtures, diffusers, grilles, speakers, sprinklers, and special trim.

##### 1.4 QUALITY ASSURANCE

- A. **Source Limitations:** Obtain doors and frames through one source from a single manufacturer.
- B. **Size Variations:** Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

## 1.5 COORDINATION

- A. **Verification:** Determine specific locations and sizes for access doors needed to gain access to concealed equipment, and indicate on schedule specified in "Submittals" Article.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. **Basis of Design:** Contract Documents are based on products specified below to establish a standard of quality. Other available manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept as expressed in the Contract Documents is not changed, as judged by the Architect.
  - 1. Manufacturer: Milcor, a brand of Hart & Cooley, Inc. a trademark of Johnson Controls.
  - 2. Products:
    - a. Rated Doors (Exposed frame): UFRAD (universal fire-rated access door); rating as required by wall construction and rating.
    - b. Non-rated Doors (Exposed frame): M-Flush, sizes as indicated on Drawings but not less than 24 inches square.

### 2.2 MATERIALS

- A. **Steel Plates, Shapes, and Bars:** ASTM A 36/A 36M.
- B. **Electrolytic Zinc-Coated Steel Sheet:** ASTM A 591/A 591M, Commercial Steel (CS), with Class C coating and phosphate treatment to prepare surface for painting; with minimum thickness indicated representing specified nominal thickness according to ASTM A 568/A 568M for uncoated base metal.

### 2.3 PAINT

- A. **Shop Primer for Ferrous Metal:** Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664; selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

### 2.4 ACCESS DOORS AND FRAMES

- A. **Flush, Insulated, Fire-Rated Access Doors and Trimless Frames:** Fabricated from steel sheet.
  - 1. Locations: Gypsum board wall and ceiling surfaces. Fire resistance rating to be 1 hour minimum rating or as scheduled on the drawings.
  - 2. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 16 gauge.
  - 3. Frame: Minimum 16 gauge sheet metal with 1-1/2 inch wide, surface-mounted trim.
  - 4. Hinges: Continuous piano hinge.

5. Automatic Closer: Spring type.
6. Latch: Self-latching bolt operated by knurled knob with interior release.
7. Lock: Key-operated cylinder lock with interior release.
8. Size: As indicated on Drawings.

- B. **Flush Access Doors and Frames with Exposed Trim:** Fabricated from steel sheet.
1. Locations: Concrete and ceramic-tile wall surfaces.
  2. Door: Minimum 16 gauge sheet metal, set flush with exposed face flange of frame.
  3. Frame: Minimum 16 gauge sheet metal with 1-1/2 inch wide, surface-mounted trim.
  4. Hinges: Concealed spring-type hinges.
  5. Latch: Screwdriver-operated cam latches.
  6. Size: As indicated on Drawings.

## 2.5 FABRICATION

- A. **General:** Provide access door 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. **Steel Doors and Frames:** Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.
1. Exposed Flanges: Nominal 1 to 1-1/2 inches (25 to 38 mm) wide around perimeter of frame.
  2. Provide mounting holes in frames to attach frames to framing in drywall construction and to attach masonry anchors in masonry construction. Furnish adjustable metal masonry anchors.
- D. **Latching Mechanisms:** Furnish number required to hold doors in flush, smooth plane when closed.
1. For cylinder lock, furnish two keys per lock and key all locks alike.

## 2.6 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.

## 2.7 METALLIC-COATED STEEL FINISHES

- A. **Galvanizing of Steel Shapes and Plates:** Hot-dip galvanize items indicated to comply with applicable standard listed below:
1. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

- B. **Surface Preparation:** Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. For galvanized surfaces, apply, after cleaning, a conversion coating suited to the organic coating to be applied over it. For metallic-coated surfaces, clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.
  - 1. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
- C. **Factory Priming for Field-Painted Finish:** Apply shop primer immediately after cleaning and pretreating.

## 2.8 STEEL FINISHES

- A. **Surface Preparation:** Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed metal fabrications:
  - 1. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  - 2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."
- B. **Apply shop primer** to uncoated surfaces of metal fabrications. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. **Advise installers** of other work about specific requirements relating to access door and floor door installation, including sizes of openings to receive access door and frame, as well as locations of supports, inserts, and anchoring devices.

### 3.2 INSTALLATION

- A. **Comply with manufacturer's written instructions** for installing access doors and frames and floor doors and frames.
- B. **Set frames accurately** in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

### 3.3 ADJUSTING AND CLEANING

- A. **Adjust doors and hardware** after installation for proper operation.
- B. **Remove and replace, with new, doors and frames** that are warped, bowed, or otherwise damaged.

**END OF SECTION**

## SECTION 08 4113

### ALUMINUM ENTRANCES AND STOREFRONTS

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. This **Section includes** the following types of aluminum entrance and storefront work:
1. Storefront-type framing system to match existing.
  2. Supplemental components to close space between new frame walls and existing exterior aluminum system.
  3. Aluminum trims to cap frame walls at contact points with curtain wall system.
- B. **Related Sections:**
1. Section 07 9200 "**Joint Sealants**" for sealing between storefront system and the substrate.
  2. Section 08 7100 "**Finish Hardware**" for aluminum door hardware. Installation of hardware is by aluminum storefront supplier.
  3. Section 08 8000 "**Glazing**" glazing requirements for aluminum entrances and storefront,

##### 1.3 SYSTEM PERFORMANCE REQUIREMENTS

- A. **General:** Provide aluminum entrance and storefront assemblies that comply with performance characteristics specified, as demonstrated by testing the manufacturer's corresponding stock assemblies according to test methods indicated.
- B. **Thermal Movement:** Design the aluminum entrance and storefront framing systems to provide for expansion and contraction of the component materials. Entrance doors shall function normally over the specified temperature range.
1. The system shall be capable of withstanding a metal surface temperature range of 180 degrees F without buckling, failure of joint seals, undue stress on structural elements, damaging loads on fasteners, reduction of performance, stress on glass, or other detrimental effects.
  2. **Structural Performance:** Conduct tests for structural performance in accordance with ASTM E 330. At the conclusion of the tests there shall be no glass breakage or permanent damage to fasteners, anchors, hardware or actuating mechanism. Framing members shall have no permanent deformation in excess of 0.2 percent of their clear span.
    - a. **Deflection Normal to the Plane of the Wall:** Test pressure required to measure deflection of framing members normal to the plane of the wall shall be equivalent to the wind load specified above. Deflection shall not exceed 1/175 of the clear span, when subjected to uniform load deflection test.

- b. **Deflection Parallel to the Plane of the Wall:** Test pressures required to measure deflection parallel to the plane of the wall shall be equal to 1.5 times the wind pressures specified above. Deflection of any member carrying its full dead load shall not exceed an amount that will reduce glass bite below 75 percent of the design dimension and shall not reduce the edge clearance between the member and the fixed panel, glass or other fixed member above to less than 1/8 inch. The clearance between the member and an operable door or window shall be at least 1/16 inch.

#### 1.4 SUBMITTALS

- A. **Product Data:** Product data for each aluminum entrance and storefront system required, including:
  - 1. Manufacturer's standard details and fabrication methods.
  - 2. Data on finishing, hardware and accessories.
  - 3. Recommendations for maintenance and cleaning of exterior surfaces.
- B. **Shop Drawings:** Shop drawings for each aluminum entrance and storefront system required, including:
  - 1. Layout and installation details, including relationship to adjacent work.
  - 2. Elevations at 1/4-inch scale.
  - 3. Detail sections of typical composite members.
  - 4. Anchors and reinforcement.
  - 5. Glazing details.

#### 1.5 QUALITY ASSURANCE

- A. **Installer Qualifications:** Engage an experienced Installer who has completed installations of aluminum storefront and entrances similar in design and extent to those required for the project and whose work has resulted in construction with a record of successful in-service performance.
- B. **Manufacturer's Qualifications:** Provide aluminum entrances and storefront systems produced by a firm experienced in manufacturing systems that are similar to those indicated for this project and that have a record of successful in-service performance.
- C. **Single Source Responsibility:** Obtain aluminum entrance and storefront systems from one source and from a single manufacturer.
- D. **Design Criteria:** The drawings indicate the size, profile, and dimensional requirements of aluminum entrance and storefront work required and are based on the specific types and models indicated. Aluminum entrance and storefront by other manufacturers may be considered, provided deviations in dimensions and profiles are minor and do not change the design concept as judged by the Architect. The burden of proof of equality is on the proposer.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. **Deliver** aluminum entrance and storefront components in the manufacturer's original protective packaging.

- B. **Store aluminum components** in a clean dry location away from uncured masonry or concrete. Cover components with waterproof paper, tarpaulin or polyethylene sheeting in a manner to permit circulation of air.
  - 1. Stack framing components in a manner that will prevent bending and avoid significant or permanent damage.

## 1.7 PROJECT CONDITIONS

- A. **Field Measurements:** Check openings by accurate field measurement before fabrication. Show recorded measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of the work.
  - 1. Where necessary, proceed with fabrication without field measurements, and coordinate fabrication tolerances to ensure proper fit.

## 1.8 WARRANTY

- A. **Special Assembly Warranty:** Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that deteriorate as defined in this Section within specified warranty period.
  - 1. Failures include, but are not limited to, the following.
    - a. Structural failures including, but not limited to, excessive deflection.
    - b. Noise or vibration caused by thermal movements.
    - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
    - d. Failure of operating components to function properly.
  - 2. **Warranty Period: 5 years** from date of Substantial Completion.
- B. **Special Finish Warranty:** Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.
  - 1. **Warranty Period: 5 years** from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. **Acceptable Manufacturers:** Subject to compliance with requirements of Contract Documents, provide the following system:
  - 1. Manufacturer: EFCO Corporation, an Apogee Company
  - 2. System: Series 401 storefront framing with AFI 350 medium stile doors (existing system).

### 2.2 MATERIALS

- A. **Aluminum Members:** Alloy and temper recommended by the manufacturer for strength, corrosion resistance, and application of required finish; comply with ASTM B 221 for aluminum extrusions, ASTM B 209 for aluminum sheet or plate, and ASTM B 211 for aluminum bars, rods and wire.
- B. **Carbon Steel:** Carbon steel reinforcement of aluminum framing members shall comply with ASTM A 36 for structural shapes, plates and bars, ASTM A 611 for cold rolled sheet and strip, or ASTM A 570 for hot rolled sheet and strip.

- C. **Glass and Glazing Materials:** Comply with requirements of "Glass and Glazing" section of these specifications.
- D. **Fasteners:** Provide fasteners of aluminum, nonmagnetic stainless steel, zinc plated steel, or other material warranted by the manufacturer to be noncorrosive and compatible with aluminum components, hardware, anchors and other components.
  - 1. **Reinforcement:** Where fasteners screw-anchor into aluminum members less than 0.125 inches thick, reinforce the interior with aluminum or nonmagnetic stainless steel to receive screw threads, or provide standard noncorrosive pressed-in splined grommet nuts.
  - 2. **Exposed Fasteners:** Do not use exposed fasteners except for application of hardware. For application of hardware, use Phillips flat-head machine screws that match the finish of member or hardware being fastened.
  - 3. **Concealed Flashing:** 0.0179-inch (26 gage) minimum dead-soft stainless steel, or 0.026-inch-thick minimum extruded aluminum of alloy and type selected by manufacturer for compatibility with other components.
  - 4. **Brackets and Reinforcements:** Provide high-strength aluminum brackets and reinforcements; where use of aluminum is not feasible provide nonmagnetic stainless steel or hot-dip galvanized steel complying with ASTM A 123.

## 2.3 COMPONENTS

- A. **Storefront Framing System:** Provide storefront and entrance framing systems fabricated from extruded aluminum members of size and profile indicated. Include subframes and other reinforcing members of the type indicated. Provide for storefront glazed from the exterior on all sides with projecting stops as scheduled. Shop-fabricate and preassemble frame components where possible. Provide storefront frame sections without exposed seams.
  - 1. **Mullion Configurations:** Provide pockets at the inside glazing face to receive resilient elastomeric glazing. Mullions and horizontals shall be one piece. Make provisions to drain moisture accumulation to the exterior.
  - 2. Where new walls intersect existing exterior glazing system and no mullion exists, provide new aluminum frame section to close between wall end cap and glazing, as shown on Drawings. Seal to glazing and to wall end cap.
- B. **Aluminum Trims:**
  - 1. Where interior gypsum board and frame walls intersect storefront system, provide anodized aluminum brake metal wall end cap.
  - 2. Class 1 anodized finish.
    - a. Match color of existing, adjoining aluminum system.
  - 3. Metal gage: 14 gage (0.063 inches).
  - 4. Minimum return: 1 inch

## 2.4 FABRICATION

- A. **General:** Fabricate aluminum entrance and storefront components to designs, sizes and thicknesses indicated and to comply with indicated standards. Sizes and profile requirements are indicated on the drawings. Variable dimensions are indicated, with maximum and minimum dimensions required, to achieve design requirements and coordination with other work.



- B. **Prefabrication:** Complete fabrication, assembly, finishing, hardware application, and other work to the greatest extent possible before shipment to the Project site. Disassemble components only as necessary for shipment and installation.
  - 1. Perform fabrication operations, including cutting, fitting, forming, drilling and grinding of metal work to prevent damage to exposed finish surfaces. Complete these operations for hardware prior to application of finishes.
  - 2. Do not drill and tap for surface-mounted hardware items until time of installation at project site.
- C. **Welding:** Comply with AWS recommendations. Grind exposed welds smooth to remove weld spatter and welding oxides. Restore mechanical finish.
  - 1. Welding behind finished surfaces shall be performed in such a manner as to minimize distortion and discoloration on the finished surface.
- D. **Reinforcing:** Install reinforcing as required for hardware and as necessary for performance requirements, sag resistance and rigidity.
- E. **Dissimilar Metals:** Separate dissimilar metals with bituminous paint, or a suitable sealant, or a nonabsorptive plastic or elastomeric tape, or a gasket between the surfaces. Do not use coatings containing lead.
- F. **Continuity:** Maintain accurate relation of planes and angles with hairline fit of contacting members.
- G. **Fasteners:** Conceal fasteners wherever possible.

## 2.5 FINISHES

- A. **General:** Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.
- B. **Appearance of Finished Work:** Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. **AA Designations:** Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.
- D. **Class I, Clear Anodic Finish:** AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

## PART 3 - EXECUTION

### 3.1. EXAMINATION

- A. **Examine substrates and supports,** with the Installer present, for compliance with requirements indicated, installation tolerances, and other conditions that affect installation of aluminum entrances and storefronts. Correct unsatisfactory conditions before proceeding with the installation.

- B. **Do not proceed with installation** until unsatisfactory conditions are corrected.

### 3.2 INSTALLATION

- A. **Comply with manufacturer's instructions** and recommendations for installation.
- B. **General:** Set units plumb, level, and true to line, without warp or rack of framing members, doors, or panels. Install components in proper alignment and relation to established lines and grades indicated. Provide proper support and anchor securely in place.
- C. **Construction Tolerances:** Install aluminum entrance and storefront to comply with the following tolerances:
  - 1. Variation from Plane: Do not exceed 1/8 inch in 12 feet of length or 1/4 inch in any total length.
  - 2. Offset from Alignment: The maximum offset from true alignment between two identical members abutting end to end in line shall not exceed 1/16 inch.
  - 3. Diagonal Measurements: The maximum difference in diagonal measurements shall not exceed 1/8 inch.
  - 4. Offset at Corners: The maximum out-of-plane offset of framing at corners shall not exceed 1/32 inch.
- D. **Separate aluminum and other corrodible metal surfaces** from sources of corrosion or electrolytic action at points of contact with other materials.
  - 1. Zinc or cadmium plate steel anchors and other unexposed fasteners after fabrication.
  - 2. Paint dissimilar metals where drainage from them passes over aluminum.
  - 3. Paint aluminum surfaces in contact with mortar, concrete or other masonry with alkali resistant coating.
- E. Paint wood and similar absorptive material in contact with aluminum and exposed to the elements or otherwise subject to wetting, with two coats of aluminum house paint. Seal joints between the materials with sealant.
- F. **Drill and tap frames and doors** and apply surface-mounted hardware items. Comply with hardware manufacturer's instructions and template requirements. Use concealed fasteners wherever possible.
- G. **Set sill members** and other members **in bed of sealant** as indicated, or with joint fillers or gaskets as indicated to provide weathertight construction. Comply with requirements of Division 7 for sealants, fillers, and gaskets.
- H. Refer to **Division 8** Section "**Glazing**" for installation of glass and other panels indicated to be glazed into doors and framing, and not preglazed by manufacturer.

### 3.3 ADJUSTING

- A. **Adjust operating hardware** to function properly, for smooth operation without binding, and for weathertight closure.

### 3.4 CLEANING

- A. **Clean the completed system**, inside and out, promptly after installation, exercising care to avoid damage to coatings.

- B. **Clean glass surfaces after installation**, complying with requirements contained in the "Glass and Glazing" Section for cleaning and maintenance. Remove excess glazing and sealant compounds, dirt and other substances from aluminum surfaces.

### 3.5 PROTECTION

- A. **Institute protective measures** required throughout the remainder of the construction period to ensure that aluminum entrances and storefronts will be without damage or deterioration, other than normal weathering, at time of acceptance.

**END OF SECTION**

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## SECTION 08 4329

### SLIDING AUTOMATIC ENTRANCE DOORS

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. This **Section includes** the following:
  - 1. Exterior and interior sliding, power-operated automatic entrance door assemblies.
- B. **Related Sections** include the following:
  - 1. Section 08 4113 "**Aluminum Entrances and Storefronts**" for entrances controlled by automatic door operators furnished separately in Division 8 Sections.
  - 2. Section 08 7100 "**Door Hardware**" for hardware to the extent not specified in this Section.
  - 3. Section 08 8000 "**Glazing**" for materials and installation requirements of glazing for automatic entrance doors.
  - 4. **Division 26** Sections for electrical connections including conduit and wiring for automatic entrance door operators.

##### 1.3 DEFINITIONS

- A. **AAADM**: American Association of Automatic Door Manufacturers.
- B. **Activation Device**: Control that, when actuated, sends an electrical signal to the door operator to open the door.
- C. **Safety Device**: Device that prevents a door from opening or closing.

##### 1.4 PERFORMANCE REQUIREMENTS

- A. **General**: Provide automatic entrance door assemblies capable of withstanding structural loads and thermal movements based on testing manufacturer's standard units in assemblies similar to those indicated for this Project.
- B. **Delegated Design**: Engage a qualified professional engineer, registered in the State of Utah, to design automatic entrances.
- C. **Structural Loads**:
  - 1. Wind Loads: As indicated on Drawings.
  - 2. Seismic Loads: As indicated on Drawings.

- D. **Thermal Movements:** Provide automatic entrance doors that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 degrees F, ambient; 180 degrees F, material surfaces.
- E. **Operating Range:** Minus 20 degrees F to 130 degrees F.
- F. **Air Infiltration:** Maximum air leakage through fixed glazing and framing areas of 1.25 cfm/sq. ft. of fixed entrance system area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft.
- G. **Opening-Force Requirements:**
1. Egress Doors: Not more than 50 lbf required to manually set door in motion if power fails, and not more than 15 lbf required to open door to minimum required width.
  2. Accessible Interior Doors: Not more than 5 lbf.
- H. **Closing-Force Requirements:** Not more than 30 lbf required to prevent door from closing.

## 1.5 SUBMITTALS

- A. **Product Data:** Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for automatic entrance doors.
- B. **Shop Drawings:** Include plans, elevations, sections, details, hardware mounting heights, and attachments to other work.
1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
  2. Wiring Diagrams: Power, signal, and control wiring.
- C. **Samples for Selection:** For units with factory-applied color finishes.
- D. **Product Certificates:** For each type of emergency-exit automatic entrance door, signed by product manufacturer.
- E. **Qualification Data:** For Installer.
- F. **Field quality-control test and inspection reports.**
- G. **Product Test Reports:** Based on evaluation of comprehensive tests performed by a qualified testing agency, for automatic entrance door assemblies.
- H. **Maintenance Data:** For door operators and control systems to include in maintenance manuals.
- I. **Warranties:** Special warranties specified in this Section.

## 1.6 QUALITY ASSURANCE

- A. **Installer Qualifications:** Manufacturer's authorized representative who is trained and approved for installation and maintenance of units required for this Project.
  - 1. **Maintenance Proximity:** Not more than two hours' normal travel time from Installer's place of business to Project site.
- B. **Manufacturer Qualifications:** A qualified manufacturer with company certificate issued by AAADM.
- C. **Certified Inspector:** Certified by AAADM.
- D. **Source Limitations:** Obtain automatic entrance door assemblies through one source from a single manufacturer.
- E. **Product Options:** Drawings indicate sizes, profiles, and dimensional requirements of automatic entrance door assemblies and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
  - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- F. **Welding:** Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code--Aluminum."
- G. **Power-Operated Door Standard:** BHMA A156.10.
- H. **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.
- I. **Emergency-Exit Door Requirements:** Comply with requirements of authorities having jurisdiction for automatic entrance doors serving as a required means of egress.
- J. **Preinstallation Conference:** Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

## 1.7 PROJECT CONDITIONS

- A. **Field Measurements:** Verify openings to receive automatic entrance door assemblies by field measurements before fabrication and indicate measurements on Shop Drawings.
  - 1. **Established Dimensions:** Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating automatic entrance door assemblies without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to established dimensions.

## 1.8 COORDINATION

- A. Coordinate size and location of recesses in concrete floors for recessed sliding tracks. Concrete, reinforcement, and formwork requirements are specified in Division 3.

- B. **Templates:** Obtain and distribute, to the parties involved, templates for doors, frames, and other work specified to be factory prepared for installing automatic entrance doors. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing automatic entrance doors to comply with indicated requirements.
- C. **Coordinate framing system** with aluminum entrances and storefronts and curtain wall system.
- D. **Coordinate hardware** with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish. Coordinate hardware for automatic entrances with hardware required for rest of Project.
- E. **Electrical System Roughing-in:** Coordinate layout and installation of automatic entrance door assemblies with connections to power supplies.

## 1.9 WARRANTY

- A. **Special Assembly Warranty:** Manufacturer's standard form in which manufacturer agrees to repair or replace components of automatic entrance door assemblies that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including, but not limited to, excessive deflection.
    - b. Faulty operation of operators, controls, and hardware.
    - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
  - 2. Warranty Period: Three years from date of Substantial Completion.
- B. **Special Finish Warranty:** Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.
  - 1. Deterioration includes, but is not limited to, the following:
    - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
    - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
    - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
  - 2. Warranty Period: 5 years from date of Substantial Completion.

## 1.10 MAINTENANCE SERVICE

- A. **Initial Maintenance Service:** Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of automatic entrance door assembly Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper automatic entrance door assembly operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.
  - 1. Engage a certified inspector to perform safety inspection after each adjustment or repair, and at end of maintenance period. Submit completed inspection form to Owner.
  - 2. Perform maintenance, including emergency callback service, during normal working hours.



## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. **Basis of Design:** Contract Documents are based on product specified below to establish a standard of quality. Other available manufacturers offering products with equivalent characteristics may be considered, provided deviations are minor and design concept as expressed in the Contract Documents is not changed, as judged by the Architect.
1. Manufacturer: Stanley Access Technologies
  2. Product: Dura-Glide 3000 Series.
- B. **Available Manufacturers:** Subject to compliance with requirements of Contract Documents, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Besam Automated Entrance Systems, Inc.
  2. DORMA Automatics; Division of DORMA Group North America.
  3. Dor-O-Matic, Inc.; an Allegion Company.
  4. Horton Automatics; Division of Overhead Door Corporation.
  5. Stanley Access Technologies; Division of The Stanley Works.
- C. **Compatibility of Systems:** Sliding entrance door systems shall be selected to match curtain wall and storefront systems (refer to Division 8 Sections "Aluminum Entrances and Storefronts" and "Glazed Aluminum Curtain Walls"). Profiles, finishes and details shall be compatible and match to largest extent possible.

### 2.2 MATERIALS

- A. **Aluminum:** Alloy and temper recommended by manufacturer for type of use and finish indicated.
1. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
  2. Sheet and Plate: ASTM B 209 (ASTM B 209M).
  3. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.
- B. **Sealants and Joint Fillers:** Refer to Division 7 Section "Joint Sealants."
- C. **Nonmetallic, Shrinkage-Resistant Grout:** Premixed, nonmetallic, noncorrosive, nonstaining grout; complying with ASTM C 1107; of consistency suitable for application.
- D. **Bituminous Paint:** Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements, except containing no asbestos; formulated for 30-mil (0.76-mm) thickness per coat.

### 2.3 AUTOMATIC ENTRANCE DOOR ASSEMBLIES

- A. **General:** Provide manufacturer's standard automatic entrance door assemblies including doors, sidelites, framing, headers, carrier assemblies, roller tracks, door operators, activation and safety devices, and accessories required for a complete installation.

- B. **Sliding Automatic Entrance Doors:**
1. Configuration: Single slide door, with one sliding leaf and sidelite.
    - a. Traffic Pattern: Two way.
    - b. Emergency Breakaway Capability: Both leaves.
    - c. Mounting: Surface.
  2. Activation Device: Motion detector mounted on each side of door header to detect pedestrians in activating zone and to open door.
  3. Safety Devices: Two photoelectric beams mounted in header to detect pedestrians in presence zone and to prevent door from closing.
  4. Finish: Finish framing, door(s), sidelite(s), and header with Class I, clear anodic finish.

## 2.4 COMPONENTS

- A. **Framing Members:** Manufacturer's standard extruded aluminum, minimum 0.125 inch thick and reinforced as required to support imposed loads.
1. Nominal Size: 1-3/4 by 4-1/2 inches.
  2. Extruded Glazing Stops and Applied Trim: Minimum 0.062-inch wall thickness.
- B. **Stile and Rail Doors:** Manufacturer's standard 1-3/4-inch- thick glazed doors with minimum 0.125-inch- thick, extruded-aluminum tubular stile and rail members. Mechanically fasten corners with reinforcing brackets that are welded, or incorporate concealed tie-rods that span full length of top and bottom rails.
1. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.
  2. Stile Design: Narrow stile.
  3. Rail Design: 4 inches nominal height.
    - a. Accessible Doors: Smooth surfaced for width of door in area within 10 inches above floor or ground plane.
  4. Muntin Bars: Horizontal tubular rail member for each door; match stile design.
- C. **Sidelites:** Manufacturer's standard 1-3/4-inch-deep sidelites with minimum 0.125-inch-thick, extruded-aluminum tubular stile and rail members matching door design.
1. Glazing Stops and Gaskets: Same materials and design as for stile and rail door.
  2. Muntin Bars: Horizontal tubular rail members for each sidelite; match stile design.
- D. **Glazing:** Type 1, as specified in Division 8 Section "Glazing."
- E. **Headers:** Fabricated from minimum 0.125-inch- thick extruded aluminum and extending full width of automatic entrance door units to conceal door operators, carrier assemblies, and roller tracks. Provide hinged or removable access panels for service and adjustment of door operators and controls. Secure panels to prevent unauthorized access.
1. Mounting: Surface mounted.
  2. Capacity: Capable of supporting doors up to 175 lb per leaf over spans up to 14 feet without intermediate supports.
    - a. Provide sag rods for spans exceeding 14 feet.

- F. **Carrier Assemblies and Overhead Roller Tracks:** Manufacturer's standard carrier assembly that allows vertical adjustment; consisting of nylon- or delrin-covered ball-bearing-center steel wheels operating on a continuous roller track, or ball-bearing-center steel wheels operating on a nylon- or delrin-covered continuous roller track. Support doors from carrier assembly by cantilever and pivot assembly.
  - 1. Rollers: Minimum two ball-bearing roller wheels and two antirise rollers for each active leaf.
- G. **Threshold:** Manufacturer's standard threshold members and bottom-guide track system, with stainless-steel ball-bearing-center roller wheels.
  - 1. Configuration: Saddle-type threshold across door opening and inverted, roller-guide track system at sidelites.
- H. **Brackets and Reinforcements:** Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- I. **Fasteners and Accessories:** Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
- J. **Caution Sign:** BHMA A156.10; 6 inches in diameter, with minimum 1/2-inch- high, black lettering on a yellow background with the words "CAUTION AUTOMATIC DOOR."
- K. **Emergency Breakaway Sign:** BHMA A156.10; red background with 1-inch- high contrasting letters with the words "IN EMERGENCY PUSH TO OPEN."

## 2.5 DOOR OPERATORS

- A. **General:** Provide door operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated.
  - 1. **Door Operator Performance:** Provide door operators that will open and close doors and maintain them in fully closed position when subjected to Project's design wind pressures.
- B. **Electromechanical Operators:** Self-contained overhead unit powered by fractional-horsepower, permanent-magnet dc motor; with closing speed controlled mechanically by gear train and dynamically by braking action of electric motor; with solid-state microprocessor controller; UL 325; and with manual operation including spring closing with power off.
  - 1. Operation: Power opening and spring closing.
  - 2. Features:
    - a. Adjustable opening and closing speeds.
    - b. Adjustable backcheck and latching.
    - c. Adjustable hold-open time between 0 and 30 seconds.
    - d. Obstruction recycle.
    - e. On-off/hold-open switch to control electric power to operator.
    - f. Energy conservation switch that reduces door-opening width.
  - 3. Mounting: Surface.

## 2.6 ACTIVATION AND SAFETY DEVICES

- A. **Motion Detectors:** Self-contained, K-band-frequency, microwave-scanner units with metal or plastic housing; adjustable to provide detection field sizes and functions required by BHMA A156.10; with relay hold time of not less than 2 to 10 seconds.
  - 1. Provide capability for switching between bi-directional and uni-directional detection.
- B. **Photoelectric Beams:** Pulsed infrared, sender-receiver assembly for recessed mounting. Beams shall not be active when doors are fully closed.
- C. **Electrical Interlocks:** Unless units are equipped with self-protecting devices or circuits, provide electrical interlocks to prevent activation of operator when door is locked, latched, or bolted.
- D. **Opening-Width Control Switch:** Two-position switch that in the normal position allows sliding doors to travel to full opening width and in the alternate position reduces opening to a selected partial opening width.

## 2.7 HARDWARE

- A. **General:** Provide units in sizes and types recommended by automatic entrance door and hardware manufacturers for entrances and uses indicated. Finish exposed parts to match door finish, unless otherwise indicated.
- B. **Emergency Breakaway Hardware:** Provide release hardware that allows panel to swing out in direction of egress to full 90 degrees from any position in sliding mode. Maximum force to open panel shall be 50 lbf according to BHMA A156.10. Interrupt powered operation of panel operator while in breakaway mode.
- C. **Deadlocks:** Manufacturer's standard deadbolt operated by exterior cylinder and interior thumb turn; with minimum 1-inch- long throw bolt; BHMA A156.5, Grade 1.
  - 1. Cylinders: As specified in Division 8 Section "Door Hardware."
    - a. Keying: Integrate into building master key system.
  - 2. Deadbolts: Laminated-steel hook, mortise type, BHMA A156.5, Grade 1.
  - 3. Two-Point Locking: Mechanism in stile of active door leaf that automatically extends lockbolt into overhead carrier assembly.
  - 4. Magnetic Locks: As specified in Division 8 Section "Door Hardware."
- D. **Sliding Weather Stripping:** Manufacturer's standard replaceable components complying with AAMA 701; made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.
- E. **Weather Sweeps:** Manufacturer's standard nylon brush sweep mounted to underside of door bottom.

## 2.8 FABRICATION

- A. **General:** Factory fabricate automatic entrance door assembly components to designs, sizes, and thicknesses indicated and to comply with indicated standards.
1. Form aluminum shapes before finishing.
  2. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
  3. Use concealed fasteners to greatest extent possible. Where exposed fasteners are required, use countersunk Phillips flat-head machine screws, finished to match framing.
    - a. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
    - b. Reinforce members as required to receive fastener threads.
  4. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
- B. **Framing:** Provide automatic entrance doors as prefabricated assemblies. Complete fabrication, assembly, finishing, hardware application, and other work before shipment to Project site.
1. Fabricate tubular and channel frame assemblies with manufacturer's standard welded or mechanical joints. Provide subframes and reinforcement as required for a complete system to support required loads.
  2. Perform fabrication operations in manner that prevents damage to exposed finish surfaces.
  3. Form profiles that are sharp, straight, and free of defects or deformations.
  4. Prepare components to receive concealed fasteners and anchor and connection devices.
  5. Fabricate components with accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion.
  6. Fabricate exterior components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.
  7. Provide anchorage and alignment brackets for concealed support of assembly from the building structure.
  8. Allow for thermal expansion of exterior units.
  9. Operator housing shall be completely enclosed. Provide closure pieces on all sides and ends.
- C. **Doors:** Factory fabricated and assembled in profiles indicated. Reinforce as required to support imposed loads and for installing hardware.
- D. **Door Operators:** Factory fabricated and installed in headers, including adjusting and testing.
- E. **Glazing:** Fabricate framing with minimum glazing edge clearances for thickness and type of glazing indicated, according to GANA's "Glazing Manual."
- F. **Hardware:** Factory install hardware to the greatest extent possible; remove only as required for final finishing operation and for delivery to and installation at Project site. Cut, drill, and tap for factory-installed hardware before applying finishes.
1. Provide sliding weather stripping, mortised into door, at perimeter of sliding doors.

- G. **Activation and Safety Devices:** Factory install devices in doors and headers.
  - 1. Install photoelectric beams in header above operable leaf.

## 2.9 ALUMINUM FINISHES

- A. **General:** Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. **Appearance of Finished Work:** Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. **AA Designations:** Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.
- D. **Class I, Clear Anodic Finish:** AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. **Examine conditions,** with Installer present, for compliance with requirements for installation tolerances, header support, and other conditions affecting performance of automatic entrance doors.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. **General:** Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure non-movement joints. Seal joints watertight.
  - 1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
  - 2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- B. **Entrances:** Install automatic entrance doors plumb and true in alignment with established lines and grades without warp or rack of framing members and doors. Anchor securely in place.
  - 1. Install surface-mounted hardware using concealed fasteners to greatest extent possible.
  - 2. Set headers, carrier assemblies, tracks, operating brackets, and guides level and true to location with anchorage for permanent support.
  - 3. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
  - 4. Level recesses for recessed thresholds using nonshrink grout.

- C. **Door Operators:** Connect door operators to electrical power distribution system as specified in Division 26 Sections.
- D. **Activation and Safety Devices:** Adjust devices to provide detection field and functions indicated.
- E. **Glazing:** Install glazing as specified in Division 8 Section "Glazing."
- F. **Sealants:** Comply with requirements specified in Division 7 Section "Joint Sealants" to provide weathertight installation.
  - 1. Set framing members, thresholds, bottom-guide track system, and flashings in full sealant bed.
  - 2. Seal perimeter of framing members with sealant.
- G. **Signage:** Provide caution signs on each automatic entrance door, visible from both sides of door. Mount caution signs with centerline 58 inches above finished floor.
  - 1. **Emergency Breakaway Panels:** Provide emergency breakaway sign visible to egress side of each automatic entrance door that has emergency breakaway capability. Mount signs adjacent to lock stile with centerline between 36 and 60 inches above finished floor.

### 3.3 FIELD QUALITY CONTROL

- A. **Inspector:** Engage Installer's certified inspector to test and inspect automatic entrance doors and prepare test and inspection reports.
- B. **Testing Services:** Certified inspector shall test and inspect each automatic entrance door to determine compliance of installed systems with applicable BHMA standards.
  - 1. **Inspection Report:** Certified inspector shall submit report in writing to Architect and Contractor within 24 hours after inspection.
- C. **Repair or remove work** where test results and inspections indicate that it does not comply with specified requirements.
- D. **Additional testing and inspecting**, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

### 3.4 ADJUSTING

- A. **Adjust door operators, controls, and hardware** for smooth and safe operation, for weathertight closure, and complying with requirements in BHMA A156.10.
- B. **Lubricate operating hardware** and other moving parts.
- C. **Readjust door operators and controls** after repeated operation of completed installation equivalent to 3 days' use by normal traffic (100 to 300 cycles). Lubricate hardware, operating equipment, and other moving parts.
- D. **Occupancy Adjustment:** When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project outside normal occupancy hours for this purpose.

### 3.5 CLEANING AND PROTECTION

- A. **Clean glass and aluminum surfaces** promptly after installation. Remove excess glazing and sealant compounds, dirt, and other substances. Repair damaged finish to match original finish.
  - 1. Comply with requirements in Division 8 Section "Glazing" for cleaning and maintaining glass.

### 3.6 DEMONSTRATION

- A. **Engage a certified inspector** to train Owner's maintenance personnel to adjust, operate, and maintain automatic entrance doors and door operators. Refer to Division 1 Section "Closeout Procedures."

**END OF SECTION**



## SECTION 08 7100

### DOOR HARDWARE

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. **This Section includes** commercial door hardware for the following:
1. Swinging doors.
  2. Sliding doors.
- B. **Door hardware includes**, but is not necessarily limited to, the following:
1. Mechanical door hardware.
  2. Electromechanical door hardware.
- C. **Related Sections:**
1. Section 08 1113 "Hollow Metal Doors and Frames".
  2. Section 08 4313 "Aluminum Entrances and Storefronts".
  3. Section 08 1416 "Flush Wood Doors".
- D. **Codes and References:** Comply with the version year adopted by the Authority Having Jurisdiction.
1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
  2. ICC/IBC - International Building Code.
  3. NFPA 70 - National Electrical Code.
  4. NFPA 80 - Fire Doors and Windows.
  5. NFPA 101 - Life Safety Code.
  6. NFPA 105 - Installation of Smoke Door Assemblies.
  7. UL/ULC and CSA C22.2 – Standards for Automatic Door Operators Used on Fire and Smoke Barrier Doors and Systems of Doors.
  8. State Building Codes, Local Amendments.
- E. **Standards:** All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:
1. ANSI/BHMA Certified Product Standards - A156 Series.
  2. UL10C – Positive Pressure Fire Tests of Door Assemblies.
  3. ANSI/UL 294 – Access Control System Units.
  4. ULC-S319 - Electronic Access Control Systems.
  5. ULC-60839-11-1, Alarm and Electronic Security Systems - Part 11-1: Electronic Access Control Systems - System and Components Requirements.
  6. UL 305 – Panic Hardware.
  7. ULC-S132, Emergency Exit and Emergency Fire Exit Hardware.
  8. ULC-S533 – Egress Door Securing and Releasing Devices.
  9. ANSI/UL 437- Key Locks.
  10. ULC-S328, - Burglary Resistant Key Locks.

### 1.3 SUBMITTALS

- A. **Product Data:** Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. **Door Hardware Schedule:** Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
  2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
  3. Content: Include the following information:
    - a. Type, style, function, size, label, hand, and finish of each door hardware item.
    - b. Manufacturer of each item.
    - c. Fastenings and other pertinent information.
    - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    - e. Explanation of abbreviations, symbols, and codes contained in schedule.
    - f. Mounting locations for door hardware.
    - g. Door and frame sizes and materials.
    - h. Warranty information for each product.
  4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. **Shop Drawings:** Details of electrified access control hardware indicating the following:
1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
    - a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
    - b. Complete (risers, point-to-point) access control system block wiring diagrams.
    - c. Wiring instructions for each electronic component scheduled herein.
  2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.
- D. **Keying Schedule:** After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

- E. **Informational Submittals:**
  - 1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.
- F. **Operating and Maintenance Manuals:** Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

#### 1.4 QUALITY ASSURANCE

- A. **Manufacturers Qualifications:** Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. **Certified Products:** Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).
- C. **Installer Qualifications:** A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- D. **Door Hardware Supplier Qualifications:** Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
- E. **Source Limitations:** Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
  - 1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
  - 2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.
- F. **Each unit to bear third party permanent label** demonstrating compliance with the referenced standards.
- G. **Keying Conference:** Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
  - 1. Function of building, purpose of each area and degree of security required.
  - 2. Plans for existing and future key system expansion.
  - 3. Requirements for key control storage and software.
  - 4. Installation of permanent keys, cylinder cores and software.
  - 5. Address and requirements for delivery of keys.

- H. **Pre-Submittal Conference:** Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
  - 1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
  - 2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
  - 3. Review sequence of operation narratives for each unique access controlled opening.
  - 4. Review and finalize construction schedule and verify availability of materials.
  - 5. Review the required inspecting, testing, commissioning, and demonstration procedures
  
- I. **At completion of installation,** provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. **Inventory door hardware** on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
  
- B. **Tag each item or package separately** with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
  
- C. **Deliver, as applicable, permanent keys,** cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

## 1.6 COORDINATION

- A. **Templates:** Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
  
- B. **Door and Frame Preparation:** Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

## 1.7 MAINTENANCE SERVICE

- A. **Maintenance Tools and Instructions:** Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

## PART 2 - PRODUCTS

### 2.1 SCHEDULED DOOR HARDWARE

- A. **General:** Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
- B. **Designations:** Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
1. **Named Manufacturer's Products:** Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- C. **Substitutions:** Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

### 2.2 HANGING DEVICES

- A. **Hinges:** ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.
1. **Quantity:** Provide the following hinge quantity:
    - a. Two Hinges: For doors with heights up to 60 inches.
    - b. Three Hinges: For doors with heights 61 to 90 inches.
    - c. Four Hinges: For doors with heights 91 to 120 inches.
    - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
  2. **Hinge Size:** Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
    - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
    - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
  3. **Hinge Weight and Base Material:** Unless otherwise indicated, provide the following:
    - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
    - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
  4. **Hinge Options:** Comply with the following:
    - a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.

5. Manufacturers:
  - a. Hager Companies (HA).
  - b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK).
  - c. Stanley Hardware (ST).
  
- B. **Pin and Barrel Continuous Hinges:** ANSI/BHMA A156.26 Grade 1-600 certified pin and barrel continuous hinges with minimum 14 gauge Type 304 stainless steel hinge leaves, concealed teflon coated stainless pin, and twin self-lubricated nylon bearings at each knuckle separation. Factory trim hinges to suit door height and prepare for electrical cut-outs.
  1. Manufacturers:
    - a. Hager Companies (HA).
    - b. Markar Products; ASSA ABLOY Architectural Door Accessories (MR).
    - c. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).

## 2.3 POWER TRANSFER DEVICES

- A. **Electrified Quick Connect Transfer Hinges:** Provide electrified transfer hinges with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.
  1. Manufacturers:
    - a. Hager Companies (HA) - ETW-QC (# wires) Option.
    - b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - QC (# wires) Option.
    - c. Stanley Hardware (ST) – C Option.
  
- B. **Concealed Quick Connect Electric Power Transfers:** Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.
  1. Manufacturers:
    - a. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE) – EL-CEPT Series.
    - b. Securitron (SU) - EL-CEPT Series.
    - c. Von Duprin (VD) - EPT-10 Series.

## 2.4 DOOR OPERATING TRIM

- A. **Flush Bolts and Surface Bolts:** ANSI/BHMA A156.3 and A156.16, Grade 1, certified.
  1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
  2. Furnish dust proof strikes for bottom bolts.
  3. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
  4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
  5. Manufacturers:
    - a. Door Controls International (DC).
    - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
    - c. Trimco (TC).

- B. **Coordinators:** ANSI/BHMA A156.3 certified door coordinators consisting of active-leaf, hold-open lever and inactive-leaf release trigger. Model as indicated in hardware sets.
1. Manufacturers:
    - a. Door Controls International (DC).
    - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
    - c. Trimco (TC).

## 2.5 CYLINDERS AND KEYING

- A. **General:** Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
- B. **Source Limitations:** Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.
1. Manufacturers:
    - a. Schlage (SC).
- C. **Cylinders:** Original manufacturer cylinders complying with the following:
1. Mortise Type: Threaded cylinders with rings and cams to suit hardware application.
  2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
  3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
  4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
  5. Keyway: Match Facility Standard.
- D. **Removable Cores:** Provide removable cores as specified, core insert, removable by use of a special key, and for use with only the core manufacturer's cylinder and door hardware.
- E. **Keying System:** Each type of lock and cylinders to be factory keyed.
1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
  2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
  3. Existing System: Field verify and key cylinders to match Owner's existing system.
- F. **Key Quantity:** Provide the following minimum number of keys:
1. Change Keys per Cylinder: Two (2)
  2. Master Keys (per Master Key Level/Group): Five (5).
  3. Construction Keys (where required): Ten (10).
  4. Construction Control Keys (where required): Two (2).
  5. Permanent Control Keys (where required): Two (2).
- G. **Construction Keying:** Provide temporary keyed construction cores.
- H. **Key Registration List (Bitting List):**
1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
  2. Provide transcript list in writing or electronic file as directed by the Owner.

## 2.6 MECHANICAL LOCKS AND LATCHING DEVICES

- A. **Mortise Locksets, Grade 1 (Heavy Duty):** ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.
1. Manufacturers:
    - a. Sargent Manufacturing (SA) – 8200 Series.
    - b. Schlage (SC) – L9000 Series.

## 2.7 ELECTROMECHANICAL LOCKING DEVICES

- A. **Electromechanical Mortise Locksets, Grade 1 (Heavy Duty):** Subject to same compliance standards and requirements as mechanical mortise locksets, electrified locksets to be of type and design as specified below.
1. Electrified Lock Options: Where indicated in the Hardware Sets, provide electrified options including: outside door lock/unlock trim control, latchbolt and lock/unlock status monitoring, deadbolt monitoring, and request-to-exit signaling. Support end-of-line resistors contained within the lock case. Unless otherwise indicated, provide electrified locksets standard as fail secure.
  2. Manufacturers:
    - a. Sargent Manufacturing (SA) - 8200 Series.
    - b. Schlage (SC) - L9000 EL/EU/RX Series.

## 2.8 AUXILIARY LOCKS

- A. **Push-Pull Latches, Mortise:** ANSI/BHMA A156.13, Series 1000, Grade 1 mortise type push-pull locks and latches with paddle trim capable of being mounted as a standard product in vertical (up or down) and horizontal (sideways) positions. Locksets to be manufactured with a corrosion resistant, formed steel case and be non-handed and field reversible for re-handing without disassembly of the lock body. Paddles and covers are manufactured from cast stainless steel, brass or bronze material.
1. Manufacturers:
    - a. Glynn Johnson (GJ) - HL-6 9000 Series.
    - b. Sargent Manufacturing (SA) - 7800 PT Series.

## 2.9 LOCK AND LATCH STRIKES

- A. **Strikes:** Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
  2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
  3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
  4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.
- B. **Standards:** Comply with the following:
1. Strikes for Mortise Locks and Latches: BHMA A156.13.
  2. Strikes for Bored Locks and Latches: BHMA A156.2.
  3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
  4. Dustproof Strikes: BHMA A156.16.



## 2.10 CONVENTIONAL EXIT DEVICES

- A. **General Requirements:** All exit devices specified herein shall meet or exceed the following criteria:
1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
  2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.
  3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
  4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
  5. Motorized Electric Latch Retraction: Devices with an electric latch retraction feature must use motors which have a maximum current draw of 600mA. Solenoid driven latch retraction is not acceptable.
  6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
    - a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
    - b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
  7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
  8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
  9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
  10. Rail Sizing: Provide exit device rails factory sized for proper door width application.
  11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
- B. **Conventional Push Rail Exit Devices (Heavy Duty):** ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.
1. Manufacturers:
    - a. Sargent Manufacturing (SA) - 80 Series.
    - b. Von Duprin (VD) - 35A/98 XP Series.

## 2.11 DOOR CLOSERS

- A. **All door closers specified herein** shall meet or exceed the following criteria:
1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
  2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.

3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
  4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
  5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
  6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.
- B. **Door Closers, Surface Mounted (Heavy Duty):** ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.
1. Manufacturers:
    - a. LCN Closers (LC) – 4040SE Series.
    - b. Norton Door Controls (NO) – 7500 Series.

## 2.12 SURFACE MOUNTED CLOSER HOLDERS

- A. **Multi-Point Closer Holders with Motion Sensor:** ANSI A156.15, Grade 1 certified multi-point, closer holder devices designed to keep doors in a held-open position if presence is detected within the opening. Push side or pull side mounting applications having a maximum opening of 180° (hold open to 175°) and dual voltage input (24V /120V). Voltage to be 24VDC unless otherwise specified. Units are fail safe, closing the door in the event of fire alarm system or electrical power interruption.
1. Safe Zone Detection: Closer holders units to have an integral motion sensor device monitoring a "zone of safety" at the door opening. Safe zone detection prevents the door from closing in event of movement within the adjustable sensing field. Movement is detectable in both directions with selectable closer hold open time and sensor sensitivity. Provide optional handheld device for programming safe zone sensor settings.
  2. Manufacturers:
    - a. Norton Door Controls (NO) - 7100SZ Series.

## 2.13 ARCHITECTURAL TRIM

- A. **Door Protective Trim**
1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
  2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2 inches less than door width (LDW) on stop side of single doors and 1 inch LDW on stop side of pairs of doors, and not more than 1 inch less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.

3. Where plates are applied to fire rated doors with the top of the plate more than 16 inches above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer's catalog and template book for specific requirements for size and applications.
4. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:
  - a. Stainless Steel: 300 grade, 050-inch thick.
5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
6. Manufacturers:
  - a. Hiawatha, Inc. (HI).
  - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
  - c. Trimco (TC).

## 2.14 DOOR STOPS AND HOLDERS

- A. **General:** Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. **Door Stops and Bumpers:** ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
  1. Manufacturers:
    - a. Hiawatha, Inc. (HI).
    - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
    - c. Trimco (TC).
- C. **Overhead Door Stops and Holders:** ANSI/BHMA A156.8, Grade 1 Certified Products Directory (CPD) listed overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.
  1. Manufacturers:
    - a. Rixson Door Controls (RF).
    - b. Sargent Manufacturing (SA).

## 2.15 ARCHITECTURAL SEALS

- A. **General:** Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. **Smoke Labeled Gasketing:** Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
  1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

- C. **Fire Labeled Gasketing:** Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
  - 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.
- D. **Sound-Rated Gasketing:** Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
- E. **Replaceable Seal Strips:** Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. **Manufacturers:**
  - 1. National Guard Products (NG).
  - 2. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).
  - 3. Reese Enterprises, Inc. (RE).

## 2.16 ELECTRONIC ACCESSORIES

- A. **Touchless Switches:** FCC certified microwave sensing switch used for REX or activation of various access control devices in place of a traditional wired switch. Unit to have an adjustable sensing zone from 4" to 24". At exterior locations furnish foam gaskets and weather covers. Provide single gang or double gang unit as specified in the hardware sets
  - 1. Manufacturers:
    - a. Norton Door Controls (NO) - 700 Series.
    - b. Securitron (SU) - WSS Series.
- B. **Switching Power Supplies:** Provide power supplies with either single or dual voltage configurations at 12 or 24VDC. Power supplies shall have battery backup function with an integrated battery charging circuit and shall provide capability for power distribution, direct lock control and Fire Alarm Interface (FAI) through add on modules. Power supplies shall be expandable up to 16 individually protected outputs. Output modules shall provide individually protected, continuous outputs and/or individually protected, relay controlled outputs.
  - 1. Manufacturers:
    - a. Securitron (SU) - AQD Series.

## 2.17 FABRICATION

- A. **Fasteners:** Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

## 2.18 FINISHES

- A. **Standard:** Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

- B. **Provide quality of finish**, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware
- C. **Protect mechanical finishes** on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. **Examine scheduled openings**, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. **Notify Architect** of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

### 3.2 PREPARATION

- A. **Hollow Metal Doors and Frames:** Comply with ANSI/DHI A115 series.
- B. **Wood Doors:** Comply with ANSI/DHI A115-W series.

### 3.3 INSTALLATION

- A. **Install each item** of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
  - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. **Mounting Heights:** Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
  - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
  - 2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
  - 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
  - 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. **Retrofitting:** Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

- D. **Thresholds:** Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- E. **Storage:** Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

### 3.4 FIELD QUALITY CONTROL

- A. **Field Inspection (Punch Report):** Reference Division 01 Sections "Closeout Procedures" and "Cash Allowances". Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.
  - 1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.
  - 2. Submit documentation of incomplete items in the following formats:
    - a. PDF electronic file.
    - b. Electronic formatted file integrated with the Openings Studio™ door opening management software platform.

### 3.5 ADJUSTING

- A. **Initial Adjustment:** Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

### 3.6 CLEANING AND PROTECTION

- A. **Protect all hardware** stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. **Clean adjacent surfaces** soiled by door hardware installation.
- C. **Clean operating items** as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

### 3.7 DEMONSTRATION

- A. **Instruct Owner's maintenance personnel** to adjust, operate, and maintain mechanical and electromechanical door hardware.

### 3.8 DOOR HARDWARE SETS

- A. **The hardware sets represent** the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
1. Quantities listed are for each pair of doors, or for each single door.
  2. The supplier is responsible for handing and sizing all products.
  3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
  4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.
- B. **Manufacturer's Abbreviations:**
1. MK - McKinney
  2. MR - Markar
  3. RO - Rockwood
  4. SC - Schlage
  5. VD - Von Duprin
  6. SD - Security Door Controls
  7. RF - Rixson
  8. LC - LCN Closers
  9. NO - Norton
  10. PE - Pemko
  11. SU - Securitron

#### Hardware Sets

##### Set: 1.0

Doors: W1216A (W1216B & W1214 are existing & relocated doors. Reinstall existing door hardware)

2 Continuous Hinge	HG315 CTP	630	MR
2 SVR Exit Device (EO-MELR)	QEL 9827EO-F LBR	US26D	VD
1 Door Operator (Dbl Egress)	Stanley Magic by others	689	
2 Kick Plate	K1050 10"	US32D	RO
2 Wall Stop	409	US32D	RO
1 Gasketing	S44BL		PE
1 Meeting Stile Seal	S771C		PE
2 Electric Power Transfer	CEPT-10		SU ⚡
2 Wave to Open Switch	WSS-WX		SU ⚡
1 Power Supply	AQD (size as req.) x PDB (as req.)		SU ⚡

**Set: 2.0**

Doors: W1220

2 Hinge, Full Mortise	TA2714 (NRP)	US26D	MK
1 Electric Hinge	TA2714-CCX	US26D	MK ⚡
1 Electrified Mortise Lock	L9092EU 17B	626	SC ⚡
1 Cylinder (mortise)	30-138	626	SC
1 Surface Closer	4011/4111 (type as required)	689	LC
1 Kick Plate	K1050 10"	US32D	RO
1 Wall Stop	409	US32D	RO
1 Gasketing	S44BL		PE
1 Power Supply	AQD (size as req.) x PDB (as req.)		SU ⚡
1 Card Reader	Provided by access control.		

## Notes:

Entry by valid credential unlocking the lever on the key side of the door; mechanical key override.  
Free egress at all times.

**Set: 3.0**

Doors: W1221

2 Hinge, Full Mortise	TA2714 (NRP)	US26D	MK
1 Electric Hinge	TA2714-CCX	US26D	MK ⚡
1 Electrified Mortise Lock	L9092EU 17B	626	SC ⚡
1 Cylinder (mortise)	30-138	626	SC
1 Surface Closer	4011/4111 (type as required)	689	LC
1 Armor Plate	K1050 F 34"	US32D	RO
1 Wall Stop	409	US32D	RO
1 Gasketing	S44BL		PE
1 Power Supply	AQD (size as req.) x PDB (as req.)		SU ⚡
1 Card Reader	Provided by access control.		

## Notes:

Entry by valid credential unlocking the lever on the key side of the door; mechanical key override.  
Free egress at all times.

**Set: 4.0**

Doors: W2100

2 Hinge, Full Mortise	TA2714 (NRP)	US26D	MK
1 Automatic Flush Bolt	2948	US26D	RO
1 Mortise Lock (storeroom)	L9080 L 17B	626	SC
1 Cylinder (mortise)	30-138	626	SC
1 Coordinator	2600 (brackets as required)	US28	RO
2 Surface Closer	4011/4111 (type as required)	689	LC
2 Armor Plate	K1050 F 34"	US32D	RO
2 Wall Stop	409	US32D	RO
1 Gasketing	S44BL		PE
1 Meeting Stile Seal	S771C		PE



**Set: 5.0**

Doors: W1135, W1222 & W2103

3 Hinge	TA2714	US26D	MK
1 Mortise Lock (office)	ML2051 PSA LC	630	RU
1 Cylinder (mortise)	30-138	626	SC
1 Stop	406/409/441H (as required)	US32D	RO
1 Threshold	EV232BL		PE
1 Gasketing	S442BL		PE
1 Door Bottom	PDB411AE		PE

**Set: 6.0**

Doors: 2511 (W1217, W1224)

3 Hinge, Full Mortise	TA2714 (NRP)	US26D	MK
1 Mortise Lock (storeroom)	L9080 L 17B	626	SC
1 Cylinder (mortise)	30-138	626	SC
1 Surface Closer	4111 CUSH	689	LC
1 Gasketing	S44BL		PE

**Set: 7.0**

Doors: W1223

3 Hinge, Full Mortise	TA2714	US26D	MK
1 Mortise Lock (privacy)	L9040 17B L283-712	626	SC
1 Surface Closer	4011/4111 (type as required)	689	LC
1 Kick Plate	K1050 10"	US32D	RO
1 Wall Stop	409	US32D	RO
1 Gasketing	S44BL		PE

**Set: 8.0**

Doors: W1200A, W1200B, W1229 & W1230

1 Hardware	By door manufacturer		
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**END OF SECTION**

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## SECTION 08 8000

### GLAZING

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. **This Section includes** glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
  - 1. Doors.
  - 2. Interior borrowed lites.

##### 1.3 PERFORMANCE REQUIREMENTS

- A. **General:** Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. **Glass Design:** Glass thicknesses indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites for various size openings in nominal thicknesses indicated, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:
  - 1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:
    - a. Probability of Breakage for Vertical Glazing: 8 lites per 1000 for lites set vertically or not more than 15 degrees off vertical and under wind action.
      - 1) Load Duration: 60 seconds or less.
    - b. Maximum Lateral Deflection: For the following types of glass supported on all four edges, provide thickness required that limits center deflection at design wind pressure to 1/50 times the short side length or 1 inch, whichever is less.

##### 1.4 SUBMITTALS

- A. **Product Data:** For each glass product and glazing material indicated.
- B. **Samples:** For the following products, in the form of 12-inch- square Samples for glass and of 12-inch- long Samples for sealants. Install sealant Samples between two strips of material representative in color of the adjoining framing system.
  - 1. Insulating glass for each designation indicated.
  - 2. For each color (except black) of exposed glazing sealant indicated.

- C. **Glazing Schedule:** Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.
- D. **Product Certificates:** Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.
- E. **Preconstruction Adhesion and Compatibility Test Report:** From glazing sealant manufacturer indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.
- F. **Warranties:** Special warranties specified in this Section.

## 1.5 QUALITY ASSURANCE

- A. **Installer Qualifications:** An experienced installer who has completed glazing similar in material, design and extent to that indicated for this project; whose work has resulted in glass installations with a record of successful in-service performance.
- B. **Source Limitations for Clear Glass:** Obtain clear float glass from one primary-glass manufacturer.
- C. **Source Limitations for Insulating Glass:** Obtain insulating-glass units from one manufacturer using the same type of glass and other components for each type of unit indicated.
- D. **Source Limitations for Glazing Accessories:** Obtain glazing accessories from one source for each product and installation method indicated.
- E. **Glass Product Testing:** Obtain glass test results for product test reports in "Submittals" Article from a qualified testing agency based on testing glass products.
  - 1. **Glass Testing Agency Qualifications:** An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.
- F. **Elastomeric Glazing Sealant Product Testing:** Obtain sealant test results for product test reports in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period.
  - 1. **Sealant Testing Agency Qualifications:** An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.
  - 2. Test elastomeric glazing sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.
- G. **Safety Glass:** Category II materials complying with testing requirements in 16 CFR 1201 and ANSI Z97.1.
  - 1. Subject to compliance with requirements, permanently mark safety glass with certification label of Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.

- H. **Glazing Publications:** Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
  - 1. **GANA Publications:** GANA'S "Glazing Manual" and "Laminated Glass Design Guide."
- I. **Pre-installation Conference:** Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. **Protect glazing materials** according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

## 1.7 WARRANTY

- A. **General Warranty:** Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

## PART 2 - PRODUCTS

### 2.1 PRODUCTS AND MANUFACTURERS

- A. **Available Products:** Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products indicated in schedules at the end of Part 3.

### 2.2 PRIMARY FLOAT GLASS

- A. **Float Glass:** ASTM C 1036, Type I (transparent glass, flat), Quality q3 (glazing select); class as indicated in schedules at the end of Part 3.

### 2.3 HEAT-TREATED FLOAT GLASS

- A. **Fabrication Process:** By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.
- B. **Heat-Treated Float Glass:** ASTM C 1048; Type I (transparent glass, flat); Quality q3 (glazing select); class, kind, and condition as indicated in schedules at the end of Part 3.

## 2.4 ELASTOMERIC GLAZING SEALANTS

- A. **General:** Provide products of type indicated, complying with the following requirements:
1. **Compatibility:** Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
  2. **Suitability:** Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
  3. **Colors of Exposed Glazing Sealants:** As selected by Architect from manufacturer's full range for this characteristic.
- B. **Elastomeric Glazing Sealant Standard:** Comply with ASTM C 920 and other requirements indicated for each liquid-applied, chemically curing sealant in the Glazing Sealant Schedule at the end of Part 3, including those referencing ASTM C 920 classifications for type, grade, class, and uses.
1. **Additional Movement Capability:** Where additional movement capability is specified in the Glazing Sealant Schedule, provide products with the capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, to withstand the specified percentage change in the joint width existing at time of installation and remain in compliance with other requirements in ASTM C 920 for uses indicated.

## 2.5 GLAZING TAPES

- A. **Back-Bedding Mastic Glazing Tape:** Preformed, butyl-based elastomeric tape with a solids content of 100 percent; non-staining and non-migrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
- B. **Expanded Cellular Glazing Tape:** Closed-cell, PVC foam tape; factory coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive; and complying with AAMA 800 for the following types:
1. Type 1, for glazing applications in which tape acts as the primary sealant.
  2. Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

## 2.6 GLAZING GASKETS

- A. **Soft Compression Gaskets:** Extruded or molded, closed-cell, integral-skinned gaskets of material indicated below; complying with ASTM C 509, Type II, black; and of profile and hardness required to maintain watertight seal:
1. Neoprene.
  2. EPDM.
  3. Silicone.
  4. Thermoplastic polyolefin rubber.
  5. Any material indicated above.

## 2.7 MISCELLANEOUS GLAZING MATERIALS

- A. **General:** Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. **Cleaners, Primers, and Sealers:** Types recommended by sealant or gasket manufacturer.
- C. **Setting Blocks:** Elastomeric material with a Shore A durometer hardness of 85, plus or minus 5.
- D. **Spacers:** Elastomeric blocks or continuous extrusions with a Shore A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. **Edge Blocks:** Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. **Cylindrical Glazing Sealant Backing:** ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

## 2.8 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

- A. **Fabricate glass and other glazing products** in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing standard, to comply with system performance requirements.
- B. **Clean-cut or flat-grind vertical edges** of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with indoor and outdoor faces.
- C. **Grind smooth and polish** exposed glass edges.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. **Examine framing glazing**, with Installer present, for compliance with the following:
  - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
  - 2. Presence and functioning of weep system.
  - 3. Minimum required face or edge clearances.
  - 4. Effective sealing between joints of glass-framing members.
- B. **Proceed with installation only after** unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. **Clean glazing channels** and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

### 3.3 GLAZING, GENERAL

- A. **Comply with combined written instructions** of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. **Glazing channel dimensions**, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.
- C. **Protect glass edges** from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- D. **Apply primers** to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.
- E. **Install setting blocks** in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. **Do not exceed edge pressures** stipulated by glass manufacturers for installing glass lites.
- G. **Provide spacers** for glass lites where the length plus width is larger than 50 inches as follows:
  - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
  - 2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- H. **Provide edge blocking** where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- I. **Set glass lites** in each series with uniform pattern, draw, bow, and similar characteristics.
- J. **Where wedge-shaped gaskets are driven** into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.



- K. **Square cut wedge-shaped gaskets** at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

### 3.4 TAPE GLAZING

- A. **Position tapes on fixed stops** so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. **Install tapes continuously**, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. **Where framing joints are vertical**, cover these joints by applying tapes to heads and sills first and then to jambs. Where framing joints are horizontal, cover these joints by applying tapes to jambs and then to heads and sills.
- D. **Place joints in tapes at corners** of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. **Do not remove release paper** from tape until just before each glazing unit is installed.
- F. **Apply heel bead** of elastomeric sealant.
- G. **Center glass lites in openings** on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. **Apply cap bead** of elastomeric sealant over exposed edge of tape.

### 3.5 GASKET GLAZING (DRY)

- A. **Fabricate compression gaskets** in lengths recommended by gasket manufacturer to fit openings exactly, with stretch allowance during installation.
- B. **Insert soft compression gasket** between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. **Center glass lites** in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. **Install gaskets** so they protrude past face of glazing stops.

### 3.6 SEALANT GLAZING (WET)

- A. **Install continuous spacers**, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. **Force sealants into glazing channels** to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. **Tool exposed surfaces** of sealants to provide a substantial wash away from glass.

### 3.7 PROTECTION AND CLEANING

- A. **Protect glass** from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.
- B. **Remove and replace glass that is broken**, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents, and vandalism, during construction period.
- C. **Wash glass** on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer.

### 3.8 MONOLITHIC FLOAT-GLASS SCHEDULE

- A. **Types:**
  - 1. Type 1: 1/4 inch Uncoated Clear Float Glass - where glass as designated below is indicated, provide Type I (transparent glass, flat), Class 1 (clear) glass lites complying with the following:
    - a. Uncoated Clear Annealed Float Glass: Annealed or Kind HS (heat strengthened), Condition A (uncoated surfaces) where heat strengthening is required to resist thermal stresses induced by differential shading of individual glass lites and to comply with performance requirements.
    - b. Uncoated Clear Heat-Strengthened Float Glass: Kind HS (heat strengthened).
    - c. Uncoated Clear Fully Tempered Float Glass: Kind FT (fully tempered). Provide as required and as indicated
  - 2. Type 2: 1/2 inch Uncoated Clear Float Glass - where glass as designated below is indicated, provide Type I (transparent glass, flat), Class 1 (clear) glass lites complying with the following:
    - a. Uncoated Clear Annealed Float Glass: Annealed or Kind HS (heat strengthened), Condition A (uncoated surfaces) where heat strengthening is required to resist thermal stresses induced by differential shading of individual glass lites and to comply with performance requirements.
    - b. Uncoated Clear Heat-Strengthened Float Glass: Kind HS (heat strengthened).
    - c. Uncoated Clear Fully Tempered Float Glass: Kind FT (fully tempered). Provide as required and as indicated

### 3.9 GLAZING SEALANT SCHEDULE

- A. **Low-Modulus Nonacid-Curing Silicone Glazing Sealant:** Where glazing sealants of this designation are indicated, provide products complying with the following:
1. Products: Available products include the following:
    - a. 790; Dow Corning.
    - b. UltraPruf SCS2300; GE Silicones.
    - c. Spectrem 1; Tremco.
  2. Type and Grade: S (single component) and NS (non-sag).
  3. Class: 25.
  4. Additional Movement Capability: 50 percent movement in extension and 50 percent movement in compression for a total of 100 percent movement.
  5. Use Related to Exposure: NT (non-traffic).
  6. Uses Related to Glazing Substrates: M, G, A, and, as applicable to glazing substrates indicated, O.
    - a. Use O Glazing Substrates: Coated glass, color anodic aluminum, aluminum coated with a high-performance coating, galvanized steel, and wood.

**END OF SECTION**

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## **DIVISION 09 – FINISHES**

Section 09 2216	Non-Structural Metal Framing
Section 09 2900	Gypsum Board
Section 09 3013	Ceramic Tile
Section 09 5100	Acoustical Ceilings
Section 09 6513	Resilient Wall Base and Accessories
Section 09 6516.23	Resilient Floor Coverings
Section 09 6813	Carpet Tile
Section 09 9123	Painting

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## SECTION 09 2216

### NON-STRUCTURAL METAL FRAMING

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. **This Section includes** non-structural metal framing members for the following applications:
  - 1. Interior framing systems (e.g., supports for partition walls, framed soffits, furring, etc.).
  - 2. Interior suspension systems (e.g., supports for ceilings, suspended soffits, etc.).
- B. **Related Sections** include the following:
  - 1. Section 07 2100 "**Building Insulation**" for insulation installed between framing members.

##### 1.3 SUBMITTALS

- A. **Product Data:** For each type of product indicated.

##### 1.4 QUALITY ASSURANCE

- A. **Fire-Test-Response Characteristics:** For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. **STC-Rated Assemblies:** For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

#### PART 2 - PRODUCTS

##### 2.1 NON-STRUCTURAL METAL FRAMING, GENERAL

- A. **Framing Members, General:** Comply with ASTM C 754 for conditions indicated.
  - 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.

##### 2.2 SUSPENSION SYSTEM COMPONENTS

- A. **Tie Wire:** ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 16 gauge 0.0625-inch- diameter wire, or double strand of 18 gauge (0.0475-inch) diameter wire.

- B. **Hanger Attachments to Concrete:**
1. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.
- C. **Wire Hangers:** ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.
- D. **Flat Hangers:** Steel sheet, minimum 1 x 3/16 inch by length indicated.
- E. **Carrying Channels:** Cold-rolled, commercial-steel sheet with a base-metal thickness of 16 gauge (0.0538 inch) and minimum 1/2-inch- wide flanges.
1. Depth: Minimum 1-1/2 inches.
- F. **Furring Channels (Furring Members):**
1. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
    - a. Minimum Base Metal Thickness: Minimum 22 gauge.
  2. Resilient Furring Channels: 1/2-inch- deep members designed to reduce sound transmission.
    - a. Subject to compliance with requirements of Contract Documents, products which may be incorporated in the Work include but are not limited to:
      - 1) ClarkDietrich Building Systems; RC Deluxe (RCSD) Resilient Channel.
- G. **Sound Clips:** Subject to compliance with requirements of Contract Documents, products which may be incorporated in the Work include but are not limited to:
1. RSIC-1; PAC International, Inc.
- H. **Grid Suspension System for Ceilings:** ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
1. **Available Products:** Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Armstrong World Industries, Inc.; Drywall Grid Systems.
    - b. Chicago Metallic Corporation.
    - c. USG Corporation; Drywall Suspension System.

### 2.3 STEEL FRAMING FOR FRAMED ASSEMBLIES

- A. **Steel Studs and Runners:** ASTM C 645.
1. Minimum Base-Metal Thickness: Minimum 20 gauge (0.0296 inch); 33 ksi.
- B. **Equivalent Gauge Steel Studs and Runners:** ASTM C 645
1. Minimum Base-Steel Thickness: 0.019 inch; 65 ksi.



- C. **Slip-Type Head Joints:**
1. **Deflection Track:** Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
    - a. **Available Products:** Subject to compliance with requirements of Contract Documents, products that may be incorporated into the Work include, but are not limited to, the following:
      - 1) Steel Network Inc. (The); VertiClip SLD/VertiTrack VTD Series.
      - 2) ClarkDietrich Building Systems, BlazeFrame or MaxTrak Slotted Deflection Track.
- C. **Flat Strap Backing Plate:** Steel sheet for blocking and bracing in length and width indicated.
1. Minimum Base-Metal Thickness: Minimum 16 gauge.
  2. Option (at Contractor's discretion): Proprietary fire-retardant wood blocking and bracing; ClarkDietrich Fire-Retardant Treated Wood Blocking Plate, D16F/D24F.
- D. **Cold-Rolled Channel Bridging:** 16 gauge bare-steel thickness, with minimum 1/2-inch wide flanges.
1. Depth: Minimum 1-1/2 inches.
  2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 14 gauge thick, galvanized steel.
- E. **Hat-Shaped, Rigid Furring Channels:** ASTM C 645.
1. Minimum Base Metal Thickness: Minimum 20 gauge.
  2. Depth: 7/8 inch.
- F. **Resilient Furring Channels:** 1/2-inch- deep, steel sheet members designed to reduce sound transmission.
1. ClarkDietrich Building Systems; RC Deluxe (RCSD) Resilient Channel
- G. **Sound Clips:** Subject to compliance with requirements of Contract Documents, products which may be incorporated in the Work include but are not limited to:
1. RSIC-1; PAC International, Inc.
- H. **Cold-Rolled Furring Channels:** 16 gauge steel thickness, with minimum 1/2-inch- wide flanges.
1. Depth: Minimum 3/4 inch.
  2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum bare-steel thickness of 22 gauge.
  3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 16 gauge diameter wire, or double strand of 0.0475-inch- diameter wire.
- I. **Z-Shaped Furring:** With nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum bare-metal thickness of 25 gauge (0.0179 inch), and depth required to fit insulation thickness indicated.

## 2.4 AUXILIARY MATERIALS

- A. **General:** Provide auxiliary materials that comply with referenced installation standards.
1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. **Examine areas and substrates**, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION, GENERAL

- A. **Installation Standard:** ASTM C 754.
  - 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. **Blocking:** Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, cabinets and casework, or similar construction.
- C. **Bracing:** Install bracing at terminations in assemblies.
- D. **Expansion Joints:** Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

### 3.3 INSTALLING SUSPENSION SYSTEMS

- A. **Install suspension system** components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.
- B. **Isolate suspension systems** from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. **Suspend hangers from building structure as follows:**
  - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
    - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  - 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
    - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by 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. **Seismic Bracing:** Sway-brace suspension systems with hangers used for support.
- F. **Grid Suspension Systems:** Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- G. **Installation Tolerances:** Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

### 3.4 INSTALLING FRAMED ASSEMBLIES

- A. **Where studs are installed directly against exterior masonry walls** or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- B. **Install studs** so flanges within framing system point in same direction.
- C. **Install tracks** (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
1. **Slip-Type Head Joints:** Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
  2. **Door Openings:** Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
    - a. Install two studs at each jamb or provide 16 gauge studs at door openings, unless otherwise indicated.
    - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
    - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
  3. **Other Framed Openings:** Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
  4. **Fire-Resistance-Rated Partitions:** Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
  5. **Sound-Rated Partitions:** Install framing to comply with sound-rated assembly indicated.
  6. **Curved Partitions:**
    - a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
    - b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of not less than 2 studs at ends of arcs, place studs 6 inches o.c.

- D. **Direct Furring:**
1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches on center
- E. **Z-Furring Members:**
1. Erect insulation (specified in Division 7 Section "Building Insulation") vertically and hold in place with Z-furring members spaced 24 inches on center
  2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches on center
  3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

**END OF SECTION**

## SECTION 09 2900

### GYPSUM BOARD

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. **This Section includes** the following:
  - 1. Interior gypsum board.
- B. **Related Sections** include the following:
  - 1. Section 07 2100 "**Building Insulation**" for insulation and vapor retarders installed in assemblies that incorporate gypsum board.
  - 2. Section 07 9200 "**Joint Sealants**" for acoustical sealants installed in assemblies that incorporate gypsum board.
  - 3. Section 09 2216 "**Non-Structural Metal Framing**" for non-structural framing and suspension systems that support gypsum board.
  - 4. Section 09 9123 "**Painting**" for **primers** applied to gypsum board surfaces.

##### 1.3 SUBMITTALS

- A. **Product Data:** For each type of product indicated.
- B. **Samples:** For the following products:
  - 1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.

##### 1.4 QUALITY ASSURANCE

- A. **Fire-Resistance-Rated Assemblies:** For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. **STC-Rated Assemblies:** For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

##### 1.5 STORAGE AND HANDLING

- A. **Store materials** inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

##### 1.6 PROJECT CONDITIONS

- A. **Environmental Limitations:** Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

- B. **Do not install interior products** until installation areas are enclosed and conditioned.
- C. **Do not install panels** that are wet, those that are moisture damaged, and those that are mold damaged.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

## PART 2 - PRODUCTS

### 2.1 PANELS, GENERAL

- A. **Size:** Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

### 2.2 INTERIOR GYPSUM BOARD

- A. **General:** Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. American Gypsum Co.
    - b. G-P Gypsum.
    - c. National Gypsum Company.
    - d. PABCO Gypsum.
    - e. USG Corporation.
- B. **Type X:**
  - 1. Thickness: 5/8 inch.
  - 2. Long Edges: Tapered.

### 2.3 TRIM ACCESSORIES

- A. **Interior Trim:** ASTM C 1047.
  - 1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
  - 2. Shapes:
    - a. Cornerbead.
    - b. Bullnose bead.
    - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
    - d. L-Bead: L-shaped; exposed long flange receives joint compound.
    - e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
    - f. Expansion (control) joint.
    - g. Curved-Edge Cornerbead: With notched or flexible flanges.

### 2.4 JOINT TREATMENT MATERIALS

- A. **General:** Comply with ASTM C 475/C 475M.
- B. **Joint Tape:**
  - 1. Interior Gypsum Wallboard: Paper.

- C. **Joint Compound for Interior Gypsum Wallboard:** For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
  - 1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
  - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
  - 3. Fill Coat: For second coat, use drying-type, all-purpose compound.
  - 4. Finish Coat: For third coat, use drying-type, all-purpose compound.

## 2.5 AUXILIARY MATERIALS

- A. **General:** Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. **Laminating Adhesive:** Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
  - 1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. **Steel Drill Screws:** ASTM C 1002, unless otherwise indicated.
  - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
  - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. **Acoustical Sealant:** As specified in Division 7 Section "Joint Sealants."
- E. **Thermal Insulation:** As specified in Division 7 Section "Building Insulation."

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. **Examine areas and substrates**, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.
- B. **Examine panels before installation.** Reject panels that are wet, moisture damaged, and mold damaged.
- C. **Proceed with installation** only after unsatisfactory conditions have been corrected.

### 3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. **Comply with ASTM C 840.**
- B. **Install ceiling panels** across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. **Install panels with face side out.** Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

- D. **Locate edge** and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. **Form control and expansion joints** with space between edges of adjoining gypsum panels.
- F. **Cover both faces** of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
  - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
  - 2. Fit gypsum panels around ducts, pipes, and conduits.
  - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- G. **Isolate perimeter** of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. **Attachment to Steel Framing:** Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

### 3.3 APPLYING INTERIOR GYPSUM BOARD

- A. **Install interior gypsum board** in the following locations:
  - 1. Type X: Vertical surfaces, unless otherwise indicated.
- B. **Single-Layer Application:**
  - 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
  - 2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
    - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
    - b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
  - 3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
  - 4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

### 3.4 INSTALLING TRIM ACCESSORIES

- A. **General:** For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. **Control Joints:** Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.



- C. **Interior Trim:** Install in the following locations:
  - 1. Cornerbead: Use at outside corners, unless otherwise indicated.
  - 2. Bullnose Bead: Use where indicated.
  - 3. LC-Bead: Use at exposed panel edges.
  - 4. L-Bead: Use where indicated.
  - 5. U-Bead: Use at exposed panel edges.
  - 6. Curved-Edge Cornerbead: Use at curved openings.
- D. **Aluminum Trim:** Install in locations indicated on Drawings.
- E. **Install corner beads** at external corners. Provide metal trim to protect edge of gypsum board wherever gypsum board intersects a dissimilar material. Hold channel and L trim back from metal window and door frames 1/8 inch to allow for caulking.

### 3.5 FINISHING GYPSUM BOARD

- A. **General:** Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. **Prefill open joints**, rounded or beveled edges, and damaged surface areas.
- C. **Apply joint tape** over gypsum board joints, except those with trim having flanges not intended for tape.
- D. **Gypsum Board Finish Levels:** Finish panels to levels indicated below:
  - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
  - 2. Level 2: Panels that are substrate for tile.
  - 3. Level 5: At all wall surfaces, except where noted otherwise above.
    - a. Primer and its application to surfaces are specified in other Division 9 Sections.

### 3.6 PROTECTION

- A. **Protect installed products** from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. **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.

### 3.7 FIELD QUALITY CONTROL

- A. **Above-Ceiling Observation:** Architect will conduct an above-ceiling observation before installing gypsum board ceilings and report deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.
  - 1. Notify Architect seven days in advance of date and time when Project, or part of Project, will be ready for above-ceiling observation.
  - 2. Before notifying Architect, complete the following in areas to receive gypsum board ceilings:
    - a. Installation of 80 percent of lighting fixtures, powered for operation.

- b. Installation, insulation, and leak and pressure testing of water piping systems.
- c. Installation of air-duct systems.
- d. Installation of air devices.
- e. Installation of mechanical system control-air tubing.
- f. Installation of ceiling support framing.

**END OF SECTION**

## SECTION 09 3013

### CERAMIC TILE

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. **This Section includes the following:**
  - 1. Porcelain mosaic floor tile
  - 2. Glazed porcelain wall tile.
  - 2. Coordinating base and trim pieces for tile.
- B. **Related Sections** include the following:
  - 1. Section 07 9200 "**Joint Sealants**" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
  - 2. Section 09 2900 "**Gypsum Board**" for tile backing panels installed in gypsum wallboard assemblies.

##### 1.3 REFERENCES

- A. **American National Standards Institute:**
  - 1. ANSI A137.1 - 2012, 'ANSI Specifications for Ceramic Tile.'
  - 2. ANSI A136 - 2013, 'ANSI Specifications for Installation of Ceramic Tile.'
- B. **Tile Council of North America:**
  - 1. TCNA Handbook, 'Handbook for Ceramic Tile Installation, current edition.'

##### 1.4 DEFINITIONS

- A. **Facial Dimension:** Nominal tile size as defined in ANSI A137.1.
- B. **Module Size:** Actual tile size (minor facial dimension as measured per ASTM C 499) plus joint width indicated.

##### 1.5 SUBMITTALS

- A. **Product Data:** For each type of tile, mortar, grout, and other products specified.
- B. **Shop Drawings:** Submit shop drawings showing location of each tile and installation method. Locate movement joints in the tile floors, indicate metal edge trim types.
- C. **Tile Samples for Verification:** Manufacturer's color charts consisting of actual tiles or sections of tiles showing the full range of colors, textures, and patterns available for each type and composition of tile indicated. Include Samples of accessories involving color selection.
- D. **Grout Samples for Selection:** Manufacturer's color charts consisting of actual sections of grout showing the full range of colors available for each type of grout indicated.

## 1.6 QUALITY ASSURANCE

- A. **Installer Qualifications:** Engage an experienced installer who has completed tile installations similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- B. **Source Limitations for Tile:** Obtain each color, grade, finish, type, composition, and variety of tile from one source with resources to provide products from the same production run for each contiguous area of consistent quality in appearance and physical properties without delaying the Work.
- C. **Source Limitations for Setting and Grouting Materials:** Obtain ingredients of a uniform quality for each waterproofing, mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.
- D. **Movement Joints:** Provide movement joints as recommended by TCNA EJ171-13 "Movement Joint Design Essentials". Space joints as recommended by TCNA method, coordinate with the Architect for precise location of joints.
  - 1. Align with any cold joints or other movement joints.
  - 2. Interior Joints: 20 to 25 feet in each direction.
  - 3. Interior Joints exposed to direct sunlight or moisture: 8 to 12 feet in each direction.
  - 4. Perimeter Joint: Where tile abuts restraining surfaces such as perimeter walls, columns, stairs and curbs.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. **Deliver and store** packaged materials **in original containers** with seals unbroken and labels intact until time of use. Comply with requirement of ANSI A137.1 for labeling sealed tile packages.
- B. **Prevent damage** or contamination to materials by water, freezing, foreign matter, and other causes.
- C. **Handle tile** with temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

## 1.8 PROJECT CONDITIONS

- A. **Environmental Limitations:** Do not install tile until construction in spaces is completed and ambient temperature and humidity conditions are being maintained to comply with referenced standards and manufacturer's written instructions.

## 1.9 EXTRA MATERIALS

- A. **Deliver extra materials to Owner.** Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
  - 1. **Tile and Trim Units:** Furnish quantity of full-size units equal to 3 percent of amount installed, for each type, composition, color, pattern, and size indicated.

## PART 2 - PRODUCTS

### 2.1 PRODUCTS

- A. **Acceptable Products:** Subject to compliance with requirements of Contract Documents, provide the following products:
1. Porcelain Mosaic Floor Tile (F6): Crossville "Notorious".
  2. Glazed Wall Tile (W2): Daltile Elevare™
- B. **ANSI Ceramic Tile Standard:** Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.
1. Provide tile complying with Standard Grade requirements, unless otherwise indicated.
  2. For facial dimensions of tile, comply with requirements relating to tile sizes specified in Part 1 "Definitions" Article.
- C. **ANSI Standards for Tile Installation Materials:** Provide materials complying with ANSI standards referenced in "Setting Materials" and "Grouting Materials" articles.
- D. **Colors, Textures, and Patterns:** Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:
1. Provide Architect's selections from manufacturer's full range of colors, textures, and patterns for products of type indicated. Also see the Finish Schedule.
  2. Provide tile trim and accessories that match color and finish of adjoining flat tile.
- E. **Factory Blending:** For tile exhibiting color variations within the ranges selected during Sample submittals, blend tile in the factory and package so tile units taken from one package show the same range in colors as those taken from other packages and match approved Samples.
- F. **Mounting:** Where factory-mounted tile is required, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless another mounting method is indicated.
1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for these kinds of installations and has a record of successful in-service performance.

### 2.2 TILE PRODUCTS

- A. **Unglazed Ceramic Mosaic Tile:**
1. Composition: Porcelain stone.
  2. Module Size: 1 x 3 inches and 2 x 3 inches (nominal).
  3. Mounting: Factory mounted in 12 x 12 inch sheets.
  4. Nominal Thickness: 10.5 mm
  5. Face: Unpolished, rectified.
  6. Colors: As indicated on Key-Finish Schedule on Drawings.

- B. **Glazed Ceramic Wall Tile:**
1. Composition: Glazed ceramic.
  2. Nominal Module Size: 6 x 18 inches
  3. Nominal Thickness: 5/16 inch
  4. Face: Glazed.
  5. Colors: As indicated on Key-Finish schedule on Drawings or, if not indicated, as selected by Architect from manufacturer's full range.
- C. **Trim Units:** Provide tile trim units to match characteristics of adjoining flat tile and to comply with the following requirements:
1. Size: As indicated, coordinated with sizes and coursing of adjoining flat tile where applicable.
  2. Shapes:
    - a. Base for Thin-Set Mortar Installations: Straight, used in conjunction with metal trims.
    - b. Wainscot Caps and External Corners for Thin-Set Mortar Installations: Straight, used in conjunction with metal trims.
    - c. Internal Corners: Field-buttet square corners, except where noted to receive metal cove trim.

## 2.4 WATERPROOFING AND CRACK ISOLATION MEMBRANE

- A. **Available Manufacturers:** Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include but are not limited to the following:
1. Manufacturer: Mapei.
  2. Product: Mapeguard UM.
- B. **Industry Standards and Approvals:**
1. ASTM C627 (Robinson): Extra Heavy Rating.
  2. ANSI: Exceeds A118.10 (Waterproofing Membrane for Thin-Set Ceramic Tile)
  3. ANSI: A118.12, Section 5.1.3 – Achieves bond strength of 50 psi or greater in 7 days per test method.
  4. ANSI: A118.12, Section 5.2.3 – Passes. Point load resistance after 28-day cure.
- C. **Properties:**
1. Compressive Strength: 0.37 N/mm<sup>2</sup>.
  2. Permeance: <0.07.
  3. Material Thickness: 1/64 inch, nominal.
  4. Membrane Height: 1/8 inch, nominal.
  5. Waterproofing Tape: Mapeguard ST, applied in accordance with manufacturer's written instructions; flood test before applying tile.

## 2.5 METAL JOINT TRIM

- A. **Acceptable Manufacturer:** Subject to compliance with requirements of Contract Documents, provided products by manufacturer listed below. If not listed, submit as substitution according to Conditions of the Contract and the provisions of Division 1 Sections.
1. Schluter Systems; [www.schluter.com](http://www.schluter.com).
- B. **Finish:** Satin anodized aluminum.
- C. **Shapes:** As indicated in Key-Finish Legend and below:
1. Base Trim: DILEX-AHK.

## 2.6 THRESHOLDS

- A. **General:** Provide thresholds that are uniform in color and finish, fabricated to sizes and profiles indicated to provide transition between tile surfaces and adjoining finished floor surfaces.
1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.
- B. **Molded Thresholds:**
1. Solid Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with the material and performance requirements of ANSI Z124.3, Type 5 or Type 6, without a pre-coated finish.
    - a. Thickness: 1/2 inch minimum.
    - b. Provide tapered front edge.
    - c. Thresholds shall be continuous between door jambs.
    - d. Provide colors as selected by Architect from manufacturer's full selection of colors.
    - e. Available Products: Subject to compliance with requirements of Contract Documents, products that may be incorporated in the Work include, but are not limited to, the following:
      - 1) Corian; DuPont Polymers.
      - 2) Solid Surfacing; Formica Corporation.
      - 3) Staron; Lotte Advanced Materials

## 2.7 SETTING MATERIALS

- A. **Primer (where required by installer to assure a warrantable installation):**
1. Basis of Design: Contract Documents are based on product specified below to establish a standard of quality. Other manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept as expressed in the Contract Documents is not changed, as judged by the Architect.
    - a. Manufacturer: Mapei; [www.mapei.com](http://www.mapei.com)
    - b. Product: "Eco Prim Grip".
  2. Properties: Solvent-free primer composed of synthetic resin in water dispersion and selected inert materials; gray latex.
- B. **Polymer-Modified Thinset Mortar:** Meet or exceed ANSI A118.4, A118.11, A118.15E and ISO C2ES1P1.
1. Basis of Design: Contract Documents are based on product specified below to establish a standard of quality. Other manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept as expressed in the Contract Documents is not changed, as judged by the Architect.
    - a. Manufacturer: Mapei; [www.mapei.com](http://www.mapei.com)
    - b. Product: "UltraFlex 3".
  2. Protection:
    - a. Install only at temperatures between 40 degrees F and 95 degrees F.
    - b. Protect from traffic for 24 hours. Protect from heavy traffic for 7 days.
    - c. Protect from frost and rain for 21 days.
    - d. Protect from water immersion for 21 days.

- C. **Polymer-Enriched Large and Heavy Tile Mortar:** A118.4HTE, A118.11 and A118.15HTE.
1. Basis of Design: Contract Documents are based on product specified below to establish a standard of quality. Other manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept as expressed in the Contract Documents is not changed, as judged by the Architect.
    - a. Manufacturer: Mapei; www.mapei.com
    - b. Product: "Large Tile and Stone Mortar".
  2. Protection:
    - a. Do not disturb the installation, allow light traffic or grout the tiles for at least 24 to 48 hours.
    - b. Protect the installation from general traffic for at least 72 hours and from heavy traffic for at least 7 days.
    - c. Protect the installation from rain for 72 hours and from freezing for 21 days.

## 2.8 GROUTING MATERIALS

- A. **Latex-Portland Cement Grout:** Meets or exceeds ANSI A118.3 and A118.6.
1. Basis of Design: Mapei Flexcolor CQ.
  2. Protection:
    - a. Use only at temperatures between 50 degrees F and 95 degrees F.
    - b. Provide for dry, heated storage on site and deliver materials at least 24 hours before tilework begins.
    - c. For at least 72 hours after completion, protect from rain and freezing, and do not immerse the installation in water.
    - d. Floors: Keep the installation free from foot traffic for at least 24 hours after grouting.
    - e. Walls: Protect the installation from impact, vibration and hammering on adjacent and opposite walls for 14 days after tile installation (see the TDS of the adhesive or setting system for details).
    - f. Because temperature and humidity (during and after installation of tile) affect the final curing time of all cement-based materials, allow for extended periods of curing and protection when temperatures drop below 60 degrees F or when the relative humidity is higher than 70 percent.
  3. Colors: As indicated on Finish Legend or, if not indicated, as selected by Architect from manufacturer's full range of colors.

## 2.9 ELASTOMERIC SEALANTS

- A. **General:** Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements of Division 7 Section "Joint Sealants."
- B. **Colors:** Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.
- C. **One-Part, Mildew-Resistant Silicone Sealant:** ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and temperature extremes.



- D. **Available Products:** Subject to compliance with requirements of Contract Documents, products which may be incorporated into the Work include, but are not limited to, the following:
1. One-Part, Mildew-Resistant Silicone Sealants:
    - a. Dow Corning 786; Dow Corning Corporation.
    - b. Sanitary 1700; GE Silicones.
    - c. Pecora 898 Sanitary Silicone Sealant; Pecora Corp.
    - d. Tremsil 600 White; Tremco, Inc.

## 2.10 MISCELLANEOUS MATERIALS

- A. **Trowelable Underlayments and Patching Compounds:** Latex-modified, Portland-cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- B. **Reinforcing for mortar bed:** 16 gage 2x2 galvanized welded wire.
- C. **Temporary Protective Coating:** Provide product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; is compatible with tile, mortar, and grout products; and is easily removable after grouting is completed without damaging grout or tile.
1. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 degrees F per ASTM D 87.
- D. **Tile Cleaner:** A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- E. **Grout Sealer:** Solvent-based, no-sheen, natural-look penetrating sealer for all sanded and non-sanded grout joints.

## 2.11 MIXING MORTARS AND GROUT

- A. **Mix mortars and grouts to comply** with referenced standards and mortar and grout manufacturers' written instructions.
- B. **Add materials and additives in accurate proportions.** Do not use or add any water to mortar or grout when mixing, use only latex additive.
- C. **Obtain and use type of mixing equipment,** mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. **Examine substrates, areas, and conditions** where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
1. Verify that substrates for setting tile are firm; dry; clean; free from oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 series of tile installation standards for installations indicated.

2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
  3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust latter in consultation with Architect.
- B. **Do not proceed with installation until** unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. **Remove coatings**, including curing compounds, and other substances that contain soap, wax, oil, or silicone and are incompatible with tile-setting materials by using a terrazzo or concrete grinder, a drum sander, or a polishing machine equipped with a heavy-duty wire brush.
- B. **Provide concrete substrates** for tile floors installed with dry-set or latex-Portland cement mortars that comply with flatness tolerances specified in referenced ANSI A108 series of tile installation standards for installations indicated.
1. Use trowelable leveling and patching compounds per tile-setting material manufacturer's written instructions to fill cracks, holes, and depressions.
  2. Remove protrusions, bumps, and ridges by sanding or grinding.
  3. Apply troweled waterproofing membranes prior to the application of any leveling or patching compound.
- C. **Blending:** For tile exhibiting color variations within the ranges selected during Sample submittals, verify that tile has been blended in the factory and packaged so tile units taken from one package show the same range in colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

### 3.3 INSTALLATION, GENERAL

- A. **ANSI Tile Installation Standards:** Comply with parts of ANSI A108 series of tile installation standards in "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.
- B. **TCNA Installation Guidelines:** TCNA's "Handbook for Ceramic Tile Installation." Comply with TCNA installation methods indicated in ceramic tile installation schedules.
- C. **Extend tile work into recesses** and under or behind equipment and fixtures to form a complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- D. **Accurately form** intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- E. **Jointing Pattern:** Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are the same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.
1. For tile mounted in sheets, make joints between tile sheets the same width as joints within tile sheets so joints between sheets are not apparent in finished work.

- F. **Movement Joints:** Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where occur by field verification or as indicated on the construction drawings. If not indicated, then as recommended by TCNA guidelines, during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
1. Locate joints in tile surfaces directly above joints in concrete substrates.
  2. Prepare joints and apply sealants to comply with requirements of Division 7 Section "Joint Sealants."
- G. **Grout tile** to comply with the requirements of the following tile installation standards:
1. For ceramic tile grouts (sand-Portland cement, dry-set, commercial Portland cement, and latex-Portland cement grouts), comply with ANSI A108.10.

### 3.4 WALL TILE INSTALLATION

- A. **Install** types of tile designated for wall installations to comply with requirements in the Ceramic Tile Wall Installation Schedule, including those referencing TCNA installation methods and ANSI setting-bed standards.
1. Installation Methods:
    - a. Tile over glass mat tile backer panels - Interior Surfaces: TCNA W245.
- B. **Joint Widths:** Install tile on walls with the following joint widths, except as recommended otherwise by tile manufacturer:
1. Ceramic Tile: 1/16 inch.
  2. Wall Tile: 1/16 inch.
- C. **Back Buttering:** For installations indicated, obtain 100 percent mortar coverage by complying with applicable special requirements for back buttering of tile in referenced ANSI A108 series of tile installation standards:
1. Tile wall installations in wet areas, including showers.
  2. Tile wall installations composed of tiles 8 by 8 inches or larger.
- D. **Apply two (2) coats of grout sealer** in accordance with manufacturer's printed instructions and recommendations. Remove sealer remaining on the tile within 3 to 5 minutes of application.

### 3.5 CLEANING AND PROTECTING

- A. **Cleaning - New Tile:** On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
1. Remove latex-Portland cement grout residue from tile as soon as possible.
  2. Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Protect metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning. Flush surface with clean water before and after cleaning.
  3. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to brick and grout manufacturer. Trap and remove coating to prevent it from clogging drains.
- B. **Cleaning - Existing Tile:** Where directed by Architect, engage professional service to thoroughly clean existing tile. Service shall extract embedded contamination and apply new surface treatment which seals tile and grout surfaces without changing color of tile or grout. Protect adjoining surfaces from cleaning products.

- C. **Finished Tile Work:** Leave finished installation clean and free of cracked, chipped, broken, unbonded, and otherwise defective tile work.
- D. **Provide final protection and maintain conditions** in a manner acceptable to manufacturer and Installer which ensure tile is without damage or deterioration at the time of Substantial Completion.
- E. **When recommended by tile manufacturer,** apply a protective coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.
- F. **Prohibit foot and wheel traffic** from tiled floors for at least 7 days after grouting is completed.
- G. **Before final inspection,** remove protective coverings and rinse neutral cleaner from tile surfaces.

**END OF SECTION**

## SECTION 09 5100

### ACOUSTICAL CEILINGS

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

##### 1.2 SUMMARY

- A. Section **includes acoustical ceiling tile, suspension system and accessories.**
- B. **Related Sections**
  - 1. Section 09 2216 "**Non-Structural Metal Framing**" for suspension system for gypsum ceilings.
  - 2. Section 09 2900 "**Gypsum Board**" for hard surface ceilings.

##### 1.3 SUBMITTALS

- A. **Product Data:** Manufacturer's product specifications and installation instructions for each acoustical ceiling material required, and for each suspension system, including certified laboratory test reports and other data as required to show compliance with these specifications.
  - 1. Include manufacturer's recommendations for cleaning and refinishing acoustical units, including precautions against materials and methods which may be detrimental to finishes and acoustical performances.
- B. **Samples:** Set of 6 inch x 4 inch samples for each acoustical unit required, showing full range of exposed color and texture to be expected in completed work.
  - 1. Set of 12 inch long samples of each exposed runner and molding.
  - 2. Verify match to existing acoustical panels and other components before proceeding with Work.

##### 1.3 QUALITY ASSURANCE

- A. **Installer Qualifications:** Firm with not less than three years of successful experience in installation of acoustical ceilings similar to requirements for this project and which is acceptable to manufacturer of acoustical units, as shown by current written statement from manufacturer.
- B. **Fire Performance Characteristics:** Provide acoustical ceiling components that are identical to those tested for the following fire performance characteristics, according to ASTM test method indicated, by UL or other testing and inspecting agency acceptable to authorities having jurisdiction. Identify acoustical ceiling components with appropriate marking of applicable testing and inspecting agency.
  - 1. Surface Burning Characteristics: As follows, tested per ASTM E 84.
    - a. Flame Spread: 25 or less.
    - b. Smoke Developed: 50 or less.

2. **Fire Resistance Ratings:** As indicated by reference to design designation in UL "Fire Resistance Directory" or "FM Approval Guide", for floor, roof or beam assemblies in which acoustical ceilings function as a fire protective membrane; tested per ASTM E 119. Provide protection materials for lighting fixtures and air ducts to comply with requirements indicated for rated assembly.
- C. **Seismic Standard:** Provide acoustical panel ceilings designed and installed to withstand the effects of earthquake motions according to the following:
  1. CISCA's Guidelines for Systems Requiring Seismic Restraint: Comply with CISCA's "Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies--Seismic Zones 3 & 4."
- D. **Coordination of Work:** Coordinate layout and installation of acoustical ceiling units and suspension system components with other work supported by or penetrating through, ceilings, including light fixtures, HVAC equipment, fire-suppression system components (if any), and partition system (if any).

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. **Deliver acoustical ceiling units** to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination or other causes.
- B. **Before installing acoustical ceiling units**, permit them to reach room temperature and stabilized moisture content.
- C. **Handle acoustical ceiling units carefully** to avoid chipping edges or damaging units in any way.

#### 1.5 PROJECT CONDITIONS

- A. **Space Enclosure:** Do not install interior acoustical ceilings until space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above ceilings completed, and ambient conditions of temperature and humidity will be continuously maintained at values near those indicated for final occupancy.

#### 1.6 EXTRA MATERIALS

- A. **Extra Stock:** Deliver stock of maintenance material to Owner. Furnish maintenance material matching products installed, packaged with protective covering for storage and identified with appropriate labels.
  1. Acoustical Ceiling Units: Furnish quantity of full size units equal to 2 percent of amount installed.
  2. Exposed Suspension Components: Furnish quantity of each exposed component required for actual installation equal to 2 percent of amount installed.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. **Acceptable Manufacturer:** Subject to compliance with requirements of Contract Documents, provide products by the following:
  1. Manufacturer: Armstrong World Industries.

2. Products:
  - a. Acoustic Panels: Ultima, Item No. 1913.
  - b. Suspension System: Prelude XL 15/16 inch grid.
  - c. Edge Trim: Classic Axiom; sizes as shown on Drawings.
  - d. Seismic Clips: BERCC.

## 2.2 MATERIALS

### A. Acoustical Ceiling Units:

1. General: Provide manufacturer's standard units of configuration indicated which are prepared for mounting method designated and which comply with FS SS-S-118 requirements, including those indicated by reference to type, form, pattern, grade (NRC or NIC's as applicable), light reflectance coefficient (LR), edge detail, and joint detail (if any).
2. Mounting Method for Measuring NRC: No. 7 (mechanically mounted on special metal support), FS SS-S-118; or Type E-400 mounting as per ASTM E 795.
3. Sound Attenuation Performance: Provide acoustical ceiling units with ratings for ceiling sound transmission class (STC) of range indicated as determined according to AMA 1-II "Ceiling Sound Transmission Test by Two-Room Method" with ceilings continuous at partitions and supported by a metal suspension system of type appropriate for ceiling unit of configuration indicated (concealed for tile, exposed for panels).

### B. Ceiling Type A:

1. Size: 24 inches x 48 inches x 3/4 inch.
2. Edge: Square lay-in.
3. CAC: 35.
4. LR: 0.90.
5. NRC: 0.75.
6. ASTM E1264 Classification: Type IV, Form 2, Pattern E.
7. Composition: Wet-formed mineral fiber with DuraBrite® acoustically transparent membrane; CAC backing.

### C. Suspension System: Provide metal suspension systems of type, structural classification and finish indicated which comply with applicable ASTM C 635 requirements.

1. Finishes and Colors: Provide manufacturer's standard finish for type of system indicated, unless otherwise required. For exposed suspension members and accessories with painted finish, provide color indicated or, if not otherwise indicated, as selected by Architect from manufacturer's full range of standard colors.
2. Attachment Devices: Size for 5 times design load indicated in ASTM C 635, Table 1, Direct Hung.
3. Hanger Wire: Galvanized carbon steel wire, ASTM A 641, soft temper, pre-stretched, Class 1 coating, sized so that stress at 3- times hanger design load (ASTM C 635, Table 1, Direct Hung), will be less than yield stress of wire, but provide not less than 12 gage.
4. Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material and finish as that used for exposed flanges of suspension system runners.
  - a. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
  - b. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

5. Hold-Down Clips: Minimum 24 gauge spring steel, 1-7/16 inches deep x 7/8 inches wide, designed to fit over cross tees. Provide clips spaced symmetrically 2 ft. o.c.
6. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces. Struts will be required at 12 feet on center both ways for all suspended ceilings according to UBC Standard 25-2. (Seismic calculations have been done which require rigid struts as 12 feet on center in order to allow for 7/8 inch perimeter wall molding in lieu of a 2 inch perimeter wall mold.) In lieu of compression struts provide a seismic clip with an ES Report number from ICC demonstrating that the compression struts and the 2 inch perimeter wall mold are not required.
7. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, pre-painted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653, not less than G30 coating designation, with pre-finished 15/16-inch- wide metal caps on flanges.
  - a. Structural Classification: Heavy-duty system.
  - b. End Condition of Cross Runners: Override type.
  - c. Face Design: Flat, flush.
  - d. Cap Material: Steel or aluminum cold-rolled sheet.
  - e. Cap Finish: Painted in color as selected from manufacturer's full range.

**D. Miscellaneous Materials:**

1. **Acoustical Sealant:** Resilient, non-staining, non-shrinking, non-hardening, non-skinning, non-drying, non-sag sealant intended for interior sealing of concealed construction joints.
  - a. Available Products: Subject to compliance with requirements of Contract Documents, products which may be incorporated into the Work include but are not limited to, the following:
    - 1) Tremco Acoustical Sealant; Tremco.
    - 2) USG Acoustical Sealant; United States Gypsum Co.
    - 3) Chem-Calk 600; Woodmont Products, Inc.
    - 4) Pecora Corp; AC 20 FTR Acoustical and Insulation Sealant
2. **Edge Trim:**
  - a. Basis of Design: Classic Axiom.
  - b. Trim Height: 4 inches.
  - c. Finish: As selected by Architect from manufacturer's full range of custom colors.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. **Coordination:** Furnish layouts for inserts, clips, or other supports required to be installed by other trades for support of acoustical ceilings.
  1. Furnish concrete inserts, steel deck hanger clips and similar devices to other trades for installation well in advance of time needed for coordination of other work.
- B. **Layout:** Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less-than-half width units at borders, and comply with reflected ceiling plans wherever possible.



### 3.2 INSTALLATION

- A. **General:** Install materials in accordance with manufacturer's printed instructions, and to comply with governing regulations, fire resistance rating requirements as indicated, and industry standards applicable to work.
- B. **Arrange acoustical units** and orient directionally-patterned units (if any) in manner shown by reflected ceiling plans.
  - 1. Install tile with pattern running in one direction.
- C. **Install suspension systems to comply with ASTM C 636**, with hangers supported only from building structural members. Locate hangers not less than 6 inches from each end and spaced 4'-0" along each carrying channel or direct-hung runner, unless otherwise indicated, leveling to tolerance of 1/8 inch in 12'-0". Comply with detail on drawings for seismic bracing.
- D. **Secure wire hangers** by looping and wire-tying, either directly to structures or to inserts, eye-screws, or other devices which are secure and appropriate for substrate, and which will not deteriorate or fail with age or elevated temperatures.
  - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum which are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal force by bracing, countersplaying or other equally effective means.
- E. **Install hangers** of type indicated at perimeter of acoustical ceiling area and at locations where necessary to conceal edges of acoustical units.
  - 1. Screw-attach moldings to substrate at intervals not over 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to tolerance of 1/8 inch in 12'-0". Miter corners accurately and connect securely.
- F. **Install acoustical panels** in coordination with suspension system, with edges concealed by support of suspension members. Scribe and cut panels to fit accurately at borders and at penetrations.
  - 1. Paint cut and exposed edges of acoustical tile.
  - 2. Install hold-down clips in areas indicated, and in areas where required by governing regulations or for fire-resistance ratings; space as recommended by panel manufacturer, unless otherwise indicated or required.

### 3.3 ADJUST AND CLEAN

- A. **Clean exposed surfaces** of acoustical ceilings, including trim, edge moldings, and suspension members; comply with manufacturer's instructions for cleaning and touch-up of minor finish damage. Remove and replace work which cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

**END OF SECTION**

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## SECTION 09 6513

### RESILIENT WALL BASE AND ACCESSORIES

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. This **Section includes** resilient wall base and accessories.
- B. **Related Sections:**
  - 1. **Key-Finish** on Drawings for color.

##### 1.3 SUBMITTALS

- A. **Product Data:** For each type of product indicated.
- B. **Samples for Initial Selection:** For each type of product indicated.
- C. **Samples for Verification:**
  - 1. **Resilient Wall Base and Accessories:** Manufacturer's standard-size samples, but not less than 12 inches long, of each resilient product color and pattern required.

##### 1.4 QUALITY ASSURANCE

- A. **Fire-Test-Response Characteristics:** Provide products identical to those tested for fire-exposure behavior per test method indicated by a testing and inspecting agency acceptable to authorities having jurisdiction.

##### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. **Store resilient products and installation materials in dry spaces** protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 degrees F or more than 90 degrees F. Store tiles on flat surfaces.

##### 1.6 PROJECT CONDITIONS

- A. **Maintain temperatures within range recommended by manufacturer**, but not less than 70 degrees F or more than 95 degrees F, in spaces to receive floor tile during the following time periods:
  - 1. 48 hours before installation.
  - 2. During installation.
  - 3. 48 hours after installation.
- B. **After post-installation period**, maintain temperatures within range recommended by manufacturer, but not less than 55 degrees F or more than 95 degrees F.

- C. **Close spaces to traffic during floor covering installation.**
- D. **Close spaces to traffic for 48 hours after floor covering installation.**
- E. **Install resilient products after other finishing operations**, including painting, have been completed.

## 1.7 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. Resilient Wall Base and Accessories: Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

## PART 2 - PRODUCTS

### 2.1 RESILIENT WALL BASE

- A. **Acceptable Manufacturers:** Subject to compliance with requirements of Contract Documents, provide products by manufacturers listed below. If not listed, submit as a substitution according to the Contract Documents and the provisions of Division 1 Sections.
  - 1. Manufacturer: Tarkett (Johnsonite).
  - 2. Product: Baseworks.
- B. **Properties:** ASTM F 1861
  - 1. Type (Material Requirement): TS (rubber, thermoset).
  - 2. Group (Manufacturing Method): 1.
  - 3. Style - Standard: Coved.
  - 4. Minimum Thickness: 0.125 inch.
  - 5. Height: 4 inches (or as required to match existing).
  - 6. Lengths: Coils in manufacturer's standard length.
  - 7. Outside Corners: Field formed.
  - 8. Inside Corners: Field formed.
  - 9. Surface: Smooth.
  - 10. Colors: As indicated on Key-Finish or, if not indicated, as selected by Architect from manufacturer's full range.

### 2.2 RESILIENT MOLDING ACCESSORY

- A. **Acceptable Manufacturers:** Subject to compliance with requirements of Contract Documents, provide products by manufacturers listed below. If not listed, submit as a substitution according to the Contract Documents and the provisions of Division 1 Sections.
  - 1. Tarkett (Johnsonite).
- B. **Applications, including but not limited to:**
  - 1. Carpet edge for glue-down applications
  - 2. Nosing for carpet
  - 3. Nosing for resilient floor covering.
  - 4. Reducer strip for resilient floor covering
  - 5. Joiner for tile and carpet.
- C. **Material:** Rubber.

- D. **Colors:** Coordinate with adjacent finishes; final colors as selected by Architect from manufacturer's full range.

## 2.3 INSTALLATION MATERIALS

- A. **Adhesives:** Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. **Examine substrates**, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.
  - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
  - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. **Prepare substrates** according to manufacturer's written recommendations to ensure adhesion of resilient products.
- B. **Concrete Substrates:** Prepare according to ASTM F 710.
  - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
  - 2. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
  - 3. Moisture Testing:
    - a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lbs. of water/1000 square feet in 24 hours.
    - b. Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
- C. **Remove substrate coatings and other substances that are incompatible** with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
- D. **Use trowelable leveling and patching compound** to fill cracks, holes, and depressions in substrates.
- E. **Move resilient products and installation materials into spaces** where they will be installed at least 48 hours in advance of installation.
  - 1. Do not install resilient products until they are same temperature as space where they are to be installed.
- F. **Sweep and vacuum clean substrates** to be covered by resilient products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.3 RESILIENT WALL BASE INSTALLATION

- A. **Apply wall base** to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- B. **Install wall base in lengths as long as practicable** without gaps at seams and with tops of adjacent pieces aligned.
- C. **Tightly adhere wall base to substrate** throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- D. **Do not stretch wall base** during installation.
- E. **On masonry surfaces or other similar irregular substrates**, fill voids along top edge of wall base with manufacturer's recommended adhesive filler material.

### 3.4 RESILIENT ACCESSORY INSTALLATION

- A. **Resilient Molding Accessories:** Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor coverings that would otherwise be exposed.

### 3.5 CLEANING AND PROTECTION

- A. **Perform the following operations immediately after** completing resilient product installation:
  - 1. Remove adhesive and other blemishes from exposed surfaces.
  - 2. Sweep and vacuum surfaces thoroughly.
  - 3. Damp-mop surfaces to remove marks and soil.
    - a. Do not wash surfaces until after time period recommended by manufacturer.
- B. **Protect resilient products** from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer..

**END OF SECTION**

## SECTION 09 6516.23

### RESILIENT FLOOR COVERINGS

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. This **Section includes**:
  - 1. Vinyl sheet floor coverings, including integral covered base.
  - 2. Luxury vinyl tile (LVT).
- B. **Related Sections**:
  - 1. **Key-Finish** on Drawings for color and installation pattern.
  - 2. Section 09 6513.13 "**Resilient Wall Base and Accessories**" for resilient wall base, stair treads, reducer strips, and other accessories installed with vinyl and rubber tile floor coverings.

##### 1.3 SUBMITTALS

- A. **Product Data**: For each type of product indicated.
- B. **Shop Drawings**:
  - 1. Show locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
  - 2. Show details of special patterns.
- C. **Samples**: For each type of linoleum floor covering indicated.
  - 1. Include similar samples of installation accessories involving color selection.
  - 2. Heat-Welding Bead: Include manufacturer's standard-size Samples, but not less than 9 inches long, of each color required.
- D. **Heat-Welded Seam Samples**: For each flooring product and welding bead color and pattern combination required; with seam running lengthwise and in center of 6-by-9-inch Sample applied to rigid backing and prepared by Installer for this Project.
- E. **Maintenance Data**: For floor coverings to include in maintenance manuals.

##### 1.4 QUALITY ASSURANCE

- A. **Installer Qualifications**: A qualified installer who employs workers for this Project that are competent in techniques required by manufacturer for floor covering installation indicated.
- B. **Fire-Test-Response Characteristics**: Provide products identical to those tested for fire-exposure behavior per test method indicated by a testing and inspecting agency acceptable to authorities having jurisdiction.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. **Store floor coverings and installation materials** in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 degrees F or more than 90 degrees F.

## 1.6 PROJECT CONDITIONS

- A. **Maintain temperatures** within range recommended by manufacturer, but not less than 70 degrees F or more than 95 degrees F, in spaces to receive floor tile during the following time periods:
  - 1. 72 hours before installation.
  - 2. During installation.
  - 3. 72 hours after installation.
- B. **After post-installation period**, maintain temperatures within range recommended by manufacturer, but not less than 55 degrees F or more than 95 degrees F.
- C. **Close spaces to traffic during** floor covering installation.
- D. **Close spaces to traffic for 72 hours after** floor covering installation.
- E. **Install floor coverings after other finishing operations**, including painting, have been completed.

## 1.7 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. **Sheet Goods:** Furnish not less than 10 linear feet in full roll width for every 500 linear feet or fraction thereof, in roll form and in full roll width, of each different type, color, and pattern of sheet floor covering installed.

## PART 2 - PRODUCTS

### 2.1 SHEET VINYL FLOOR COVERING

- A. **Acceptable Manufacturer:** Subject to compliance with requirements of Contract Documents, provide products by the following manufacturer.
  - 1. Manufacturer: Mannington Commercial
  - 2. Products: Biospec SR.
- B. **Colors and Patterns:** As indicated on Key-Finish Schedule on Drawings.
- C. **Sheet Floor Covering:** Complying with ASTM F 1913, Type 1, Grade 1, Class B, and consisting of a urethane wear layer with aluminum oxide, cured by ultraviolet process. Patterns and colors shall extend through entire wear-layer thickness.
  - 1. **Roll Size:** In manufacturer's standard length by not less than 78 inches wide.



- D. **Seaming Method:** Heat welded.
- E. **Overall Thickness:** 0.080 inch.
- F. **Fire-Test-Response Characteristics:**
  - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm per ASTM E 648.

## 2.2 LUXURY VINYL TILE (SOLID VINYL)

- A. **Available Manufacturers:** Subject to compliance with requirements of Contract Documents, manufacturers offering products which may be incorporated into the Work include, but are not limited to, the following:
  - 1. Manufacturer: Shaw Contract; Shaw Industries Group, a Berkshire Hathaway company.
  - 2. Product: Solitude #0684V.
- B. **Tile Standards:** ASTM F 1700.
  - 1. Class: Class III printed film vinyl tile.
  - 2. Type: B, smooth surface; finish: UV-cured polyurethane.
  - 3. Overall Thickness: 0.197 inch.
  - 4. Wear Layer Thickness: 0.020 inch.
  - 5. Size: 6 inches W x 48 inches L.
  - 6. Finish: ExoGuard quartz enhanced urethane.
  - 7. Edge: Square.
- C. **Colors and Patterns:** As listed in the Key-Finish Schedule or if not listed in the finish schedule then as selected by the Architect from the manufacturer's full range of colors. Coordinate with the Architect for the pattern.

## INSTALLATION MATERIALS

- A. **Trowelable Leveling and Patching Compounds:** Latex-modified, Portland cement based or blended hydraulic cement based formulation provided or approved by floor covering manufacturer for applications indicated.
- B. **Adhesives:** Water-resistant type recommended by floor covering manufacturer for products and substrate conditions indicated.
- C. **Heat-Welding Bead:** Solid-strand product of sheet floor covering manufacturer.
  - 1. Color: Match floor covering.
- D. **Coved Base Accessories:** Cove forms and cap pieces, as selected by Architect from manufacturer's full range.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. **Examine substrates**, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.
  - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor coverings.
  - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. **Prepare substrates** according to manufacturer's written recommendations to ensure adhesion of floor coverings.
- B. **Concrete Substrates:** Prepare according to ASTM F 710.
  - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
  - 2. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
  - 3. Moisture Testing:
    - a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb. of water/1000 sq. ft. in 24 hours.
    - b. Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
- C. **Remove substrate coatings and other substances** that are incompatible with floor covering adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
- D. **Use trowelable leveling and patching compound** to fill cracks, holes, and depressions in substrates.
- E. **Move floor coverings and installation materials** into spaces where they will be installed at least 72 hours in advance of installation.
  - 1. Do not install floor coverings until they are same temperature as space where they are to be installed.
- F. **Sweep and vacuum clean substrates** to be covered by floor coverings immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.3 INSTALLATION, GENERAL

- A. **Scribe and cut floor coverings** to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings.

- B. **Extend floor coverings** into toe spaces, door reveals, closets, and similar openings.
- C. **Maintain reference markers**, holes, or openings that are in place or marked for future cutting by repeating on floor coverings as marked on subfloor. Use chalk or other nonpermanent marking device.
- D. **Install floor coverings** on covers for telephone and electrical ducts and similar items in finished floor areas. Maintain overall continuity of color and pattern with pieces of floor coverings installed on covers. Tightly adhere floor covering edges to substrates that abut covers and to cover perimeters.
- E. **Adhere floor coverings to substrates** using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

### 3.4 SHEET FLOOR COVERING INSTALLATION

- A. **Unroll sheet floor coverings** and allow them to stabilize before cutting and fitting.
- B. **Lay out sheet floor coverings** as follows:
  - 1. Maintain uniformity of floor covering direction.
  - 2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in floor covering substrates.
  - 3. Match edges of floor coverings for color shading at seams.
  - 4. Avoid cross seams.
  - 5. Eliminate deformations that result from hanging method used during drying process (stove bar marks).
- C. **Integral-Flash-Cove Base**: Cove flooring to dimension indicated up vertical surfaces. Support flooring at horizontal and vertical junction with cove strip. Butt at top against cap strip.
- D. **Heat-Welded Seams**: Comply with ASTM F 1516. Rout joints and use welding bead to permanently fuse sections into a seamless floor covering. Prepare, weld, and finish seams to produce surfaces flush with adjoining floor covering surfaces.

### 3.5 CLEANING AND PROTECTION

- A. **Perform the following operations** immediately after installing floor coverings:
  - 1. Remove adhesive and other surface blemishes from floor covering surfaces.
  - 2. Sweep and vacuum floor coverings thoroughly.
  - 3. Damp-mop floor coverings to remove marks and soil.
    - a. Do not wash floor coverings until after time period recommended by manufacturer.

- B. **Protect floor coverings** against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods indicated or recommended in writing by manufacturer.
1. Apply protective floor polish when recommended by flooring manufacturer or as directed by Architect to surfaces that are free of soil, visible adhesive, and surface blemishes.
    - a. Seal as recommended by manufacturer but with not less than three coats of floor polish.
    - b. Use commercially available product acceptable to manufacturer.
    - c. Coordinate selection of floor polish with Owner's maintenance service.
  2. Cover vinyl and rubber floor coverings with "Ram Board" heavy duty protective covering until inspection for Substantial Completion.
  3. Do not move heavy and sharp objects directly over floor covering surfaces. Place plywood or hardboard panels over floor coverings and under objects while they are being moved. Slide or roll objects over panels without moving panels.

**END OF SECTION**

## SECTION 09 6813

### CARPET TILE

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. This **Section includes** modular, fusion-bonded carpet tile.
- B. **Related Sections** include the following:
  - 1. **Key-Finish** on Drawings for colors and installation pattern.
  - 2. Section 09 6513 "**Resilient Wall Base and Accessories**" for resilient wall base and accessories installed with carpet tile.

##### 1.3 SUBMITTALS

- A. **Product Data:** For each type of product indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance. Include installation recommendations for each type of substrate.
- B. **Shop Drawings:** Show the following:
  - 1. Carpet tile type, color, and dye lot.
  - 2. Type of subfloor.
  - 3. Type of installation.
  - 4. Pattern of installation.
  - 5. Pattern type, location, and direction.
  - 6. Pile direction.
  - 7. Type, color, and location of insets and borders.
  - 8. Type, color, and location of edge, transition, and other accessory strips.
  - 9. Transition details to other flooring materials.
- C. **Samples:** For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
  - 1. Carpet Tile: Full-size Sample.
  - 2. Exposed Edge, Transition, and other Accessory Stripping: 12-inch- long Samples.
  - 3. Edge Binding Tape: 12-inch- long Samples.
- D. **Product Schedule:** For carpet tile. Use same designations indicated on Drawings.
- E. **Product Test Reports:** Based on evaluation of comprehensive tests performed by a qualified testing agency.

- F. **Maintenance Data:** For carpet tiles to include in maintenance manuals. Include the following:
1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
  2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.
- G. **Warranty:** Special warranty specified in this Section.

#### 1.4 QUALITY ASSURANCE

- A. **Installer Qualifications:** An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.
- B. **Fire-Test-Response Characteristics:** Provide products with the critical radiant flux classification indicated in Part 2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
1. Provide certification that carpet has been tested to NFPA Standard 253.
  2. Carpet products in corridors, exit enclosures, and exit passageways: Class I (0.45 watt/cm<sup>2</sup>).
  3. Carpet products in all rooms in Group B occupancy: Class II (0.22 watts/cm<sup>2</sup>).
- C. **Product Options:** Products and manufacturers named in Part 2 establish requirements for product quality in terms of appearance, construction, and performance. Other manufacturers' products comparable in quality to named products and complying with requirements may be considered.
- D. **Pre-installation Conference:** Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to carpet tile installation including, but not limited to, the following:
1. Review delivery, storage, and handling procedures.
  2. Review ambient conditions and ventilation procedures.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. **Comply** with CRI 104 "Standard for Installation of Commercial Carpet 2015", Section 4.0 "Storage and Handling."

#### 1.6 PROJECT CONDITIONS

- A. **Comply** with CRI 104 "Standard for Installation of Commercial Carpet 2015", Section 7.0, "Site Conditions."
- B. **Environmental Limitations:** Do not install carpet tiles until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- C. **Do not install carpet tiles** over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

## 1.7 WARRANTY

- A. **Special Warranty for Carpet Tiles:** Manufacturer's standard form in which manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
  2. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, dimensional stability, and delamination.
  3. Warranty Period: Lifetime Commercial Limited.

## 1.8 EXTRA MATERIALS

- A. **Furnish extra materials** described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 square yard.

## PART 2 - PRODUCTS

### 2.1 CARPET TILE

- A. **Acceptable Products:** Subject to compliance with requirements of Contract Documents, provide products listed below. If not listed, submit as a substitution according to the Conditions of the Contract and provisions of Division 1 sections.
1. Carpet F-1: Shaw Contract Group; Hand Drawn Collection, "Stipple Tile", 5T116.
    - a. Construction: Multi-level pattern cut/loop.
    - b. Size: 18 x 36 inches.
    - c. Fiber Product: Eco-solution Q® premium branded nylon.
    - d. Protective treatments: S.S.P® Shaw Soil Protection.
    - e. Gauge: 1/12 inch.
    - f. Stitches per inch: 8.5 per inch.
    - g. Finished Pile Thickness: 0.108 inches.
    - h. Average Density: 6667.
    - i. Dye Method: 100 percent solution dyed.
    - j. Secondary Backing: EcoWorx® tile.
    - k. Warranty: Lifetime Commercial Limited.
- B. **Color:** As noted on Key - Finish Schedule on Drawings or, if not noted, as selected by Architect from manufacturer's full range.

### 2.2 INSTALLATION ACCESSORIES

- A. **Trowelable Leveling and Patching Compounds:** Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.
- B. **Adhesives:** Water-resistant, mildew-resistant, non-staining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. **Examine substrates**, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.
- B. **Concrete Subfloors:** Verify that concrete slabs comply with ASTM F 710 and the following:
  - 1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.
  - 2. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
- C. **Proceed with installation** only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. **General:** Comply with CRI "Carpet Installation Standard 2011", Sections 7, 8 and 9 and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.
- B. **Use trowelable leveling and patching compounds**, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider and protrusions more than 1/32 inch, unless more stringent requirements are required by manufacturer's written instructions.
- C. **Remove coatings**, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.
- D. **Broom and vacuum clean substrates** to be covered immediately before installing carpet tile.

### 3.3 INSTALLATION

- A. **General:** Comply with CRI 104 "Standard for Installation of Commercial Carpet 2015", Section 13, "Direct Glue-Down." and with carpet tile manufacturer's written installation instructions.
- B. **Installation Method:** Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.
- C. **Maintain dye lot integrity.** Do not mix dye lots in same area.
- D. **Cut and fit carpet tile to butt tightly** to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.



- E. **Extend carpet tile into toe spaces**, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- F. **Maintain reference markers**, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, non-staining marking device.
- G. **Install pattern parallel** to walls and borders. Install in pattern as indicated in Key-Finish.

### 3.4 CLEANING AND PROTECTION

- A. **Perform the following operations** immediately after installing carpet tile:
  - 1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
  - 2. Remove yarns that protrude from carpet tile surface.
  - 3. Vacuum carpet tile using commercial machine with face-beater element.
- B. **Protect carpet tile** against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

**END OF SECTION**

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## SECTION 09 9123

### PAINTING

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

##### 1.2 SUMMARY

- A. **Section includes** exterior and interior painting work. Work includes, but is not limited to painting the following:
1. Exterior handrails and other exposed metal.
  2. Metal doors, metal door frames, grilles, frames and fire extinguisher cabinet doors.
  3. Interior walls and ceilings.
  4. Interior concrete floors.
  5. Interior wood including but not limited to trim, moldings and miscellaneous items.
  6. Work includes field painting of exposed bare and covered pipes and ducts (including color coding), and of hangers, exposed steel and iron work, plug mold, electric panels, and primed metal surfaces of equipment installed under mechanical and electrical work, except as otherwise indicated.
- B. **Related Sections:**
1. Finish Legend on Drawings for product selections and colors.
  2. Shop Primers: Unless otherwise specified, shop priming of ferrous metal items is included under various sections for structural steel, metal fabrications, hollow metal work and similar items.
    - a. Unless otherwise specified, shop priming of fabricated components such as architectural woodwork, wood casework and shop-fabricated or factory-built mechanical and electrical equipment or accessories is included under other sections of these specifications.
    - b. Comply with PDCA Standard P15 "Painting of Shop Primed Substrates"
- C. **"Paint"** as used herein means all coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.
- D. **Gloss and Sheen Definitions** shall determine the equivalency of the desired finish luster when described in the construction documents by a traditional name instead of gloss units due to the wide variance of sheen descriptions available from manufacturer to manufacturer. Gloss shall be determined by ASTM D523 - 08 Standard Test Method for Specular Gloss.
1. Flat: Refers to a lusterless or matte finish with a gloss range below 5 units when measured with a 60 degree meter and no more than 10 units measured at an 85 degree meter.
  2. Low-Sheen: Refers to a velvet-like finish with a gloss range below 10 units when measured with a 60 degree meter and between 10-35 units measured at an 85 degree meter.
  4. Satin: Refers to low-to-medium range finish with a gloss range between 20-35 units when measured with a 60 degree meter and at least 35 units measured at an 85 degree meter.

5. Semi-Gloss: Refers to a medium sheen finish with a gloss range between 35-70 units when measured with a 60 degree meter.
  6. Gloss: Refers to a high sheen finish with a gloss range between 70-85 units when measured with a 60 degree meter.
  7. High-Gloss: Refers to a very high sheen finish with a gloss range more than 85 units when measured with a 60 degree meter.
- E. **Gypsum Board Finishing Levels:** Except where otherwise specified, a Gypsum Board Finishing Level 5 is required on gypsum board substrates scheduled to receive an eggshell or higher sheen. Gypsum Board Finishing Level 4 is acceptable with the use of flat and low-sheen paints, except where critical lighting conditions are determined to be an issue by the Architect.
- F. **Surfaces to be Painted:** Except where natural finish of material is specifically noted as a surface not to be painted, paint all exposed surfaces whether or not colors are designated in "schedules". Where items or surfaces are not specifically mentioned, paint the same as similar adjacent materials or areas. If color or finish is not designated, Architect will select these from manufacturer's full range of colors and finishes. Multiple colors will be selected by the Architect for any type of paint system. If colors are not indicated on the drawings, provide for a minimum of 20 percent of the walls to be an accent color.
1. Surface preparation, priming and coats of paint specified are in addition to shop-priming and surface treatment specified under other sections of work.
  2. Walls behind scheduled coverings shall receive prime coat.
  3. If it can be seen, *paint it*.
- G. **Following categories of work are not included** as part of field-applied finish work:
1. Pre-Finished Items: Unless otherwise indicated, do not include painting when factory-finishing or installer-finishing is specified for such items as (but not limited to) metal toilet enclosures, pre-finished partition systems, architectural woodwork and casework, elevator entrance doors and frames, elevator equipment, and finished mechanical and electrical equipment, including light fixtures, switchgear and distribution cabinets.
  2. Concealed Surfaces: Unless otherwise indicated, painting is not required on surfaces such as walls or ceilings in concealed areas and generally inaccessible areas, foundation spaces, furred areas, utility tunnels, pipe spaces and duct shafts.
  3. Finished Metal Surfaces: Unless otherwise indicated, metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze and similar finished materials will not require finish painting.
  4. Operating Parts: Unless otherwise indicated, moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sinkages, sensing devices, motor and fan shafts will not require finish painting.
  5. Labels: Do not paint over any code-required labels, such as Underwriters' Laboratories and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates.

### 1.3 SUBMITTALS

- A. **Product Data:** Submit manufacturer's technical information including Paint label analysis and application instructions for each material proposed for use.
- B. **Sustainability:** For paints and coatings, printed statement of VOC content demonstrating conformance to Utah Air Quality Regulations (R307-361).

- C. **Samples:** Prior to beginning work, review Finish Legend for colors to be painted. Use representative colors when preparing samples for review. Submit samples for Architect's review of color and texture only. Provide a listing of material and application for each coat of each finish sample.
1. On 12 inch x 12 inch hardboard, provide two samples of each color and material, with texture to simulate actual conditions. Resubmit samples as requested by Architect until acceptable sheen, color, and texture is achieved.
  2. On actual wood surfaces, provide two 4 inch x 8 inch samples of natural and stained wood finish. Label and identify each as to location and application.
  3. On actual wall surfaces and other exterior and interior building components, duplicate painted finishes of prepared samples. Refer to "Mockups" below.

#### 1.4 QUALITY ASSURANCE

- A. **Single Source Responsibility:** Provide primers and other undercoat paint produced by same manufacturer as finish coats. Use only thinners approved by paint manufacturer, and use only within recommended limits.
- B. **Coordination of Work:** Review other sections of these specifications in which prime paints are to be provided to ensure compatibility of total coatings system for various substrates. Upon request from other trades, furnish information or characteristics of finish materials provided for use, to ensure compatible prime coats are used.
- C. **Mockups:** Apply full-coat mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution. Simulate finished lighting conditions for review of in-place work.
1. Architect will select one surface, except as noted below, to represent surfaces and conditions for application of each paint system.
    - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
    - b. Other Items: Architect will designate items or areas required.
    - c. Masonry to Receive Clear Coat: Provide free-standing samples of honed masonry, 48 inches x 48 inches for initial review of clear coat.
  2. Final approval of color selections will be based on mockups.
    - a. If preliminary color/sheen selections are not approved, apply additional mockups of additional colors/sheens selected by Architect at no added cost to Owner.
  3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
  4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.5 DELIVERY AND STORAGE

- A. **Deliver materials** to job site in original, new and unopened packages and containers bearing manufacturer's name and label, and following information:
1. Name or title of material.
  2. Federal Specification number, if applicable.
  3. Manufacturer's batch number and date of manufacture.
  4. Manufacturer's name.
  5. Contents by volume, for major pigment and vehicle constituents.
  6. Thinning instructions.
  7. Application instructions.
  8. Color name and number.

- B. **Store materials** not in actual use in tightly covered containers. Maintain containers used in storage of paint in a clean condition, free of foreign materials and residue.
  - 1. Protect from freezing where necessary. Keep storage area neat and orderly. Remove oily rags and waste daily. Take all precautions to ensure that workmen and work areas are adequately protected from fire hazards and health hazards resulting from handling, mixing and application of paints.

## 1.6 PROJECT CONDITIONS

- A. **Apply water-based paints** only when temperature of surfaces to be painted and surrounding air temperatures are between 50 degrees F and 90 degrees F, unless otherwise permitted by paint manufacturer's printed instructions.
- B. **Apply solvent-thinned paints** only when temperature of surfaces to be painted and surrounding air temperatures are between 45 degrees F and 95 degrees F, unless otherwise permitted by paint manufacturer's printed instructions.
- C. **Do not paint in snow, rain, fog or mist**, or when relative humidity exceeds 85 percent, or to damp or wet surfaces, unless otherwise permitted by paint manufacturer's printed instructions.
  - 1. Painting may be continued during inclement weather if areas and surfaces to be painted are enclosed and heated within temperature limits specified by paint manufacturer during application and drying periods.
- D. **Determine moisture content of surfaces** to be painted by performing appropriate tests using a commercially available moisture meter. Apply paint only when surfaces are within limits specified by the paint manufacturer's printed instructions.

## 1.7 MAINTENANCE MATERIALS

- A. **Furnish extra materials** that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Paint: 5 percent, but not less than 1 gallon of each material and color applied.
  - 2. Coating Maintenance Manual: Upon conclusion of the project, the Contractor or paint manufacturer/supplier shall furnish a coating maintenance manual, such as Sherwin-Williams "Custodian Project Color and Product Information" report or equal. Manual shall include an Area Summary with finish schedule, Area Detail designating where each product/color/finish was used, product data pages, Material Safety Data Sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used

## PART 2 - PRODUCTS

### 2.1 MANUFACTURER

- A. **Basis of Design Manufacturer:** Contract Documents are based on products specified in Part 3 Schedules to establish a standard of quality. Other acceptable manufacturers offering products with equivalent characteristics may be considered, provided deviations are minor and design concept as expressed in the Contract Documents is not changed, as judged by the Architect.
  - 1. Manufacturer: Sherwin-Williams Company.

- B. **Acceptable Manufacturers:** Subject to compliance with requirements of Contract Documents, provide products by one of the following manufacturers.
1. PPG Industries, Pittsburgh Paints.
  2. The Sherwin-Williams Company (S-W).
  3. Benjamin Moore & Co.

## 2.2 MATERIALS

- A. **Low-Emitting Materials - VOC Content** (Utah Administrative Code R307-361): Products shall comply with VOC limits of authorities having jurisdiction and, for interior and exterior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24)].
1. Flat Paints and Coatings: 50 g/L.
  2. Nonflat Paints and Coatings: 100 g/L.
  3. Dry-Fog Coatings: 150 g/L.
  4. Primers, Sealers, and Undercoaters: 100 g/L.
  5. Industrial maintenance Coatings Applied to Ferrous Metals: 250 g/L.
  6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
  7. Pretreatment Wash Primers: 420 g/L.
  8. Floor Coatings Foot Traffic: 100 g/L.
  9. Floor Coatings High Performance: 250 g/L.
  10. Shellacs, Clear: 730 g/L.
  11. Shellacs, Pigmented: 550 g/L.
  12. Wood Coatings: 275 g/L.
- B. **Material Quality:** Provide best quality grade of various types of coatings as regularly manufactured by acceptable paint materials manufacturers. Materials not displaying manufacturer's identification as a standard, best-grade product will not be acceptable.
- C. **Proprietary names** used to designate color or materials are not intended to imply that products of named manufacturers are required to exclusion of equivalent products of other manufacturers.
- D. **Federal Specifications** establish minimum acceptable quality for paint materials. Provide written certification from paint manufacturer that materials provided meet or exceed these minimums.
- E. **Manufacturer's products** which comply with coating qualitative requirements of applicable Federal Specifications, yet differ in quantitative requirements, may be considered for use when acceptable to Architect. Furnish material data and manufacturer's certificate of performance to Architect for any proposed substitutions.
- F. **Color Pigments:** Pure, non-fading, applicable types to suit substrates and service indicated.
- G. **Lead content in pigment**, if any, is limited to contain not more than 0.009 percent lead, as lead metal based on the total non-volatile (dry-film) of paint by weight.
1. This limitation is extended to interior surfaces and those exterior surfaces, such as stairs, decks, porches, railings, windows, and doors which are readily accessible to children under seven years of age.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. **Applicator must examine areas** and conditions under which painting work is to be applied and notify Contractor in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Applicator.
  - 1. Comply with PDCA Standard P4 "Responsibility for Inspection and Acceptance of Surfaces prior to Painting and Decorating"
- B. **Starting of painting work** will be construed as Applicator's acceptance of surfaces and conditions within any particular area.
- C. **Do not paint over dirt**, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of a durable paint film.

### 3.2 PREPARATION

- A. **General:** Perform preparation and cleaning procedures in accordance with paint manufacturer's instructions and as herein specified, for each particular substrate condition.
- B. **Barrier Coats:** Provide barrier coats over incompatible primers or remove and re-prime as required. Notify Architect in writing of any anticipated problems in using the specified coating systems with substrates primed by others.
- C. **Accessories Removal:** Remove hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish-painted, or provide surface-applied protection prior to surface preparation and painting operations. Remove, if necessary, for complete painting of items and adjacent surfaces. Following completion of painting of each space or area, reinstall removed items.
- D. **Surface Preparation:** Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning. Program cleaning and painting so that contaminants from cleaning process will not fall onto wet, newly-painted surfaces.
- E. **Cementitious Materials:** Prepare cementitious surfaces to be painted by removing efflorescence, chalk, dust, dirt, grease, oils, and by roughening as required to remove glaze.
  - 1. Determine alkalinity and moisture content of surfaces to be painted by performing appropriate tests. If surfaces are found to be sufficiently alkaline to cause blistering and burning of finish paint, correct this condition before application of paint. Do not paint over surfaces where moisture content exceeds that permitted in manufacturer's printed directions.
  - 2. Concrete Floors:
    - a. Floors must be structurally sound and fully cured a minimum of 28 days. Test floor for vapor drive in accordance with ASTM D 4263, ASTM F 2170 or ASTM F 2420. If vapor drive exceeds the levels recommended by the manufacturer of the flooring system, a moisture mitigation system, as approved by Architect, may be applied to reduce the permeance of moisture vapor to acceptable levels.
    - b. Repair concrete as necessary.
    - c. Use a commercial degreaser to clean floors of oil, grease, and other bond inhibiting materials.



- d. Remove curing and parting compounds and other surface hardeners and floor coatings in accordance with the manufacturer's instructions.
  - e. Mechanical surface profiling is the recommended method of surface preparation for both new and existing floors. Mechanically profile the floor to CSP 3 (approximately medium grit sandpaper) as described by the International Concrete Repair Institute (Guideline #310.2). Do not use acid etching for surface preparation. Do not use any method that will fracture the concrete.
  - f. Apply a 25 square foot test in an inconspicuous area that meets Owner's expectation for appearance, slip resistance and performance.
- F. **Ferrous Metals:** Clean ferrous surfaces, which are not galvanized or shop-coated, of oil, grease, dirt, loose mill scale and other foreign substances by solvent or mechanical cleaning.
- 1. Caulk fabrication joints in hollow metal door frames which paint application cannot bridge.
  - 2. Follow manufacturer's surface preparation recommendations for ferrous metal substrates, ranging from one of the following procedures:
    - a. SSPC-SP 1 - Solvent Cleaning (Nov-04)
    - b. SSPC-SP 2 - Hand Tool Cleaning (Nov-04)
    - c. SSPC-SP 3 - Power Tool Cleaning (Nov-04)
    - d. SSPC-SP 5/NACE No. 1 - White Metal Blast Cleaning (Jan-07)
    - e. SSPC-SP 6/NACE No. 3 - Commercial Blast Cleaning (Jan-07)
    - f. SSPC-SP 7/NACE No. 4 - Brush-Off Blast Cleaning (Jan-07)
    - g. SSPC-SP 8 - Pickling (Nov-04)
    - h. SSPC-SP 10/NACE No. 2 - Near-White Metal Blast Cleaning (Jan-07)
    - i. SSPC-SP 11 - Power Tool Cleaning to Bare Metal (July-12)
    - j. SSPC-SP 14/NACE No. 8 - Industrial Blast Cleaning (Jan-07)
    - k. SSPC-SP 15 - Commercial Grade Power-Tool Cleaning (July-12)
    - l. SSPC-SP 16 - Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals (Apr-10)
- G. **Touch-up:** Touch-up shop-applied prime coats wherever damaged or bare, where required by other sections of these specifications. Clean and touch-up with same type shop primer.
- H. **Galvanized Surfaces:** Clean free of oil and surface contaminants with non-petroleum based solvent. Comply with best practices specified in ASTM D6386 - 10 "Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting."
- I. **Wood:** Clean wood surfaces to be painted of dirt, oil, or other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sandpaper smooth those finished surfaces exposed to view, and dust off. Scrape and clean small, fry, seasoned knots and apply a thin coat of white shellac or other recommended knot sealer, before application of priming coat. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood-filler. Sandpaper smooth when dried.
- 1. Prime, stain, or seal wood required to be job-painted immediately upon delivery to job. Prime edges, ends, faces, undersides, and backsides of such wood, including cabinets, counters, cases, paneling.
  - 2. When transparent finish is required, use spar varnish for backpriming.

3. Interior Wood Substrates:
  - a. Scrape and clean knots, and apply coat of knot sealer before applying primer.
  - b. Apply wood filler paste to open-grain woods, as defined in "MPI Architectural Painting Specification Manual," to produce smooth, glasslike finish.
  - c. Sand surfaces exposed to view and dust off.
  - d. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dry.

J. **Materials Preparation:**

1. Mix and prepare painting materials in accordance with manufacturer's directions.
2. Maintain containers used in mixing and application of paint in a clean condition, free of foreign materials and residue.
3. Stir materials before application to produce a mixture of uniform density, and stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.

### 3.3 APPLICATION

A. **General:** Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.

1. Paint colors, surface treatments, and finishes, are indicated in "schedules" of the contract documents.
2. Provide finish coats which are compatible with prime paints used.
3. Apply additional coats when undercoats, stains or other conditions show through final coat of paint, until paint film is of uniform finish, color and appearance. Give special attention to insure that surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
4. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Paint surfaces behind permanently-fixed equipment or furniture with prime coat only before final installation of equipment.
5. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint.
6. Paint back sides of access panels, and removable or hinged covers to match exposed surfaces.
7. Finish doors on tops, bottoms and side edges same as faces, unless otherwise indicated.
8. Sand lightly between each succeeding enamel or varnish coat.
9. Omit first coat (exterior faces) of surfaces which have been shop-primed and touch-up painted, unless otherwise indicated.

B. **Scheduling Painting:** Apply first-coat material to surfaces that have been cleaned, pretreated or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. **Re-coat Time:** Allow sufficient time between successive coatings to permit proper drying. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.
2. **Minimum Coating Thickness:** Apply materials at not less than manufacturer's recommended spreading rate, to establish a total dry film thickness as indicated or, if not indicated, as recommended by coating manufacturer.

- C. **Mechanical and Electrical Work:** Painting of mechanical and electrical work is limited to those items exposed to mechanical equipment rooms and in occupied spaces.
1. Mechanical items to be painted include, but are not limited to, the following:
    - a. Piping, pipe hangers, and supports.
    - b. Roof mounted mechanical units.
    - c. Ductwork, where exposed in occupied spaces.
    - d. Motor, mechanical equipment, and supports.
    - e. Accessory items.
  2. Electrical items to be painted include, but are not limited to, the following:
    - a. Conduit and fittings.
- D. **Prime Coats:** Apply prime coat of material which is required to be painted or finished, and which has not been prime coated by others.
1. Recoat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.
- E. **Pigmented (Opaque) Finishes:** Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness or other surface imperfections will not be acceptable.
- F. **Completed Work:** Match approved samples for color, texture and coverage. Remove, refinish or repaint work not in compliance with specified requirements.

### 3.4 FIELD QUALITY CONTROL

- A. **Owner will engage services of an independent testing laboratory** to sample paint being used. Samples of materials delivered to project site will be taken, identified and sealed, and certified in presence of Contractor.
1. Testing laboratory will perform appropriate tests for any or all of following characteristics: Abrasion resistance, apparent reflectivity, flexibility, washability, absorption, accelerated weathering, dry opacity, accelerated yellowness, recoating, skinning, color retention, alkali resistance and quantitative materials analysis.
- B. **If test results show** that material being used does not comply with specified requirements, Contractor may be directed to stop painting work, and remove non-complying paint; pay for testing; repaint surfaces coated with rejected paint; remove rejected paint from previously painted surfaces if, upon repainting with specified paint, the two coatings are non-compatible.

### 3.5 CLEAN-UP AND PROTECTION

- A. **Clean-Up:** During progress of work, remove from site discarded paint materials, rubbish, cans and rags at end of each work day.
1. Upon completion of painting work, clean window glass and other paint spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.
- B. **Protection:** Protect work of other trades, whether to be painted or not, against damage by painting and finishing work. Correct any damage by cleaning, repairing or replacing, as acceptable to Architect.
1. Provide "Wet Paint" signs as required to protect newly-painted finishes. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations.
  2. At completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces.

### 3.6 EXTERIOR PAINT SCHEDULE

A. **General:** Provide the following paint systems for the various substrates as indicated below or equivalent system from approved manufacturers listed above.

B. **Metal (Galvanized)**

Sherwin-Williams - Latex (100% Acrylic) Systems

1st Coat: S-W Pro Industrial Pro-Cry Universal Primer B66-310 Series

Finish: Low sheen.

Thickness: (Mils per coat) 5 - 10 wet; 2 - 4 dry.

2nd Coat: S-W Pro Industrial Zero VOC Acrylic Gloss, B66-600 Series

3rd Coat: S-W Pro Industrial Zero VOC Acrylic Gloss, B66-600 Series

Finish: Gloss

Thickness: (Mils per coat) 6 - 12 wet; 2.5 - 4 dry.

### 3.7 INTERIOR PAINT SCHEDULE

A. **General:** Provide the following paint systems for the various substrates as indicated below or equivalent system from approved manufacturers listed above.

B. **Metal - (Interior Galvanized)**

Sherwin-Williams - Latex (100% Acrylic) Systems

1st Coat: S-W Pro Industrial Pro-Cry Universal Primer B66-310 Series

Finish: Low sheen.

Thickness: (Mils per coat) 5 - 10 wet; 2 - 4 dry.

VOC: Less than 100 g/L

2nd Coat: S-W Pro Industrial Zero VOC Acrylic Semi-Gloss, B66-650 Series

3rd Coat: S-W Pro Industrial Zero VOC Acrylic Semi-Gloss, B66-650 Series

Finish: Semi-Gloss

Thickness: (Mils per coat) 6 - 12 wet; 2.5 - 4 dry.

C. **Metal - (Interior Structural Steel - Columns, Joists, Trusses, Beams - Misc. & Ornamental Iron, Doors, Door Frames, Non-Galvanized Metal)**

Sherwin-Williams - Latex (100% Acrylic) Systems

1st Coat: S-W Pro Industrial Pro-Cry Universal Primer B66-310 Series

Finish: Low sheen.

Thickness: (Mils per coat) 5 - 10 wet; 2 - 4 dry.

VOC: Less than 100 g/L

2nd Coat: S-W Pro Industrial Zero VOC Acrylic Gloss, B66-600 Series

3rd Coat: S-W Pro Industrial Zero VOC Acrylic Gloss, B66-600 Series

Finish: Gloss

Thickness: (Mils per coat) 6 - 12 wet; 2.5 - 4 dry.

- E. **Gypsum Board** (Walls, Ceilings, Gypsum Board, Etc.)  
Sherwin-Williams - Vinyl Acrylic Systems  
1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer,  
B28W02600 Series.  
Finish: Flat  
Sheen (at 85 degrees): 0 - 5 units.  
Thickness: (Mils per coat) 4 wet; 1.5 dry.  
VOC: 0 g/L  
2nd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss,  
B31-2600 Series  
3rd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss,  
B31-2600 Series  
Finish: Semi-Gloss  
Sheen (at 60 degrees): 25 - 35 units  
Thickness: (Mils per coat) 4 wet; 1.6 dry.  
VOC: 0 g/L

- F. **Gypsum Board** (Interior Epoxy System - Walls, Ceilings, Gypsum Board, Etc.)  
Sherwin-Williams - Epoxy System (Water Base) with Vinyl Acrylic Primer  
1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer,  
B28W02600 Series.  
Finish: Flat  
Sheen (at 85 degrees): 0 - 5 units  
Thickness (Mils per coat): 4 wet; 1.5 dry.  
VOC: 0 g/L  
2nd Coat: S-W Pro Industrial Zero VOC Water-Based Epoxy  
Gloss, B73-300 series  
3rd Coat: S-W Pro Industrial Zero VOC Water-Based Epoxy  
Gloss, B73-300 series  
Finish: Gloss (Verify with Architect and Owner)  
Sheen (at 60 degrees): 90+ units.  
Thickness (Mils per coat): 5 - 10 wet; 2 - 4 dry.  
VOC: 0 g/L

- G. **Gypsum Board** (Interior Graphics, Deep Tone Accents, Special Features, Etc.)  
Sherwin-Williams - Vinyl Acrylic  
1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer,  
B28W2600 Series  
Finish: Flat  
Sheen (at 85 degrees): 0 - 5 units  
Thickness: (Mils per coat) 4 wet; 1.5 dry.  
VOC: 0 g/L  
2nd Coat: S-W ProMar 200 Zero VOC Semi-Gloss B31-2600  
series  
3rd Coat: S-W ProMar 200 Zero VOC Semi-Gloss B31-2600  
series  
Sheen (at 60 degrees): 25 - 35 units.  
Thickness (Mils per coat): 4 wet; 1.6 dry.  
VOC: 0 g/L

H. **Gypsum Board** (Interior behind Wall Panels, Casework etc.)

Sherwin-Williams - Vinyl Acrylic

1st Coat: S-W ProMar 200 Zero VOC Interior Latex Wall  
Primer, B28W2600 Series.  
Finish: Flat  
Sheen (at 85 degrees): 0 - 5 units  
Thickness: (Mils per coat) 4 wet - 1.5 dry.  
VOC: 0 g/L

I. **Concrete Floors (F8):**

Sherwin-Williams – Catalyzed Epoxy

1st Coat: S-W ArmorSeal 33 Epoxy primer/Sealer  
Thickness (Mils per coat): 8.0  
2nd Coat: S-W ArmorSeal 1000 HS  
Finish: Gloss  
Thickness: (Mils per coat) 5.0 – 8.0 wet; 3.0 – 5.0 dry.  
VOC: <340 g/L  
3rd Coat: S-W ArmorSeal 1000 HS  
Finish: Gloss  
Thickness: (Mils per coat) 5.0 – 8.0 wet; 3.0 – 5.0 dry.  
VOC: <340 g/L

J. **Woodwork** (Stained & Varnished - Clear Finish)

Open Grained Wood

1st Coat: S-W WoodClassics 250 g/L Stain, A49W800 Series  
2nd Coat: S-W SHERWOOD Natural Filler, D70T1  
3rd Coat: S-W Minwax WB Polyurethane Satin, <275 g/L VOC  
4th Coat: S-W Minwax WB Polyurethane Satin, <275 g/L VOC

Closed Grain Wood

1st Coat: S-W WoodClassics 250g/L Stain, A49W800 Series  
2nd Coat: S-W Minwax WB Polyurethane Satin, <275 g/L VOC  
3rd Coat: S-W Minwax WB Polyurethane Satin, <275 g/L VOC

K. **Woodwork** (Natural - Clear Finish)

Open Grained Wood

1st Coat: S-W SHERWOOD Natural Filler, D70T1  
2nd Coat: S-W Minwax WB Polyurethane Satin, <275 g/L VOC  
3rd Coat: S-W Minwax WB Polyurethane Satin, <275 g/L VOC

Closed Grain Wood

1st Coat: S-W Minwax WB Polyurethane Satin, <275 g/L VOC  
2nd Coat: S-W Minwax WB Polyurethane Satin, <275 g/L VOC

L. **Woodwork (Painted)**

Latex Systems - Semi-Gloss

1st Coat: S-W ProMar 200 Zero VOC Interior Latex  
Primer, B28W2600 Series.

2nd Coat: S-W ProMar 200 Zero VOC Semi-Gloss  
B31-2600 series

3rd Coat: S-W ProMar 200 Zero VOC Semi-Gloss  
B31-2600 series

Thickness (Mils per coat): 4 wet; 1.6 dry

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## **DIVISION 10 - SPECIALTIES**

Section 10 2123  
Section 10 2600  
Section 10 2800  
Section 10 5713

Cubicle Tracks and Curtains  
Wall and Corner Guards  
Toilet and Bath Accessories  
Coat Hooks

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## SECTION 10 2123

### CUBICLE TRACKS AND CURTAINS

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. **Section includes:**
  - 1. Suspended overhead metal curtain track and guides.
  - 2. Curtains with hookless connections.
- B. **Related Requirements**
  - 1. Section 05 5000 "**Metal Fabrication**" for track supports above ceiling.
  - 2. Section 06 10530 "**Miscellaneous Rough Carpentry**" for blocking and supports for track.
  - 3. Section 09 5100 "**Acoustical Ceilings**" for suspended ceiling system to support track.

##### 1.3 SUBMITTALS

- A. **Product Data:** Provide data for curtain fabric characteristics.
- B. **Shop Drawings:** Indicate a reflected ceiling plan view of curtain track, hangers and suspension points, attachment details, schedule of curtain sizes.
- C. **Samples for Selection (Fabric):** Submit two 6 x 6 inch (or larger as required to adequately demonstrate pattern and range of color) fabric samples illustrating each fabric color and pattern for entire product line.
- D. **Samples for Verification (Fabric):** Submit 12 x 12 inch sample patch of curtain cloth with representative hem stitch detail, heading with reinforcement, and carrier attachment to curtain header.
- E. **Samples for Verification (Track):** Submit 12 inch sample length of curtain track including typical splice and wall and ceiling hanger and escutcheon.
- F. **Manufacturer's Installation Instructions:** Indicate special procedures, perimeter conditions requiring special attention.

##### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. **Accept curtain materials on site** and inspect for damage.
- B. **Store curtain materials** on site and deliver to Owner for installation when requested.

## PART 2 - PRODUCTS

### 2.1 TRACKS AND TRACK COMPONENTS

- A. **Acceptable Manufacturer:** Subject to compliance with requirements of Contract Documents, provide system by the following manufacturer.
1. Manufacturer: On The Right Track Systems, Inc.; ontherighttrack.com.
  2. System: Cubicle track system, surface mounted; designed for quick-release "hookless" curtains.
- B. **Track:** Extruded aluminum sections; one piece per cubicle track run.
1. Dimensions: 1 1/2 inches high by 3/8 inch wide.
  2. Provide straight and bent sections as indicated on drawings.
  3. Accessories: Provide as required for complete installation. Coordinate locations with those found on the Contract Drawings.
  4. Furnish system with "grabber" for easy removal of curtains.
  5. Finish: Clear anodized.

### 2.2 CURTAINS

- A. **Curtain Materials:**
1. Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E 84.
  2. Naturally flame resistant or flame-proofed; capable of passing NFPA 701 test.
  3. Curtain: Close weave polyester; anti-bacterial, self-deodorizing, sanitized, and preshrunk.
    - a. Acceptable Manufacturer: Subject to compliance with requirements of Contract Documents, provide system by the following manufacturer.
      - 1) Manufacturer: On The Right Track Systems, Inc.; ontherighttrack.com.
      - 2) System: Textile curtains, with "hookless" rings.
      - 3) Fabric: Mini Squares "Cookie", as indicated in Legend-Finish on Drawings.
- B. **Open Mesh Cloth:** Open weave to permit air circulation; flameproof material, same color as curtain or as selected by Architect from manufacturer's full range.
- C. **Curtain Fabrication:**
1. Manufacture curtains of one piece, sized 20 percent wider than track length. Terminate curtain 15 inches from floor.
  2. Include open mesh cloth at top 24 inches of curtain for room air circulation.
  3. Curtain Heading: Triple thickness 2 inches wide, with stitched button holes for carriers 6 inches on center, double fold bottom hem 2 inches wide with lead weights included. Lock stitch seams in two rows. Turn seam edges and lock stitch.
  4. Integral rings designed to mount directly to track.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. **Verify surfaces and supports** above ceiling are ready to receive work of this Section.
- B. **Verify field measurements** are as indicated on shop drawings.

### 3.2 INSTALLATION

- A. **Install curtain track** to be secure, rigid, and true to ceiling line. Mechanically attach tracks using manufacturer's recommended anchors and attachment devices
- B. **Install curtains on rail system** ensuring smooth operation.
- C. **Test** for proper operation. Replace damaged units.

**END OF SECTION**

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## SECTION 10 2600

### WALL AND CORNER GUARDS

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. **This Section includes** the following types of protection guards:
  - 1. PVC wall and corner guards.
  - 2. Impact-resistant wall protection systems.
- B. **Related Sections:**
  - 1. Section 06 1050 "**Miscellaneous Carpentry**" for wood blocking in walls.
  - 2. Section 08 7100 "**Door Hardware**" for metal protective trim units, according to BHMA A156.6, used for armor, kick, mop, and push plates.
  - 3. Section 09 2216 "**Non-Structural Metal Framing**" for metal straps in walls for blocking, etc.

##### 1.3 SUBMITTALS

- A. **Product Data:** Product data for each type of wall and corner guard specified, including details of construction relative to materials, dimensions of individual components, profiles, and finishes.
- B. **Drawings:** Shop drawings detailing fabrication and installation of wall and corner guards. Include plans, elevations, and large-scale details showing layout and types required. Show anchorages and accessory items.

##### 1.4 QUALITY ASSURANCE

- A. **Manufacturer Qualifications:** A firm experienced in manufacturing wall and corner guards similar to that indicated for this Project and that has a record of successful in-service performance.
- B. **Design Criteria:** The drawings indicate sizes, profiles, and dimensional requirements of the various items of wall and corner guards and are based on the specific types and models indicated. Similar equipment by other manufacturers may be considered, provided deviations in dimensions and profiles are minor and do not change the design concept as judged by the Architect. The burden of proof of equality is on the proposer.

##### 1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. **Furnish extra materials,** from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Wall-Guard and Handrail Covers: Full-size plastic covers of maximum length equal to 2 percent of each type, color, and texture of cover installed, but no fewer than two, 96-inch- long units.

2. Corner-Guard Covers: Full-size plastic covers of maximum length equal to 2 percent of each type, color, and texture of cover installed, but no fewer than two, full height units.
3. Mounting and Accessory Components: Amounts proportional to the quantities of extra materials. Package mounting and accessory components with each extra material.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. **Store wall and door protection** in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
1. Maintain room temperature within storage area at not less than 70 degrees F during the period plastic materials are stored.
  2. Keep plastic materials out of direct sunlight.
  3. Store plastic wall- and door-protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 degrees F.
    - a. Store corner-guard covers in a vertical position.
    - b. Store wall-guard and handrail covers in a horizontal position.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. **Source Limitations:** Obtain wall-protection products of each type from single source from single manufacturer.
- B. **Acceptable Manufacturers:** Subject to compliance with requirements of Contract Documents, provide products by the following:
1. Wall Protection
    - a. Manufacturer: Koroseal Wall Protection Systems, a division of RJF International Corporation
    - b. Product: Traffic Patterns® Decorative Wall Protection.
  2. Corner and Wall Bumpers:
    - a. Manufacturer: Construction Specialties, Inc.
    - b. Products:
      - 1) Corner Guards: Acrovyn VA-200N.
      - 2) Crash Rails: Acrovyn SCR-40N/SCR-64N (locations per Drawings).

### 2.2 PERFORMANCE REQUIREMENTS

- A. Surface Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Flame-Spread Index: 25 or less.
  2. Smoke-Developed Index: 450 or less.

### 2.3 VINYL WALL PROTECTION

- A. **Description:** Fabricated from nominal 0.030 inch thick extruded semi-rigid vinyl sheets with polyvinyl fluoride film with matching wainscot and joint moldings and outside and inside corner trims as required.
- B. **Mounting Method:** Adhesive.



- C. **Color and Texture:** As selected by Architect from manufacturer's full range to match existing.

## 2.4 CORNER AND WALL GUARDS

- A. **Products:**
1. **Corner Guards:** 90 degree surface mounted corner guard with 1-1/2 inch legs and 3/32 inch radius; 0.090 inch thick PETG; self-adhesive.
  2. **Surface-Mounted Crash Rail Type Wall Guards:** 4 inch and 8 inch high surface mounted crash rail with full aluminum retainer and integral shock absorbing cushions; color-matched, removable end caps mechanically fastened with concealed fasteners; 0.078 inch thick PETG; attached with pan head screws and plastic anchors.
- B. **Aluminum Extrusions:** Alloy and temper recommended by manufacturer for type of use and finish indicated, but with not less than strength and durability properties specified in ASTM B 221 (ASTM B 221M) for Alloy 6063-T5. Thickness: 0.080 inch (2 mm).
- C. **PVC-Free Plastic (Engineered PETG):** Extruded material high impact plastic. Chemical and stain resistance per ASTM D543 standards as established by the manufacturer.
1. Impact Resistance: Minimum 25.4 ft-lbf/in. of notch when tested according to ASTM D 256, Test Method A.
  2. Chemical and Stain Resistance: Tested according to ASTM D 543.
  3. Self-extinguishing when tested according to ASTM D 635.
  4. Flame-Spread Index: 25 or less.
  5. Smoke-Developed Index: 450 or less.
- D. **Colors:** As selected by Architect from manufacturer's full range.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. **General:** Coordinate installation of wall and corner guards indicated to be attached to concrete or masonry, and furnish anchoring devices with templates, diagrams, and instructions for their installation.
1. Coordinate delivery of anchoring devices to Project site to avoid delaying progress.

### 3.2 INSTALLATION

- A. **General:** Comply with manufacturer's detailed instructions for installing wall and corner guards.
- B. **Wall/Corner Guards:** Install wall surface protection units plumb, level, and true to line without distortions.
1. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished work.

### 3.3 ADJUST AND CLEAN

- A. After installation, restore marred, abraded surfaces to the original condition.

**END OF SECTION**

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## SECTION 10 2800

### TOILET AND BATH ACCESSORIES

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. This **Section includes toilet and bath accessories** including but not limited to the following:
1. Toilet tissue dispenser (furnished by Owner/installed by Contractor).
  2. Paper towel dispensers (furnished by Owner/installed by Contractor).
  3. Soap dispenser (furnished by Owner/installed by Contractor).
  4. Toilet seat cover dispensers.
  5. Grab bars.
  6. Mirrors.
  7. Sanitary napkin disposal unit (furnished by Owner/installed by Contractor).
  8. Clothes hooks (restrooms only)
  9. Shower rods, curtain, and seat.
- B. **Related Sections** include the following:
1. Section 06 1000 "**Rough Carpentry**" for wood blocking in walls.
  2. Section 09 2216 "**Non-Structural Metal Framing**" for metal strap blocking in walls.
  3. Section 10 5713 "**Coat Hooks**" for hooks for spaces other than restrooms.

##### 1.3 SUBMITTALS

- A. **Product Data:** Include construction details, material descriptions and thicknesses, dimensions, profiles, fastening and mounting methods, specified options, and finishes for each type of accessory specified.
- B. **Samples:** For each accessory item to verify design, operation, and finish requirements.
1. Approved full-size Samples will be returned and may be used in the Work.
- C. **Setting Drawings:** For cutouts required in other work; include templates, substrate preparation instructions, and directions for preparing cutouts and installing anchoring devices.
- D. **Product Schedule:** Indicating types, quantities, sizes, and installation locations by room of each accessory required. Use designations indicated in the Toilet and Bath Accessory Schedule and room designations indicated on Drawings in product schedule.
- E. **Maintenance Data:** For accessories to include in maintenance manuals specified in Division 1. Provide lists of replacement parts and service recommendations.

## 1.4 QUALITY ASSURANCE

- A. **Source Limitations:** Provide products of same manufacturer for each type of accessory unit and for units exposed to view in same areas, unless otherwise approved by Architect.
- B. **Product Options:** Accessory requirements, including those for materials, finishes, dimensions, capacities, and performance, are established by specific products indicated in the Toilet and Bath Accessory Schedule.
  - 1. Products of other manufacturers listed in Part 2 with equal characteristics, as judged solely by Architect, may be provided.
  - 2. Do not modify aesthetic effects, as judged solely by Architect, except with Architect's approval. Where modifications are proposed, submit comprehensive explanatory data to Architect for review.

## 1.5 COORDINATION

- A. **Coordinate accessory locations** with other work to prevent interference with clearances required for access by disabled persons, proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. **Deliver inserts** and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. **Acceptable Manufacturers:** Subject to compliance with requirements of Contract Documents, provide products by the following:
  - 1. Bobrick Washroom Equipment, Inc.

### 2.2 MATERIALS

- A. **Stainless Steel:** ASTM A 666, Type 304, with No. 4 finish (satin), in 0.0312-inch minimum nominal thickness, unless otherwise indicated.
- B. **Brass:** ASTM B 19, leaded and unleaded flat products; ASTM B 16, rods, shapes, forgings, and flat products with finished edges; ASTM B 30, castings.
- C. **Sheet Steel:** ASTM A 366/A 366M, cold rolled, commercial quality, 0.0359-inch minimum nominal thickness; surface preparation and metal pretreatment as required for applied finish.
- D. **Galvanized Steel Sheet:** ASTM A 653/A 653M, G60.
- E. **Chromium Plating:** ASTM B 456, Service Condition Number SC 2 (moderate service), nickel plus chromium electrodeposited on base metal.
- F. **Baked-Enamel Finish:** Factory-applied, gloss-white, baked-acrylic-enamel coating.
- G. **Galvanized Steel Mounting Devices:** ASTM A 153/A 153M, hot-dip galvanized after fabrication.

- H. **Mirror Glass:** ASTM C 1036, Type I, Class 1, Quality q2, nominal 6.0 mm thick, with silvering, electroplated copper coating, and protective organic coating complying with FS DD-M-411.
- I. **Fasteners:** Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.

## 2.3 FABRICATION

- A. **General:** Names or labels are not permitted on exposed faces of accessories. On interior surface not exposed to view or on back surface of each accessory, provide printed, waterproof label or stamped nameplate indicating manufacturer's name and product model number.
- B. **Surface-Mounted Toilet Accessories:** Unless otherwise indicated, fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with continuous stainless-steel hinge. Provide concealed anchorage where possible.
- C. **Recessed Toilet Accessories:** Unless otherwise indicated, fabricate units of all-welded construction, without mitered corners. Hang doors and access panels with full-length, stainless-steel hinge. Provide anchorage that is fully concealed when unit is closed.
- D. **Framed Glass-Mirror Units:** Fabricate frames for glass-mirror units to accommodate glass edge protection material. Provide mirror backing and support system that permits rigid, tamper-resistant glass installation and prevents moisture accumulation.
  - 1. Provide galvanized steel backing sheet, not less than 0.034 inch and full mirror size, with non-absorptive filler material. Corrugated cardboard is not an acceptable filler material.
- E. **Mirror-Unit Hangers:** Provide mirror-unit mounting system that permits rigid, tamper- and theft-resistant installation, as follows:
  - 1. Heavy-duty wall brackets of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.
- F. **Keys:** Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. **Install accessories according to manufacturers' written instructions**, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. **Install grab bars** to withstand a downward load of at least 250 lbf, when tested according to method in ASTM F 446.
- C. **Provide blocking and wall supports for all toilet accessories**, whether provided by Contractor or Owner. Verify locations and requirements of Owner-furnished equipment and provide necessary blocking.

### 3.2 ADJUSTING AND CLEANING

- A. **Adjust accessories** for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items.
- B. **Remove temporary labels** and protective coatings.
- C. **Clean and polish** exposed surfaces according to manufacturer's written recommendations.

### 3.3 TOILET AND BATH ACCESSORY SCHEDULE

- A. **Toilet Tissue Dispenser**
  - 1. Furnished by Owner and installed by Contractor - verify blocking and attachment requirements with Owner.
- B. **Towel Dispenser**
  - 1. Furnished by Owner and installed by Contractor - verify blocking and attachment requirements with Owner.
- C. **Soap Dispenser**
  - 1. Furnished by Owner and installed by Contractor - verify blocking and attachment requirements with Owner.
- E. **Toilet Seat-Cover Dispenser**
  - 1. Product: Bobrick B-221
  - 2. Material: Type-304 stainless steel with all-welded construction; satin finish on exposed surfaces.
  - 3. Configuration: Concealed opening in bottom for filling; capacity: 250 paper toilet seat covers.
- F. **Grab Bar**
  - 1. Product: Bobrick, B-6806 Series; lengths as indicated on the Drawings.
  - 2. Stainless-Steel Nominal Thickness: Minimum 0.05 inch.
  - 3. Mounting: Concealed with manufacturer's standard flanges and anchors.
  - 4. Gripping Surfaces: Manufacturer's standard slip-resistant texture.
  - 5. Outside Diameter: 1-1/2 inches for heavy-duty applications.
- G. **Sanitary Napkin Disposal Unit**
  - 1. Furnished by Owner and installed by Contractor - verify blocking and attachment requirements with Owner.
- H. **Clothes Hooks**
  - 1. Product: Bobrick, B- 76727.
  - 2. Surface-Mounted Double Robe Hook
    - a. Flange & Support Arm: 18-8 S, type 304 22 gauge stainless steel. Concealed, 18 gauge stainless steel mounting bracket. All welded construction. Secured to wall plate with a stainless steel setscrew.
    - b. Concealed Wall Plate: 18-8 S, type 304 19 gauge stainless steel.
    - c. Cap: 18-8 S, type 304 14 gauge stainless steel. Welded to the support arm.

- I. **Mirror Unit:**
1. Basis of Design Product: Bobrick, B-290 Series.
  2. Frame mirror with one-piece, type-304, stainless steel angle 3/4 x 3/4 inch; roll-formed construction with continuous integral stiffener on all sides. Frame shall have beveled design on front of angle to hold mirror tightly against frame to prevent exposure to sharp edges. Corners shall be heliarc welded, ground, and polished smooth. Exposed surfaces shall have satin finish with vertical grain. Mirror shall be No. 1 quality, 1/4 inch (6mm) float/plate glass. Protect mirror edges with plastic filler strips; protect mirror back by full-size, shock-absorbing, water-resistant, non-abrasive 3/16 inch thick polyethylene padding. Galvanized steel back shall have integral horizontal hanging brackets located at top and bottom for mounting on concealed one-piece rectangular wall hanger(s). Fasten galvanized steel back to frame with concealed screws to permit glass replacement; attachment by rivets or tabs is not acceptable. Secure mirror to hanger with concealed Phillips head locking setscrews in bottom of frame.
  3. Size: 24 x 48 inches, and as shown on Drawings.
- J. **Mop and Broom Holder:**
1. Basis of Design Product: Bobrick, B-224x48.
  2. Mop and Broom Holder with Utility Shelf: 48-inch- long unit fabricated of minimum nominal 0.05-inch- thick stainless steel with shelf; support brackets for wall mounting; three hooks for wiping rags; four spring-loaded, rubber hat, cam-type, mop/broom holders mounted on front of shelf; and approximately 1/4-inch- diameter, stainless-steel rod suspended beneath shelf for drying rags.
- K. **Under-Lavatory Guard:** Provide under-lavatory guard where lavatory piping is exposed below the counter or with wall hung lavatories. Under-lavatory guards to complying with the following
1. Basis of Design Product: Truebro, Inc.
  2. Insulating Piping Coverings: White, antimicrobial, molded-vinyl covering for supply and drain piping assemblies intended for use at accessible lavatories to prevent direct contact with and burns from piping. Provide components as required for applications indicated with flip tops at valves that allow service access without removing coverings.
- L. **Shower Curtain Rod:**
1. Basis of Design: Bobrick, B-6047 Series, length as indicated on Drawings.
  2. Shower curtain rod shall be type-304, 18-gauge stainless steel with satin finish and have outside diameter of 1-1/4 inch. One-piece, die-formed flanges shall be type-304, 20-gauge (1.0mm) stainless steel with satin finish.
- M. **Shower Curtain:**
1. Shower Curtain: Water repellent, anti-microbial, 100 percent polyester material with ultrasonic water sheeting bottom hem. Provide with matching "Flex-On" color rings sized for shower curtain rod.
    - a. Size: Minimum 6 inches wider than opening by 72 inches high.
    - b. Color: As selected by Architect from manufacturer's full range.
    - c. Quantity: Provide two (2) shower curtains for each shower as indicated. Furnish unused curtain to Owner for attic stock.
    - d. Basis of Design: Litchfield, Hookless Shower Curtain; Arcs & Angles, [www.arcsandangles.com](http://www.arcsandangles.com).
      - 1) Pattern: 'Plainweave'
      - 2) Fabric: 100% polyester, water repellent with ultrasonically cut bottom hem.
      - 3) Size: As indicated on the Drawings.
      - 4) Color: White with chrome rings.

**N. Folding Shower Seat:**

1. Basis of Design: Bobrick, B-5181
2. Shower Seat: Heavy-duty hinged seat designed to fold up against wall when not in use; with stainless-steel support braces, hinges, frame, and fasteners; of all-welded construction.
3. Configuration: L-shaped seat, designed for wheelchair access.
4. Seat Material: Phenolic or polymeric composite of slat-type or one-piece construction. Color as selected by Architect from manufacturer's full range.

**END OF SECTION**



## SECTION 10 5713

### COAT HOOKS

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. This **section includes** the following:
  - 1. Coat hooks.
- B. **Related Sections:**
  - 1. Section 10 2800 "**Toilet and Bath Accessories**" for hooks to be installed in restrooms.

##### 1.3 SUBMITTALS

- A. **Product data** for each type of accessory specified, with installation instructions for each unit built-in or connected to other construction. Include methods of installation for each type of substrate.
- B. **Shop drawings** showing installation details of accessories permanently affixed to construction, including full scale installation details of special conditions.
- C. **Samples for initial selection** purposes consisting of manufacturer's standard size samples showing full range of colors, textures, and patterns available for each type of accessory required.

##### 1.4 QUALITY ASSURANCE

- A. **Manufacturer Qualifications:** Firm (material producer) with not less than 3 years of production experience, whose published literature clearly indicates general compliance of products with requirements of this section.
- B. **Single Source Responsibility:** Provide material produced by a single manufacturer for each accessory type.

##### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. **Deliver materials to project site** in original factory wrappings and containers, clearly labeled with identification of manufacturer, brand name, and lot number. Store materials in original undamaged packages and containers, inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, humidity; laid flat, blocked off ground to prevent sagging and warping.
- B. **Comply with instructions and recommendations** of manufacturer for special delivery, storage, and handling requirements.

## 1.6 SEQUENCE AND SCHEDULING

- A. **Sequence accessory installation** with other work to minimize possibility of damage and soiling during remainder of construction period.

## 1.7 MAINTENANCE

- A. **Maintenance Instructions:** Submit manufacturer's printed instructions for maintenance of installed work, including methods and frequency recommended for maintaining optimum condition under anticipated use conditions. Include precautions against materials and method which may be detrimental to finishes and performance.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. **Available Manufacturers:** Subject to compliance with requirements of Contract Documents, manufacturers offering products which may be incorporated into the Work include, but are not limited to, the following:
  1. Umbra; [www.umbra.com](http://www.umbra.com).
  2. Product: "flip hook"

### 2.2 COAT HOOKS

- A. **Properties:** Wall mounted hardwood with five flip-down hooks,
  1. Overall Weight Limit: 60 lb.
  2. Wood Finish: As selected by Architect from manufacturer's full range.
  3. Metal Finish: Brushed nickel-plate.

### 2.3 MATERIALS

- A. **Fasteners:** Screws, bolts or other exposed devices of same material as accessory unit, or of galvanized steel where concealed. Equip items with theft-proof fasteners where accessible to tampering.

### 2.4 FABRICATION, GENERAL

- A. Provide accessory items, permanently installed, equipped with functions as specified. Fabricate units with tight seams and joints, exposed metal edges rolled. Manufacturer or product identification on exposed surfaces is unacceptable. Provide products with smooth welds, consistent finish with no evidence of wrinkling, chipping, uneven coloration, dents, or other imperfections.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. **Verify** that materials are those specified before installing.
- B. **Install accessories** after other finishing operations, including painting, have been completed.

- C. **Permanently Placed Equipment and Components:** Rigid, level, plumb, square, and true; anchored securely to supporting structure; positioned at locations and elevations indicated on Shop Drawings; in proper relation to adjacent construction; and aligned with room layout.
- D. **Anchoring to In-Place Construction:** Use anchors and fasteners where necessary for securing built-in and permanently placed equipment and components to structural support and for properly transferring load to in-place construction.
- E. **Adjust accessory items** for proper operation. Clean and polish exposed surfaces, using materials and methods recommended by the manufacturer.

### 3.2 PROTECTION

- A. **Protect accessories** against damage during remainder of construction period, complying with manufacturer's directions.

**END OF SECTION**

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**DIVISION 11 - EQUIPMENT**

Section 11 7013  
Section 11 7014

Medical Equipment  
Medical Equipment Schedule

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## SECTION 11 7013

### MEDICAL 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. Medical equipment, furnished by Owner and installed by Contractor, as outlined in Schedules.
  2. Toilet accessories, furnished by Owner and installed by Contractor, as outlined in Schedules.
  3. Appliances, furnished by Owner and installed by Contractor, as outlined in Schedules.
  4. Tackboards as outlined in Schedules.
- B. **Owner-Furnished Equipment:** Where indicated, Owner will furnish equipment for installation by Contractor.
- C. **Related Sections:**
1. Section 06 4023 "**Interior Architectural Woodwork**" for requirements for tackboards and other items noted in Medical Equipment Schedules to be provided by Contractor to accommodate medical equipment.
  2. Section 10 2800 "**Toilet and Bath Accessories**" for toilet accessories provided by Contractor.

##### 1.3 PROJECT CONDITIONS

- A. **Field Measurements:** Verify actual dimensions of construction by field measurements before fabrication or installation.

##### 1.4 COORDINATION

- A. **Coordinate equipment layout and installation** with other work, including layout and installation of lighting fixtures, HVAC equipment, and fire-suppression system components.
- B. **Coordinate** locations and requirements of utility **service connections**.

#### PART 2 - PRODUCTS

##### 2.1 MEDICAL EQUIPMENT

- A. See Medical Equipment Schedule for scope of items to be provided by Contractor as well as items to be furnished by Owner and installed by Contractor.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. **Obtain manufacturer's written installation instructions** for all Owner-furnished/Contractor-installed equipment prior to hanging gypsum board.
- B. **Provide blocking** in walls where required by manufacturer's installation instructions and as required to assure equipment can be permanently secured where indicated on Drawings.

### **3.2 INSTALLATION**

- A. **Install equipment level and plumb**, according to manufacturer's written instructions.
  - 1. Connect equipment to utilities.
  - 2. Provide cutouts in equipment, neatly formed, where required to run service lines through equipment to make final connections.
- B. **Complete equipment assembly** where field assembly is required.
- C. **Install equipment with access and maintenance clearances** that comply with manufacturer's written installation instructions and with requirements of authorities having jurisdiction.
- D. **Install closure-trim strips** and similar items requiring fasteners in a bed of sealant.
- E. **Install joint sealant in joints** between equipment and abutting surfaces with continuous joint backing unless otherwise indicated.

### **3.3 CLEANING AND PROTECTING**

- A. After completing installation of equipment, repair damaged finishes.
- B. Clean and adjust equipment as required to produce ready-for-use condition.
- C. Protect equipment from damage during remainder of the construction period.

### **3.4 MEDICAL EQUIPMENT SCHEDULE**

- A. **The following Equipment Schedule** is for equipment referenced on the Drawings.

**END OF SECTION**



ALTA VIEW HOSPITAL  
ACUTE REHAB UNIT

EQUIPMENT & FURNITURE SCHEDULE



QUANTITY - TOTAL		EQUIPMENT CODE	DESCRIPTION	MODEL NAME / NUMBER	MANUFACTURER	WIDTH	DEPTH	HEIGHT	SIZE	FLOOR (F) / BASE CABINET (B) / WALL (W) / CEILING (C) / MOBILE (M)	DRAIN	COLD WATER	HOT WATER	VOLTS	AMPS (A) / WATTS (W)	ALARM	EMERGENCY	DATA	COMMENTS	NEW	EXISTING	FURNISHED BY	CONTRACTOR (C) OWNER (O) VENDOR (V)
12																							
LEVEL 1 - ACUTE REHAB UNIT																							
12																							
12	1	PB2	HOSPITAL PATIENT BED	ADVANTA 2	HILL-ROM	40"	84"	33"		M	-	-	-	-	-	-	-	-		X	-	O	O
12	1	LF1	PATIENT LIFT - CEILING MOUNTED	LIKO	HILL-ROM					C	-	-	-	120V	-	-	-	-	(ONLY IN ROOMS W1201, W1202, W1203, W1204 & W1206)	X	-	O	C
12	1	PM10	PATIENT MONITOR (WALL)	INTELLIVUE MX800	PHILIPS	19"	6"	15"		W	-	-	-	120V	-	-	-	-		X	-	O	O
12	1	PM15	PATIENT MONITORING SYSTEM - TRANSPORT (PORTABLE)	INTELLIVUE X3	PHILIPS	10"	4"	5"		W	-	-	-	120V	-	-	-	-		X	-	O	O
12	1		WALL BRACKET - PATIENT MONITOR	MX800 WHM WALL	GCX					W	-	-	-	-	-	-	-	-	PROVIDE WALL BACKING	X	-	O	C
12	1	TA14	OVERBED TABLE	OBT635	HILL-ROM	38"	20"	47"		M	-	-	-	-	-	-	-	-		X	-	O	C
12	1	O	OXYGEN FLOWMETER	FM15COH	OHIO MEDICAL	2"	4"	6"		W	-	-	-	-	-	-	-	-		X	-	O	C
12	1	A	MEDICAL AIR FLOWMETER	FM15ACH	OHIO MEDICAL	2"	4"	6"		W	-	-	-	-	-	-	-	-		X	-	O	C
12	1	V	MEDICAL VACUUM / SUCTION REGULATOR	3710	BOEHRINGER	3"	4"	6"		W	-	-	-	-	-	-	-	-		X	-	O	C
12	1	SC	SUCTION CANISTER W. BRACKET	65652-516	CARDINAL HEALTH	6"	9"	12"		W	-	-	-	-	-	-	-	-		X	-	O	C
12	1	DB1.2	DIAGNOSTIC BOARD W. BLOOD PRESSURE CUFF - WALL	GREEN SERIES 777	WELCH ALLYN	40"	4"	12"		W	-	-	-	120V	-	-	-	-		X	-	O	O
12	1	DB3.2	BLOOD PRESSURE CUFF + BASKET - WALL MOUNTED	767 / 509 INFLATION SYSTEM BASKET	WELCH ALLYN	6"	6"	6"		W	-	-	-	120V	-	-	-	-		X	-	O	O
12	1	CA5.2	GENERAL PROCEDURE CART (6 DRAWERS)	STARSYS SXRS2220L	INTERMETRO	25"	23"	45"		M	-	-	-	-	-	-	-	-		X	-	O	O
12	1	CO1	WALL MOUNTED COMPUTER - ALL-IN-ONE	ALL-IN-ONE (22")	DELL	21"	3"	15"	22" D	W	-	-	-	120V	-	-	-	X		X	-	O	O
12	1		WALL BRACKET - COMPUTER	LX WALL MOUNT SYSTEM	ERGOTRON	19"	4"	34"		W	-	-	-	120V	-	-	-	X	PROVIDE WALL BACKING	X	-	O	C
12	1	TE1	TELEPHONE (WALL)								-	-	-	-	-	-	-	X	PROVIDE WALL BACKING	X	-	O	O
12	1	PR4	PRINTER - LABEL	GX420	ZEBRA	7"	9"	6"		B	-	-	-	120V	-	-	-	X		X	-	O	O
12	1	SN4	SCANNER - BARCODE (HANDHELD)							B	-	-	-	120V	-	-	-	X		X	-	O	O
12	1	TV1	TV MONITOR WALL MOUNTED - 32" HOSPITAL GRADE	32LV760M	LG	30"	3"	18"		W	-	-	-	120V	-	-	-	-		X	-	O	O
12	1		BRACKET - TV WALL	LOW PROFILE WALL MOUNT	ERGOTRON	28"	2"	19"		W	-	-	-	-	-	-	-	-	PROVIDE WALL BACKING	X	-	O	C
12	1		DVD PLAYER							B	-	-	-	120V	-	-	-	X		X	-	O	O
12	1	DB6.1	THERMOMETER-ELECTRONIC	SURETEMP PLUS 692	WELCH ALLYN	4"	3"	9"		W	-	-	-	120V	-	-	-	-	PROVIDE WALL BACKING	X	-	O	O
12	1	SL1	PHYSICIAN STOOL	RRITER 272	MIDMARK			18"	16" D	W	-	-	-	-	-	-	-	-		X	-	O	O
12	1	1006.1	SOAP DISPENSER	3226	DIAL	6"	5"	11"		W	-	-	-	-	-	-	-	-		X	-	O	O
12	1	1006.2	PAPER TOWEL DISPENSER	56650 C-FOLD	GEORGIA PACIFIC	11"	6"	16"		W	-	-	-	-	-	-	-	-		X	-	O	O
12	1	D14	ANTIMICROBIAL WALL BRACKET	AVAGARD	3M	4"	4"	9"		W	-	-	-	-	-	-	-	-		X	-	O	C
12	1	D17	GLOVE BOX DISPENSER - TRIPLE	GP-330	BOWMAN	12"	4"	15"		W	-	-	-	-	-	-	-	-		X	-	O	C
12	1	D15	PERSONAL PROTECTIVE EQUIPMENT (PPE)	LD-070	BOWMAN	20"	5"	26"		W	-	-	-	-	-	-	-	-		X	-	O	C
12	1	D26	EMESIS BAG DISPENSER - WALL	MEB9930D	MEDLINE	7"	7"	8"		W	-	-	-	-	-	-	-	-		X	-	O	C
12	1	D1Z7	DISINFECTANT WIPES DISPENSER - WALL MOUNTED	P010901 SANI BRACKET	PDI	6"	6"	9"		W	-	-	-	-	-	-	-	-		X	-	O	C
12	1	RA6	COAT / HAT RACK	B-7672	BOBRICK	4"	2"	2"		W	-	-	-	-	-	-	-	-		X	-	O	C
12	1	WH33.2	BIOHAZARD WASTE - SQUARE STEEL CAN (8 GAL)	35267	BREWER	13"	12"	19"		M	-	-	-	-	-	-	-	-		X	-	O	O
12	1	WH2.3	LINEN HAMPER W. CLOSE LID + STEP-ON PEDAL	CX102	CENTURION MEDICAL	19"	19"	33"	19" D	M	-	-	-	-	-	-	-	-		X	-	O	O
12	1	WH3	SHARPS RECEPTACLE w. LOCKING CABINET (2 GAL.)	C-02RES-0203	STERICYCLE	15"	6"	14"		W	-	-	-	-	-	-	-	-		X	-	O	O
12	1	WH11	WASTE RECEPTACLE - 7 GAL.	2986	RUBBERMAID	11"	15"	15"		M	-	-	-	-	-	-	-	-		X	-	O	O
12	1	WH13	WASTE RECEPTACLE - 23 GAL.	3540 SLIM JIM	RUBBERMAID	11"	20"	30"		M	-	-	-	-	-	-	-	-		X	-	O	O











## **DIVISION 12 – FURNISHINGS**

Section 12 4813

Carpet Type Entry Mats

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## SECTION 12 4813

### CARPET TILE ENTRY MATS

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. This **Section includes** the following:
  - 1. Carpet tile entry mats.
- B. **Related Sections** include the following:
  - 1. Section 09 6813 "**Carpet Tile**" for modular carpet elsewhere on Project.

##### 1.3 SUBMITTALS

- A. **Product Data:** Include manufacturer's specifications and installation instructions, construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of floor mat and frame specified.
- B. **Samples for Selection:** For each type of floor mat and frame indicated.
- C. **Maintenance Data:** For cleaning and maintaining floor mats to include in maintenance manuals.

##### 1.4 QUALITY ASSURANCE

- A. **Source Limitations:** Obtain floor mats and frames through one source from a single manufacturer.
- B. **Accessibility Requirements:** In addition to requirements of authorities having jurisdiction, provide installed floor mats that comply with Sections 302 and 303 in ICC A117.1.

##### 1.5 STORAGE AND HANDLING

- A. **Comply with** CRI 104 "Standard for Installation of Commercial Carpet - 2015", and with carpet tile manufacturer's written instructions.

#### PART 2 - PRODUCTS

##### 2.1 MANUFACTURERS

- A. **Acceptable Manufacturer:** Subject to compliance with requirements of Contract Documents, provide product by the following manufacturer:
  - 1. Manufacturer: Shaw Contract
  - 2. Product: Steppin Out Collection; Welcome II Tile, 5T031.

## 2.2 ENTRY CARPET

- A. **Properties:**
1. Construction: Needlebond hobnail.
  2. Gauge: 1/12.
  3. Stitches: 11.0 per inch.
  4. Finished Pile Thickness: 0.157 inch average.
  5. Face Yarn: PET polyester.
  6. Dye System: Solution dyed.
  7. Face Yarn Weight: 49 ounces/square yard.
  8. Backing Material: Ecoworx® tile.
  9. Size: 24 x 24 inch square.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. **Examine substrates, areas, and conditions** for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Verify that substrates and conditions are satisfactory for carpet installation and comply with requirements specified.
- B. **Concrete Subfloors:** Verify that concrete slabs comply with ASTM F 710 and the following:
1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by the Carpet manufacturer.
  2. Subfloor finishes comply with requirements specified in Division 3 Section "Cast-in-Place Concrete" for slabs receiving carpet.
  3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
- C. **Proceed with installation only after** unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. **General:** Comply with CRI 104 "Standard for Installation of Commercial Carpet - 2015", and with carpet tile manufacturer's written instructions for preparing substrates indicated to receive carpet tile installation.
- B. **Use trowelable leveling and patching compounds**, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.
- C. **Remove coatings**, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by the carpet manufacturer.
- D. **Broom and vacuum clean substrates** to be covered immediately before installing carpet. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.3 INSTALLATION

- A. **General:** Comply with CRI 104 "Standard for Installation of Commercial Carpet - 2015", and with carpet tile manufacturer's written installation instructions.
  - 1. Do not install carpet tile in entry vestibules and other areas of excessive traffic until other construction operations are completed.
- B. **Installation Method:** Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.
- C. **Maintain dye lot integrity.** Do not mix dye lots in same area.
- D. **Do not bridge building expansion joints** with carpet.
- E. **Cut and fit carpet to butt tightly** to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.
- F. **Extend carpet into** toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- G. **Maintain reference markers,** holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.
- H. **Unless noted otherwise, install pattern parallel** to walls and borders. Pattern as indicated on Legend-Finish and as determined by Architect prior to beginning installation.

### 3.4 CLEANING AND PROTECTION

- A. **Perform the following operations** immediately after installing carpet:
  - 1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
  - 2. Remove yarns that protrude from carpet surface.
  - 3. Vacuum carpet using commercial machine with face-beater element.
- B. **Protect installed carpet** tile per CRI 104 "Standard for Installation of Commercial Carpet - 2015", and with carpet tile manufacturer's written instructions.
- C. **Protect carpet against damage** from construction operations.

### 3.2 PROTECTION

- A. **Defer installation** of entry mats until Project is near Substantial Completion.

**END OF SECTION**

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# Alta View Hospital – Acute Rehabilitation Unit

9960 SOUTH 1300 EAST | SANDY, UTAH

## OWNER

Intermountain Healthcare  
36 S State Street, 16th Floor | Salt Lake City, Utah

## DATE

15 December 2020

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## **DIVISION 28**

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## **DIVISION 21 - FIRE SUPPRESSION**

Section 21 1000      Water-Based Fire Suppression

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## SECTION 21 1000

### 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.
- B. Section 019113 applies to this section for coordination with commissioning.

##### 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.
- 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	Existing to remain.
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
Flexible Sprinkler Drops	Match existing.
FM Global	No
Calculations	Not required if hydraulic demand is not increased.
Alarm Device	Horn/Strobe

FDC Caps	Existing to remain.
Special Items	See drawings for rooms with ceiling mounted patient lifts to be coordinated with.

### 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. Automatic Wet-Type, Class I Standpipe System: Includes NPS 1-1/2 hose connections with 1-1/2" reducers. Has open water-supply valve with pressure maintained and is capable of supplying water demand for fire sprinklers and hose valves. Piping is wet and serves floor control valve assemblies.
- B. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

### 1.5 PERFORMANCE REQUIREMENTS

- A. Standard Piping System Component Working Pressure: Listed for at least 175 psig.
- B. 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.



- C. Contractor is responsible for obtaining flow data for hydraulic calculations if the existing design basis is not maintained, use 10% reduced flow data and obtain approval from engineer, prior to submitting to other authorities having jurisdiction:
1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
  2. Sprinkler Occupancy Hazard Classifications:
    - a. Building Service Areas: Ordinary Hazard, Group 1.
    - b. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
    - c. General Storage Areas: Ordinary Hazard, Group 1.
    - d. Laundries: Ordinary Hazard, Group 1.
    - e. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
    - f. Exam and Procedure Offices: Light Hazard.
    - g. Corridors and Public Areas: Light Hazard.
    - h. Restaurant Service Areas: Ordinary Hazard, Group 1.
    - i. Shelled Space: Ordinary Hazard, Group 1.
  3. 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.
  4. Maximum Protection Area per Sprinkler:
    - a. Building Service Areas: 130 sq. ft.
    - b. Electrical Equipment Rooms: 130 sq. ft.
    - c. General Storage Areas: 130 sq. ft.
    - d. Laundries: 130 sq. ft.
    - e. Mechanical Equipment Rooms: 130 sq. ft.
    - f. Exam and Procedure Offices: 225 sq. ft.
    - g. Corridors and Public Areas: 225 sq. ft.
    - h. Restaurant Service Areas: 130 sq. ft.
    - i. Automobile Parking Areas: 130 sq. ft.
    - j. Shelled Space: 130 sq. ft.
    - k. Other Areas: According to NFPA 13 recommendations, unless otherwise indicated.
  5. 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.
- D. 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. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations, if applicable. Drawings are to be approved by Engineer prior to submission to State Fire Marshal.
- E. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13 and NFPA 14. Include "Contractor's Material and Test Certificate for Aboveground Piping" and "Contractor's Material and Test Certificate for Underground Piping."
- F. Welding certificates.
- G. Field quality-control test reports.
- H. Operation and Maintenance Data: For standpipe and sprinkler specialties to include in emergency, operation, and maintenance manuals.

## 1.7 QUALITY ASSURANCE

### A. Installer Qualifications:

1. An experienced installer who has designed and installed fire-suppression piping similar to that indicated for this Project and obtained design approval and inspection approval from authorities having jurisdiction. The Engineer requires evidence to support the ability of the contractor to perform work in the scope and volume as specified. A contractor, who cannot show such experience, may be found not suitable to perform the work. The following are the approved contractors for this project:
  - a. PRE-APPROVED CONTRACTORS LIST
    - 1) Alta Fire
    - 2) Certified Fire
    - 3) Chaparral Fire
    - 4) Delta Fire
    - 5) Quality Fire Protection
    - 6) Fire Engineering
    - 7) Fire Services Inc.
    - 8) FireTrol
    - 9) Simplex-Grinnell
    - 10) Western Automatic
    - 11) 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-2012, "International Building Code."
  - 2. IFC-2012, "International Fire Code."

## 1.8 COORDINATION

- A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

## 1.9 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Sprinkler Cabinets: Finished, wall-mounting, steel cabinet with hinged cover, with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler on Project.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

## 2.2 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 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.

## 2.4 FLEXIBLE CONNECTORS

- A. Flexible connectors shall 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. Flex-Hose Co., Inc.
  - 2. Flexicraft Industries.
  - 3. Flex-Pression, Ltd.
  - 4. Flex-Weld, Inc.
  - 5. Hyspan Precision Products, Inc.
  - 6. Metraflex, Inc.
- C. Stainless-Steel-Hose/Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include steel nipples or flanges, welded to hose.
- D. Stainless-Steel-Hose/Stainless-Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include stainless-steel nipples or flanges, welded to hose.

## 2.5 CORROSION-PROTECTIVE ENCASUREMENT FOR PIPING

- A. Encasement for Underground Metal Piping: ASTM A 674 or AWWA C105, PE film, 0.008-inch minimum thickness, tube or sheet.

## 2.6 SPRINKLER SPECIALTY FITTINGS

- A. Sprinkler specialty fittings shall have a 175-psig minimum working-pressure rating, and made of materials compatible with piping.
- 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. Manufacturers:

- 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.
- 1. Manufacturers:
    - a. Elkhart Brass Mfg. Co., Inc.
    - b. Fire-End and Croker Corp.
    - c. Potter-Roemer; Fire-Protection Div.
- D. Sprinkler Inspector's Test Fitting: Cast- or ductile-iron housing with threaded inlet and drain outlet and sight glass.
- 1. Manufacturers:
    - a. AGF Manufacturing Co.
    - b. Central Sprinkler Corp.
    - c. G/J Innovations, Inc.
    - d. Triple R Specialty of Ajax, Inc.
- E. Drop-Nipple Fittings: UL 1474, adjustable with threaded inlet and outlet, and seals.
- 1. Manufacturers:
    - a. CECA, LLC.
    - b. Merit.
- F. Dry-Pipe-System Fittings: UL listed for dry-pipe service.

## 2.7 LISTED FIRE-PROTECTION VALVES

- A. Valves shall have a 175-psig minimum pressure rating.
- 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. Globe Fire Sprinkler Corporation.
  - g. Grinnell Fire Protection.
  - h. Hammond Valve.
  - i. McWane, Inc.; Kennedy Valve Div.
  - j. Mueller Company.
  - k. NIBCO.
  - l. Potter-Roemer; Fire Protection Div.
  - m. Reliable Automatic Sprinkler Co., Inc.
  - n. Star Sprinkler Inc.
  - o. Stockham.
  - p. United Brass Works, Inc.
  - q. Victaulic Co. of America.
  - r. 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) Hammond Valve.
  - 3) NIBCO.
  - 4) 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) Hammond Valve.
  - 5) Milwaukee Valve Company.
  - 6) Mueller Company.
  - 7) NIBCO.
  - 8) 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.

## 2.8 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.

## 2.9 SPECIALTY VALVES

- A. Sprinkler System Control Valves: 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. Central Sprinkler Corp.
- b. Globe Fire Sprinkler Corporation.
- c. Grinnell Fire Protection.
- d. Reliable Automatic Sprinkler Co., Inc.
- e. Star Sprinkler Inc.
- f. Victaulic Co. of America.
- g. 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 gauges, 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) Grinnell Fire Protection.
- f) Reliable Automatic Sprinkler Co., Inc.
- g) Star Sprinkler Inc.
- h) 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) Grinnell Fire Protection.
- d) Reliable Automatic Sprinkler Co., Inc.
- e) Viking Corp.

- B. Automatic Drain Valves: UL 1726, NPS 3/4, ball-check device with threaded ends.

- 1. Manufacturers:

- a. Grinnell Fire Protection.

## 2.10 SPRINKLERS

- A. Sprinklers shall be UL listed or FMG approved, with 175-psig minimum pressure rating. Sprinklers shall have 250-psig minimum 300-psig pressure rating if sprinklers are components of high-pressure piping system.
- B. Manufacturers:
  - 1. Central Sprinkler Corp.
  - 2. Globe Fire Sprinkler Corporation.
  - 3. Grinnell Fire Protection.
  - 4. Reliable Automatic Sprinkler Co., Inc.
  - 5. Star Sprinkler Inc.
  - 6. Victaulic Co. of America.
  - 7. Viking Corp.
- C. Automatic Sprinklers: With heat-responsive element complying with the following:
  - 1. UL 199, for nonresidential applications.
  - 2. UL 1626, for residential applications.
- D. Sprinkler Types and Categories: Nominal 1/2-inch orifice for "Ordinary" temperature classification rating, unless otherwise indicated or required by application.
  - 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.
- E. Sprinkler types, features, and options as follows:
  - 1. Concealed ceiling sprinklers, including cover plate.
  - 2. Extended-coverage sprinklers, not allowed unless approved in writing prior to bidding.
  - 3. Flush ceiling sprinklers, including escutcheon, not allowed.
  - 4. Pendent sprinklers.
  - 5. Pendent, dry-type sprinklers.
  - 6. Quick-response sprinklers.
  - 7. Concealed sidewall sprinklers.
  - 8. Sidewall, dry-type sprinklers.
  - 9. Upright sprinklers.
- F. Sprinkler Finishes: Chrome plated, bronze, and painted.
- G. Special Coatings: Wax, lead, and corrosion-resistant paint.
- H. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for sprinklers are specified with sprinklers.
  - 1. Ceiling Mounting: Plastic, white finish, one piece, flat.
  - 2. Sidewall Mounting: Plastic, white finish, one piece, flat.
- I. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler.

## 2.11 HOSE CONNECTIONS

### A. Manufacturers:

1. Central Sprinkler Corp.
2. Elkhart Brass Mfg. Co., Inc.
3. Fire-End and Croker Corp.
4. Grinnell Fire Protection.
5. Guardian Fire Equipment Incorporated.
6. McWane, Inc.; Kennedy Valve Div.
7. Mueller Company.
8. Potter-Roemer; Fire-Protection Div.
9. 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.

## 2.12 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Electrically Operated Alarm: Horn/Strobe, NEMA 3R minimum:

- 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.

## 2.13 PRESSURE GAUGES

- 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 gauge 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.

## 2.14 DOUBLE CHECK VALVE ASSEMBLIES

- A. Manufacturers
- 1. Ames
  - 2. Febco
  - 3. Wilkins
  - 4. Watts
- B. Description; Resilient seated, spring loaded with testable outlets provided, as required by authorities Having Jurisdiction.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. 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 2 and Smaller: Threadable steel pipe with threaded ends; cast- or malleable-iron threaded fittings; and threaded joints.

- a. Victaulic Brand Mechanical tee fittings may be used

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 for applications where required by NFPA 13 and NFPA 14.
2. General-Duty Valves: For applications where UL-listed 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 gauge'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 Factory Mutual 2-8 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 gauges on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gauges with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gauge and valve. Install gauges to permit removal, and install where they will not be subject to freezing.



### 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 or horizontal position, per listings and for proper direction of flow.
- D. Deluge Valves: Install in vertical position, in proper direction flow, in main supply to deluge system.

### 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.
  - 3. Wall Mounting: Concealed sidewall sprinkler.
  - 4. Institutional sprinklers shall be installed in areas of detention, correctional or mental health care facilities.
  - 5. Spaces Subject to Freezing: Upright; pendent, dry-type; and sidewall, dry-type sprinklers.
  - 6. Provide freeze proof type automatic sprinkler heads serving unconditioned spaces, areas subject to freezing and in other areas requiring their use.
  - 7. Heads located within the air streams of unit heaters or other heat-emitting equipment shall be selected for proper temperature rating.
  - 8. Sprinkler Finishes: Use sprinklers with the following finishes:
    - a. Upright, Pendent, and Sidewall Sprinklers: Chrome in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view.
    - b. Concealed Sprinklers: Rough brass, with White cover plate to match ceiling color.
- B. Sprinklers: Use the following:
  - 1. All sprinklers shall be listed, quick response type.
  - 2. 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 flat plate type escutcheon.

### 3.12 SPRINKLER INSTALLATION

- A. Every effort shall be required to insure that the heads form a symmetrical pattern in the ceiling with the ceiling grid, lights, diffusers and grilles. Offsets shall be made in piping to accommodate ductwork in the ceiling. Heads should be symmetrical and all piping run parallel or perpendicular to building lines.
  - 1. In no case shall sprinkler heads be installed closer than approved distances from ceiling obstructions and HVAC ductwork.
  - 2. Sprinkler heads shall not conflict with tile grids.
  - 3. Sprinkler heads shall be located near center of corridors.
- B. Where layout of sprinkler heads is shown on reflected ceiling plans the locations shall be followed unless approval is obtained from the Architect or such locations shown do not meet the requirements of NFPA-13. In either case, approval of the Architect shall be obtained in writing before sprinkler head locations are changed. If the installation of additional heads is needed to conform to NFPA 13 requirements in areas where heads are shown on reflected ceiling plans, they shall be included in the contract price.
- C. Install sprinklers in patterns indicated.
- D. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing. Use dry-type sprinklers with water supply from heated space.
- E. Future finish shelled and tenant finish; Shell spaces shall be piped to accommodate future. 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 throughout the project.

### 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 CONNECTIONS

- A. Connect water-supply piping and standpipes and sprinklers where indicated.
- B. Install ball drip valves at each check valve for fire department connection. Drain to floor drain or outside building.
- C. Connect piping to specialty valves, hose valves, specialties, fire department connections, and accessories.
- D. Electrical Connections: Power wiring is specified in Division 28.
- E. Connect alarm devices to fire alarm.

### 3.15 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."

### 3.16 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. Report test results promptly and in writing to Architect and authorities having jurisdiction.
- E. 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.

### 3.17 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Remove and replace sprinklers having paint other than factory finish.

### 3.18 PROTECTION

- A. Protect sprinklers from damage until Substantial Completion.

### 3.19 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.

### 3.20 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.

### 3.21 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.
- C. Electronic copy of AutoCAD as-built drawings shall also be provided on CD, with each O&M Manual.

### 3.22 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.

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## **DIVISIONS 22 - PLUMBING**

Section 22 0500	Common Work Results for Plumbing
Section 22 0517	Sleeves and Sleeve Seals for Plumbing Piping
Section 22 0518	Escutcheons for Plumbing Piping
Section 22 0523	General Duty Valves for Plumbing Piping
Section 22 0529	Hangers and Supports for Plumbing Piping and Equipment
Section 22 0533	Heat Tracing for Plumbing Piping
Section 22 0548	Vibration and Seismic Control for Plumbing Piping and Equipment
Section 22 0553	Identification for Plumbing Piping and Equipment
Section 22 0719	Plumbing Piping Insulation
Section 22 1116	Domestic Water Piping
Section 22 1119	Domestic Water Piping Specialties
Section 22 1316	Sanitary Waste and Vent Piping
Section 22 1319	Sanitary Waste Piping Specialties
Section 22 1413	Facility Storm Drainage Piping
Section 22 1423	Storm Drainage Piping Specialties
Section 22 4000	Plumbing Fixtures
Section 22 6113	Compressed-Air Piping for Laboratory and Healthcare Facilities
Section 22 6213	Vacuum Piping for Laboratory and Healthcare Facilities
Section 22 6313	Gas Piping for Laboratory and Healthcare Facilities

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## SECTION 22 0500

### 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.
- B. Section 019113 applies to this section for coordination with commissioning.

##### 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 SEISMIC REQUIREMENTS

- A. Seismic Performance: Equipment, pipe hangers and supports shall withstand the effects of earthquake motions determined according to SEI/ASCE 7 and with the requirements specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
  - 1. For components with a seismic importance factor of 1.0 the term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified."
  - 2. For components with a seismic importance factor of 1.5 the term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified and the system will be fully operational after the seismic event."

##### 1.4 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.

#### 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.

## **PART 3 - EXECUTION**

### **3.1 PLUMBING DEMOLITION**

- A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove plumbing systems, equipment, and components indicated to be removed.
  - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
  - 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
  - 3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
  - 4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
  - 5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

### **3.2 SEISMIC REQUIREMENTS**

- A. Comply with SEI/ASCE 7 and with requirements for seismic seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

### **3.3 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.

### 3.4 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.

### 3.5 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.

### 3.6 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.

### 3.7 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.

### 3.8 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.

### 3.9 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

### 3.10 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.

### 3.11 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**

## 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."
  4. For sound-rated partitions, fill the opening between sleeve and piping with insulation prior to sealing.
- 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-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**



## SECTION 22 0518

### ESCUTCHEONS FOR PLUMBING PIPING

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. Section Includes:
  - 1. Escutcheons.

##### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

#### PART 2 - PRODUCTS

##### 2.1 ESCUTCHEONS

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.
- C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

#### PART 3 - EXECUTION

##### 3.1 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to 2 inch (50mm), tube, and insulation of insulated piping and with OD that completely covers opening.
  - 1. Escutcheons for New Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type with polished, chrome-plated finish.
    - b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.

- c. Insulated Piping: One-piece, stamped-steel type with chrome-plated finish.
- d. Bare Piping 2 inch and Smaller at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
- e. Bare Piping Larger than 2 inch at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type with polished, chrome-plated finish.
- f. Bare Piping 2 inch and Smaller at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
- g. Bare Piping Larger than 2 inch at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type with polished, chrome-plated finish.
- h. Bare Piping 2 inch and Smaller in Unfinished Service Spaces: One-piece, cast-brass type with polished, chrome-plated or rough-brass finish.
- i. Bare Piping Larger than 2 inch in Unfinished Service Spaces: One-piece, stamped-steel type with polished, chrome-plated finish.
- j. Bare Piping 2 inch and Smaller in Equipment Rooms: One-piece, cast-brass type with polished, chrome-plated or rough-brass finish.
- k. Bare Piping in Equipment Rooms Larger than 2 inch: One-piece, stamped-steel type with chrome- or cadmium-plated finish.

### 3.2 FIELD QUALITY CONTROL

- A. Replace broken and damaged escutcheons and floor plates using new materials.

**END OF SECTION**

## SECTION 22 0523

### 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. Iron swing check valves with closure control.
8. Iron, center-guided check valves.
9. Iron, plate-type check valves.
10. Bronze gate valves.
11. Bronze globe valves.
12. Iron globe valves.
13. Chainwheels.

###### B. Related Sections:

1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
3. Division 33 water distribution piping Sections for general-duty and specialty valves for site construction piping.

##### 1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Nonrising stem.
- E. OS&Y: Outside screw and yoke.
- F. RS: Rising stem.

G. SWP: Steam working pressure.

#### 1.4 SUBMITTALS

A. Product Data: For each type of valve indicated.

#### 1.5 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
2. ASME B31.1 for power piping valves.
3. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 for valve materials for potable-water service.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set angle, gate, 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.
5. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.

E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:

1. Gate Valves: With rising stem.
2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
3. Butterfly Valves: With extended neck.

F. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Grooved: With grooves according to AWWA C606.
3. Solder Joint: With sockets according to ASME B16.18.
4. 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. Legend Valve.
- g. Milwaukee Valve Company.
- h. NIBCO INC.
- i. Red-White Valve Corporation.
- j. 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. Legend Valve.
- k. Milwaukee Valve Company.
- l. NIBCO INC.
- m. Norriseal; a Dover Corporation company.
- n. Red-White Valve Corporation.
- o. Spence Strainers International; a division of CIRCOR International, Inc.
- p. 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. Legend Valve.
- l. Milwaukee Valve Company.
- m. Mueller Steam Specialty; a division of SPX Corporation.
- n. NIBCO INC.
- o. Norriseal; a Dover Corporation company.
- 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: 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. Legend Valve.
- l. Milwaukee Valve Company.
- m. Mueller Steam Specialty; a division of SPX Corporation.
- n. NIBCO INC.
- o. Norriseal; a Dover Corporation company.
- p. Red-White Valve Corporation.
- q. Spence Strainers International; a division of CIRCOR International, Inc.
- r. Sure Flow Equipment Inc.
- s. 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. Legend Valve.
  - g. Milwaukee Valve Company.
  - h. NIBCO INC.
  - i. Powell Valves.
  - j. Red-White Valve Corporation.
  - k. Sure Flow Equipment Inc.
  - l. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  - m. 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 IRON SWING CHECK VALVES WITH CLOSURE CONTROL

### A. Class 125, Iron Swing Check Valves with Lever- and Spring-Closure Control:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. NIBCO 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.
  - h. Closure Control: Factory-installed, exterior lever and spring.

## 2.9 IRON, CENTER-GUIDED CHECK VALVES

### A. Class 125, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Anvil International, Inc.
  - b. APCO Willamette Valve and Primer Corporation.
  - c. Crispin Valve.
  - d. DFT Inc.
  - e. Flo Fab Inc.
  - f. GA Industries, Inc.
  - g. Hammond Valve.
  - h. Metraflex, Inc.
  - i. Milwaukee Valve Company.
  - j. Mueller Steam Specialty; a division of SPX Corporation.
  - k. NIBCO INC.
  - l. Spence Strainers International; a division of CIRCOR International, Inc.
  - m. Sure Flow Equipment Inc.
  - n. Val-Matic Valve & Manufacturing Corp.
  - o. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
  - a. Standard: MSS SP-125.
  - b. CWP Rating: 200 psig.
  - c. Body Material: ASTM A 126, gray iron.
  - d. Style: Compact wafer.

e. Seat: Bronze.

B. Class 150, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. APCO Willamette Valve and Primer Corporation.
- b. Crispin Valve.
- c. Val-Matic Valve & Manufacturing Corp.

2. Description:

- a. Standard: MSS SP-125.
- b. CWP Rating: 300 psig.
- c. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
- d. Style: Compact wafer.
- e. Seat: Bronze.

C. Class 250, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. APCO Willamette Valve and Primer Corporation.
- b. Crispin Valve.
- c. DFT Inc.
- d. Flo Fab Inc.
- e. Hammond Valve.
- f. Metraflex, Inc.
- g. Milwaukee Valve Company.
- h. NIBCO INC.
- i. Sure Flow Equipment Inc.
- j. Val-Matic Valve & Manufacturing Corp.

2. Description:

- a. Standard: MSS SP-125.
- b. CWP Rating: 400 psig.
- c. Body Material: ASTM A 126, gray iron.
- d. Style: Compact wafer, spring loaded.
- e. Seat: Bronze.

D. Class 300, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. APCO Willamette Valve and Primer Corporation.
- b. Crispin Valve.
- c. Val-Matic Valve & Manufacturing Corp.

2. Description:

- a. Standard: MSS SP-125.

- b. CWP Rating: 500 psig.
- c. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
- d. Style: Compact wafer, spring loaded.
- e. Seat: Bronze.

## 2.10 IRON, PLATE-TYPE CHECK VALVES

### A. Class 125, Iron, Dual-Plate Check Valves with Metal Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. APCO Willamette Valve and Primer Corporation.
  - b. Crane Co.; Crane Valve Group; Crane Valves.
  - c. Flomatic Corporation.
  - d. Mueller Steam Specialty; a division of SPX Corporation.
2. Description:
  - a. Standard: API 594.
  - b. CWP Rating: 200 psig.
  - c. Body Design: Wafer, spring-loaded plates.
  - d. Body Material: ASTM A 126, gray iron.
  - e. Seat: Bronze.

### B. Class 150, Iron, Dual-Plate Check Valves with Metal Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. APCO Willamette Valve and Primer Corporation.
  - b. Crane Co.; Crane Valve Group; Crane Valves.
  - c. Mueller Steam Specialty; a division of SPX Corporation.
  - d. Val-Matic Valve & Manufacturing Corp.
2. Description:
  - a. Standard: API 594.
  - b. CWP Rating: 300 psig.
  - c. Body Design: Wafer, spring-loaded plates.
  - d. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
  - e. Seat: Bronze.

### C. Class 250, Iron, Dual-Plate Check Valves with Metal Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. APCO Willamette Valve and Primer Corporation.
  - b. Crane Co.; Crane Valve Group; Crane Valves.
2. Description:
  - a. Standard: API 594.

- b. CWP Rating: 400 psig.
- c. Body Design: Wafer, spring-loaded plates.
- d. Body Material: ASTM A 126, gray iron.
- e. Seat: Bronze.

D. Class 300, Iron, Dual-Plate Check Valves with Metal Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. APCO Willamette Valve and Primer Corporation.
  - b. Crane Co.; Crane Valve Group; Crane Valves.
  - c. Mueller Steam Specialty; a division of SPX Corporation.
  - d. Val-Matic Valve & Manufacturing Corp.
2. Description:
  - a. Standard: API 594.
  - b. CWP Rating: 500 psig.
  - c. Body Design: Wafer, spring-loaded plates.
  - d. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
  - e. Seat: Bronze.

E. Class 125, Iron, Dual-Plate Check Valves with Resilient Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. APCO Willamette Valve and Primer Corporation.
  - b. Cooper Cameron Valves TVB Techno.
  - c. Crane Co.; Crane Valve Group; Crane Valves.
  - d. Crane Co.; Crane Valve Group; Stockham Division.
  - e. NIBCO INC.
  - f. Spence Strainers International; a division of CIRCOR International, Inc.
  - g. Sure Flow Equipment Inc.
  - h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
  - a. Standard: API 594.
  - b. CWP Rating: 200 psig.
  - c. Body Design: Wafer, spring-loaded plates.
  - d. Body Material: ASTM A 126, gray iron.
  - e. Seat: EPDM or NBR.

F. Class 150, Iron, Dual-Plate Check Valves with Resilient Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. APCO Willamette Valve and Primer Corporation.
  - b. Crane Co.; Crane Valve Group; Crane Valves.
  - c. Crane Co.; Crane Valve Group; Jenkins Valves.
  - d. Val-Matic Valve & Manufacturing Corp.

2. Description:

- a. Standard: API 594.
- b. CWP Rating: 300 psig.
- c. Body Design: Wafer, spring-loaded plates.
- d. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
- e. Seat: EPDM or NBR.

G. Class 250, Iron, Dual-Plate Check Valves with Resilient Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. APCO Willamette Valve and Primer Corporation.
- b. Crane Co.; Crane Valve Group; Crane Valves.
- c. Sure Flow Equipment Inc.

2. Description:

- a. Standard: API 594.
- b. CWP Rating: 400 psig.
- c. Body Design: Wafer, spring-loaded plates.
- d. Body Material: ASTM A 126, gray iron.
- e. Seat: EPDM or NBR.

H. Class 300, Iron, Dual-Plate Check Valves with Resilient Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. APCO Willamette Valve and Primer Corporation.
- b. Val-Matic Valve & Manufacturing Corp.

2. Description:

- a. Standard: API 594.
- b. CWP Rating: 500 psig.
- c. Body Design: Wafer, spring-loaded plates.
- d. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
- e. Seat: EPDM or NBR.

2.11 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.

## 2.12 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.

2.13 CHAINWHEELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1. Babbitt Steam Specialty Co.
- 2. Roto Hammer Industries.
- 3. Trumbull Industries.

B. Description: Valve actuation assembly with sprocket rim, brackets, and chain.

- 1. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
- 2. Attachment: For connection to ball butterfly and plug valve stems.
- 3. Sprocket Rim with Chain Guides: Aluminum, of type and size required for valve.
- 4. Chain: Hot-dip, galvanized steel, of size required to fit sprocket rim.

**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 chainwheels on operators for ball butterfly gate globe and plug valves NPS 4 and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor.
- F. Install check valves for proper direction of flow and as follows:
  - 1. Swing Check Valves: In horizontal position with hinge pin level.
  - 2. Center-Guided and Plate-Type Check Valves: In horizontal or vertical position, between flanges.
  - 3. 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 with spring or iron, center-guided, metal or resilient-seat 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.
4. Iron, Center-Guided Check Valves: Class 125, globe, metal seat.
5. Iron, Plate-Type Check Valves: Class 125; dual plate; metal seat.

### 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, 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 Swing Check Valves with Closure Control: Class 125, lever and spring weight.
6. Iron, Center-Guided Check Valves: Class 125, Class 150, Class 250 or Class 300, compact-wafer, metal seat.
7. Iron, Plate-Type Check Valves: Class 125, Class 150, Class 250 or Class 300; single plate; metal seat.
8. Iron Globe Valves: Class 125 or Class 250.

**END OF SECTION**

## SECTION 22 0529

### HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. This Section includes the following 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 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

- C. Seismic Performance: Plumbing equipment, hangers and supports shall withstand the effects of earthquake motions determined according to SEI/ASCE 7 and with the requirements specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment.
1. For components with a seismic importance factor of 1.0 the term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified."
  2. For components with a seismic importance factor of 1.5 the term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified and the system will be fully operational after the seismic event."

## 1.5 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).

## 1.6 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. Globe Pipe Hanger Products, Inc.
  - 9. Grinnell Corp.
  - 10. GS Metals Corp.
  - 11. National Pipe Hanger Corporation.
  - 12. PHD Manufacturing, Inc.
  - 13. PHS Industries, Inc.
  - 14. Piping Technology & Products, Inc.
  - 15. Tolco Inc.
  - 16. 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. GS Metals Corp.
5. Hilti, Inc.
6. Power-Strut Div.; Tyco International, Ltd.
7. Thomas & Betts Corporation.
8. Tolco Inc.
9. 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-joint construction to attach to top flange of structural shape.
  3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.

5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
  6. C-Clamps (MSS Type 23): For structural shapes.
  7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
  8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
  9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
  10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
  11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
  12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    - a. Light (MSS Type 31): 750 lb.
    - b. Medium (MSS Type 32): 1500 lb.
    - c. Heavy (MSS Type 33): 3000 lb.
  13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
  14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
  15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
  2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
  3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
  2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
  3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
  4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
  5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
  6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
  7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
  8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

- a. Horizontal (MSS Type 54): Mounted horizontally.
  - b. Vertical (MSS Type 55): Mounted vertically.
  - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
  - M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.
  - N. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
  - O. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

### 3.2 HANGER AND SUPPORT INSTALLATION

- A. Comply with SEI/ASCE 7 and with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- C. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
  - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
  - 2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- E. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- F. Fastener System Installation:
  - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual. Powder actuated fasteners shall not be used for seismic bracing attachments.
  - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions. For anchors resisting seismic loads and/or supporting life-safety systems including fire sprinkler systems, anchors shall have been tested for 'Cracked Concrete' per A.C. 193 and shall have a valid ICC-ES Evaluation Report
- G. Pipe 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 0533

### HEAT TRACING 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. This Section includes plumbing piping heat tracing for freeze prevention, domestic hot-water-temperature maintenance, and snow and ice melting on roofs and in gutters and downspouts with the following electric heating cables:

- 1. Constant wattage.

##### 1.3 SUBMITTALS

- A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each type of product indicated.

- 1. Schedule heating capacity, length of cable, spacing, and electrical power requirement for each electric heating cable required.

- B. Shop Drawings: For electric heating cable. Include plans, sections, details, and attachments to other work.

- 1. Wiring Diagrams: Power, signal, and control wiring.

- C. Field quality-control test reports.

- D. Operation and Maintenance Data: For electric heating cables to include in operation and maintenance manuals.

- E. Warranty: Special warranty specified in this Section.

##### 1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

## 1.5 WARRANTY

- A. When warranties are required, verify with Owner's counsel that special warranties stated in this Article are not less than remedies available to Owner under prevailing local laws. Coordinate with Division 01 Section "Product Requirements."
- B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace electric heating cable that fails in materials or workmanship within specified warranty period.
  - 1. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 CONSTANT-WATTAGE HEATING CABLES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. BH Thermal Corporation.
  - 2. Chromalox, Inc.; Wiegard Industrial Division; Emerson Electric Company.
  - 3. Delta-Therm Corporation.
  - 4. Easy Heat Inc.
  - 5. Nelson Heat Trace.
  - 6. Pyrotenax; a division of Tyco Thermal Controls.
  - 7. Raychem; a division of Tyco Thermal Controls.
  - 8. Thermon Manufacturing Co.
  - 9. Trasor Corp.
- B. Heating Element: Pair of parallel No. 12 AWG, nickel-coated stranded copper bus wires with single-stranded resistor wire connected between bus wires. Terminate with waterproof, factory-assembled nonheating leads with connectors at one end, and seal the opposite end watertight.
- C. Electrical Insulating Jacket: Flame-retardant fluoropolymer.
- D. Cable Cover: Stainless-steel braid, and polyolefin outer jacket with UV inhibitor.
- E. Maximum Operating Temperature (Power On): 392 deg F.
- F. Capacities and Characteristics:
  - 1. Maximum Heat Output: Provide capacities and characteristics as noted on the drawings.

### 2.2 CONTROLS

- A. Pipe-Mounting Thermostats for Freeze Protection:
  - 1. Remote bulb unit with adjustable temperature range from 30 to 50 deg F.
  - 2. Snap action; open-on-rise, single-pole switch with minimum current rating adequate for connected cable.

3. Remote bulb on capillary, resistance temperature device, or thermistor for directly sensing pipe-wall temperature.
4. Corrosion-resistant, waterproof control enclosure.

### 2.3 ACCESSORIES

- A. Cable Installation Accessories: Fiberglass tape, heat-conductive putty, cable ties, silicone end seals and splice kits, and installation clips all furnished by manufacturer, or as recommended in writing by manufacturer.
- B. Warning Labels: Refer to Division 22 Section "Identification for Plumbing Piping and Equipment."
- C. Warning Tape: Continuously printed "Electrical Tracing"; vinyl, at least 3 mils thick, and with pressure-sensitive, permanent, waterproof, self-adhesive back.
  1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches: 3/4 inch minimum.
  2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches or Larger: 1-1/2 inches minimum.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine surfaces and substrates to receive electric heating cables for compliance with requirements for installation tolerances and other conditions affecting performance.
  1. Ensure surfaces and pipes in contact with electric heating cables are free of burrs and sharp protrusions.
  2. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 APPLICATIONS

- A. Install the following types of electric heating cable for the applications described:
  1. Snow and Ice Melting in Gutters and Downspouts: Constant-wattage heating cable.
  2. Freeze protection for roof drainage piping: Constant-wattage heating cable.
  3. Exterior water piping: Constant-wattage heating cable.

### 3.3 INSTALLATION

- A. Install electric heating cable across expansion, construction, and control joints according to manufacturer's written recommendations using cable protection conduit and slack cable to allow movement without damage to cable.
- B. Electric Heating Cable Installation for Snow and Ice Melting in Gutters and Downspouts: Install in gutters and downspouts with clips furnished by manufacturer that are compatible with gutters, and downspouts.

- C. Electric Heating Cable Installation for Freeze Protection for Piping:
  - 1. Install electric heating cables after piping has been tested and before insulation is installed.
  - 2. Install electric heating cables according to IEEE 515.1.
  - 3. Install insulation over piping with electric cables according to Division 22 Section "Plumbing Insulation."
  - 4. Install warning tape on piping insulation where piping is equipped with electric heating cables.
- D. Set field-adjustable switches and circuit-breaker trip ranges.
- E. Protect installed heating cables, including nonheating leads, from damage.

### 3.4 CONNECTIONS

- A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

### 3.5 FIELD QUALITY CONTROL

- A. Testing: Perform tests after cable installation but before application of coverings such as insulation, wall or ceiling construction, or concrete.
  - 1. Test cables for electrical continuity and insulation integrity before energizing.
  - 2. Test cables to verify rating and power input. Energize and measure voltage and current simultaneously.
- B. Repeat tests for continuity, insulation resistance, and input power after applying thermal insulation on pipe-mounting cables.
- C. Remove and replace malfunctioning units and retest as specified above.

**END OF SECTION**

## **SECTION 22 0548**

### **VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT**

#### **PART 1 - GENERAL**

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. This Section includes the following restraints and vibration isolation as defined in Section 230548 "Vibration Isolation and Seismic Controls for HVAC" for the following:
  - 1. Plumbing Piping.
  - 2. Plumbing Equipment.

#### **PART 2 - PRODUCTS**

##### 2.1 (NOT USED)

#### **PART 3 - EXECUTION**

##### 3.1 (NOT USED)

END OF SECTION

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## SECTION 22 0553

### IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. Section Includes:
  - 1. Equipment labels.
  - 2. 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 0719

### PLUMBING PIPING INSULATION

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. Section includes insulating the following plumbing piping services:
  1. Domestic cold-water piping.
  2. Domestic hot-water piping.
  3. Domestic recirculating hot-water piping.
  4. Roof drains and rainwater leaders.
  5. Supplies and drains for handicap-accessible lavatories and sinks.

##### 1.3 DEFINITIONS:

- A. Refer to Section 220500 "Common Work Results for Plumbing".

##### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).
- B. LEED Submittals:
  1. Product Data for Credit IEQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content and chemical components.
  2. Laboratory Test Reports for Credit IEQ 4: For adhesives and sealants, documentation indicating that product complies 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: Include plans, elevations, sections, details, and attachments to other work.
  1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
  2. Detail attachment and covering of heat tracing inside insulation.
  3. Detail insulation application at pipe expansion joints for each type of insulation.
  4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
  5. Detail removable insulation at piping specialties, equipment connections, and access panels.
  6. Detail application of field-applied jackets.

7. Detail application at linkages of control devices.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

#### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

#### 1.8 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

#### 1.9 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.



- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

## **PART 2 - PRODUCTS**

### **2.1 INSULATION MATERIALS**

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Insulation for below-ambient service requires a vapor-barrier.
- C. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- D. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- E. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- F. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- G. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular 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-Lock, Insul-Tube, and K-FLEX LS.
- H. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553:
  - 1. Type II and ASTM C 1290, Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
  - 2. Products: Subject to compliance with requirements, provide one of the following:
    - a. CertainTeed Corp.; 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.
- 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-Degree 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,
- a. Without factory-applied jacket with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- J. Prefabricated Thermal Insulating Fitting Covers: Comply with ASTM C 450 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

## 2.2 INSULATING CEMENTS

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
- 1. Products: Subject to compliance with requirements, provide the following:
    - a. Ramco Insulation, Inc.; Super-Stik.
- B. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.
- 1. Products: Subject to compliance with requirements, provide the following:
    - a. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.

## 2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Flexible Elastomeric 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 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. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
    - b. Eagle Bridges - Marathon Industries; 225.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-20.
    - 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).
- E. PVC Jacket Adhesive: Compatible with PVC jacket.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Dow Corning Corporation; 739, Dow Silicone.
    - b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
    - c. P.I.C. Plastics, Inc.; Welding Adhesive.
    - d. Speedline Corporation; Polyco VP Adhesive.
  2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
    - b. Vimasco Corporation; 749.
  2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
  3. Service Temperature Range: Minus 20 to plus 180 deg F .
  4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
  5. Color: White.
- C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-30.
  - b. Eagle Bridges - Marathon Industries; 501.
  - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-35.
  - d. Mon-Eco Industries, Inc.; 55-10.
2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
3. Service Temperature Range: 0 to 180 deg F .
4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
5. Color: White.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel.
  - b. Eagle Bridges - Marathon Industries; 570.
  - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.
2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F .
4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
5. Color: White.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
  - b. Eagle Bridges - Marathon Industries; 550.
  - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
  - d. Mon-Eco Industries, Inc.; 55-50.
  - e. Vimasco Corporation; WC-1/WC-5.
2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F .
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

## 2.5 SEALANTS

A. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide the following:
  - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F .
5. Color: White.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.6 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

## 2.7 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Johns Manville; Zeston.
    - b. P.I.C. Plastics, Inc.; FG Series.
    - c. Proto Corporation; LoSmoke.
    - d. Speedline Corporation; SmokeSafe.
  2. Adhesive: As recommended by jacket material manufacturer.
  3. Color: Color-code jackets based on system.
    - a. White.
  4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
    - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
- C. Metal Jacket:
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
    - b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
    - c. RPR Products, Inc.; Insul-Mate.
  2. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), 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. 3-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. ABI, Ideal Tape Division; 428 AWF ASJ.
    - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
    - c. Compac Corporation; 104 and 105.
    - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
  - 2. Width: 3 inches.
  - 3. Thickness: 11.5 mils.
  - 4. Adhesion: 90 ounces force/inch in width.
  - 5. Elongation: 2 percent.
  - 6. Tensile Strength: 40 lbf/inch in width.
  - 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. ABI, Ideal Tape Division; 370 White PVC tape.
    - b. Compac Corporation; 130.
    - c. Venture Tape; 1506 CW NS.
  - 2. Width: 2 inches.
  - 3. Thickness: 6 mils.
  - 4. Adhesion: 64 ounces force/inch in width.
  - 5. Elongation: 500 percent.
  - 6. Tensile Strength: 18 lbf/inch in width.
- C. 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.

## 2.9 SECUREMENTS

- A. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

## 2.10 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 Company.
  - b. Insul-Tect Products Co.; a subsidiary of MVG Molded Products.
  - c. McGuire Manufacturing.
  - d. Plumberex.
  - e. Truebro; a brand of IPS Corporation.
  - f. Zurn Industries, LLC; 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.

- B. Protective Shielding Piping Enclosures:

1. Manufacturers: Subject to compliance with requirements provide products by one of the following:
  - a. Truebro; a brand of IPS Corporation.
  - b. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.
2. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
  - 1. Verify that systems to be insulated have been tested and are free of defects.
  - 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
  - 1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
  - 2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

### **3.3 GENERAL INSTALLATION REQUIREMENTS**

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.



- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at:
    - a. 2 inches o.c.
    - b. For below-ambient services, apply vapor-barrier mastic over staples.
  - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
  - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
  - 1. Vibration-control devices.
  - 2. Testing agency labels and stamps.
  - 3. Nameplates and data plates.

4. 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 Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
1. Pipe: Install insulation continuously through floor penetrations.
  2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
  2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
  3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
  4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
  5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
  6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
  7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
  8. For services not specified to receive a field-applied jacket except for flexible install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
  9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
  2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
  3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.

4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

### 3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
  1. Install pipe insulation to outer diameter of pipe flange.
  2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
  3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
  4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
  1. Install mitered sections of pipe insulation.
  2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
  1. Install preformed valve covers manufactured of same material as pipe insulation when available.
  2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
  3. Install insulation to flanges as specified for flange insulation application.
  4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

### 3.7 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
  1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
  2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
  3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.

4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

### 3.8 FIELD-APPLIED JACKET INSTALLATION

A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. 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.

B. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

### 3.9 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Insulation shall have a k value that meets the minimum requirements of the latest International Energy Conservation Code (IECC).

- C. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
1. Drainage piping located in crawl spaces.
  2. Underground piping.
  3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

### 3.10 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. NPS 1-1/2 and Smaller: Insulation shall be one of the following:
  - a. Flexible Elastomeric:
    - 1) 1 inch thick
  - b. Mineral-Fiber, Preformed Pipe Insulation, Type I:
    - 1) 1 inch thick
2. NPS 2 and Larger: Insulation shall be one of the following:
  - a. Flexible Elastomeric:
    - 1) 1-1/2 inches thick.
  - b. Mineral-Fiber, Preformed Pipe Insulation:
    - 1) 1-1/2 inches 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) 1 inch thick.
2. NPS 2 and Larger: Insulation shall be the following:
  - a. Mineral-Fiber, Preformed Pipe Insulation, Type I:
    - 1) 1-1/2 inches thick

C. Domestic Chilled Water (Potable):

1. All Pipe Sizes: Insulation shall be one of the following:
  - a. Flexible Elastomeric: 1 inch thick.
  - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

D. Storm water and Overflow:

1. All Pipe Sizes: Insulation shall be one of the following:
  - a. Flexible Elastomeric: 1 inch thick.
  - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

E. Roof Drain and Overflow Drain Bodies:

1. All Pipe Sizes: Insulation shall be one of the following:

- a. Flexible Elastomeric: 1 inch thick.
- b. Mineral-Fiber, Blanket Insulation, Type I: 1 inch thick.
- c. Drain Manufacturer's Pre-formed bowl Insulation: 1 inch thick.

F. Sanitary Waste Piping Where Heat Tracing Is Installed:

- 1. All Pipe Sizes: Insulation shall be the following:
  - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inches thick.

G. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F :

- 1. All Pipe Sizes: Insulation shall be one of the following:
  - a. Flexible Elastomeric:
    - 1) 3/4 inch thick.
  - b. Mineral-Fiber, Preformed Pipe Insulation, Type I:
    - 1) 3/4 inch thick.

H. Hot Service Drains:

- 1. All Pipe Sizes: Insulation shall be the following:
  - a. Mineral-Fiber, Preformed Pipe, Type I or II: 1 inch thick.

I. Hot Service Vents:

- 1. All Pipe Sizes: Insulation shall be the following:
  - a. Mineral-Fiber, Preformed Pipe, Type I or II: 1 inch thick.

### 3.11 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Domestic Water Piping:

- 1. All Pipe Sizes: Insulation shall be one of the following:
  - a. Flexible Elastomeric: 2 inches thick.
  - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.

B. Domestic Hot and Recirculated Hot Water:

- 1. All Pipe Sizes: Insulation shall be the following:
  - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.

C. Sanitary Waste Piping Where Heat Tracing Is Installed:

- 1. All Pipe Sizes: Insulation shall be the following:
  - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.

D. Hot Service Drains:

1. All Pipe Sizes: Insulation shall be the following:
  - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

E. Hot Service Vents:

1. All Pipe Sizes: Insulation shall be the following:
  - a. Mineral-Fiber, Preformed Pipe Insulation, Type II: 1 inch thick.

3.12 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Concealed:
  1. None.
- D. Piping, Exposed:
  1. PVC:
    - a. White: 30 mils thick

3.13 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. Aluminum, Stucco Embossed: 0.016 inch thick.

3.14 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

- A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

**END OF SECTION**



**SECTION 22 1116**  
**DOMESTIC WATER PIPING**

**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

- 1. Under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.
- 2. Encasement for piping.

B. Related Requirements:

- 1. Division 22 Section "Facility Water Distribution Piping" for water-service piping outside the building from source to the point where water-service piping enters the building.

1.3 SEISMIC REQUIREMENTS

- A. Seismic Performance: Pipe hangers and supports shall withstand the effects of earthquake motions determined according to SEI/ASCE 7 and with the requirements specified in Section 230548 "Vibration and Seismic Controls for HVAC."

- 1. For piping 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 piping 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."

1.4 ACTION SUBMITTALS

- A. Product Data: For transition fittings and dielectric fittings.

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. 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.

1.5 INFORMATIONAL SUBMITTALS

- A. System purging and disinfecting activities report.
- B. Field quality-control reports.

1.6 FIELD CONDITIONS

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
  1. Notify Construction Manager 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.

## 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. PP-to-Metal Transition Fittings:
  - 1. Description:
    - a. PP one-piece fitting with manufacturer's Schedule 80 equivalent dimensions.
    - b. One end with threaded brass insert and one fusion-socket end.
- F. 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 and outlet 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," "Braze Joints" chapter.
- E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- F. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- G. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

### 3.4 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
  - 1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
  - 2. Fittings for NPS 2 and Larger: Sleeve-type coupling.
- C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings.

### 3.5 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric nipples/waterways.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric nipples/waterways.
- 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. 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, brazed joints and fittings.
- 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, brazed joints and fittings.
- 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, brazed joints and fittings.
- I. Aboveground domestic water piping, NPS 2 and smaller, shall be 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 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 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 or ball, with flanged ends for piping NPS 4 and larger.
  - 2. Throttling Duty: Use ball valves for piping NPS 2 and smaller. Use butterfly or ball 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**

## SECTION 22 1119

### 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.
12. Trap-seal primer valves.
13. Water meters

- 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 "Pressure 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. Legend Valve.
    - e. MIFAB, Inc.
    - f. Prier Products, Inc.
    - g. Watts Industries, Inc.; Water Products Div.

- h. Woodford Manufacturing Company.
    - i. Zurn Plumbing Products Group; Light Commercial Operation.
    - j. Zurn Plumbing Products Group; Wilkins Div.
  - 2. Standard: ASSE 1011.
  - 3. Body: Bronze, nonremovable, with manual drain.
  - 4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
  - 5. Finish: Chrome or nickel plated.
- C. Pressure Vacuum Breakers:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Ames Co.
    - b. Conbraco Industries, Inc.
    - c. FEBCO; SPX Valves & Controls.
    - d. Flomatic Corporation.
    - e. Toro Company (The); Irrigation Div.
    - f. Watts Industries, Inc.; Water Products Div.
    - g. Zurn Plumbing Products Group; Wilkins Div.
  - 2. Standard: ASSE 1020.
  - 3. Operation: Continuous-pressure applications.
  - 4. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
  - 5. Accessories:
    - a. Valves: Ball type, on inlet and outlet.
- D. Spill-Resistant Vacuum Breakers:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Conbraco Industries, Inc.
    - b. Watts Industries, Inc.; Water Products Div.
  - 2. Standard: ASSE 1056.
  - 3. Operation: Continuous-pressure applications.
  - 4. Accessories:
    - a. Valves: Ball type, on inlet and outlet.

## 2.2 BACKFLOW PREVENTERS

### A. Reduced-Pressure-Principle Backflow Preventers:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Ames Co.
  - b. Conbraco Industries, Inc.
  - c. FEBCO; SPX Valves & Controls.
  - d. Flomatic Corporation.

- e. Watts Industries, Inc.; Water Products Div.
  - f. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1013.
  3. Operation: Continuous-pressure applications.
  4. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
  5. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved] for NPS 2-1/2 and larger.
  6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
  7. Accessories:
    - a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
    - b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.
- B. Double-Check Backflow-Prevention Assemblies:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Ames Co.
    - b. Conbraco Industries, Inc.
    - c. FEBCO; SPX Valves & Controls.
    - d. Flomatic Corporation.
    - e. Watts Industries, Inc.; Water Products Div.
    - f. Zurn Plumbing Products Group; Wilkins Div.
  2. Standard: ASSE 1015.
  3. Operation: Continuous-pressure applications, unless otherwise indicated.
  4. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
  5. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
  6. End Connections: Threaded for NPS 2 and smaller; [flanged] <Insert type> for NPS 2-1/2 and larger.
  7. Accessories:
    - a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
- C. Beverage-Dispensing-Equipment Backflow Preventers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Conbraco Industries, Inc.
    - b. Watts Industries, Inc.; Water Products Div.
    - c. Zurn Plumbing Products Group; Wilkins Div.
  2. Standard: ASSE 1022.
  3. Operation: Continuous-pressure applications.
  4. Size: NPS 1/4 or NPS 3/8.
  5. Body: Stainless steel.
  6. End Connections: Threaded.



D. Dual-Check-Valve Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Cash Acme.
  - b. Conbraco Industries, Inc.
  - c. FEBCO; SPX Valves & Controls.
  - d. Flomatic Corporation.
  - e. Ford Meter Box Company, Inc. (The).
  - f. Honeywell Water Controls.
  - g. Legend Valve.
  - h. McDonald, A. Y. Mfg. Co.
  - i. Mueller Co.; Water Products Div.
  - j. Watts Industries, Inc.; Water Products Div.
  - k. 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. Legend Valve.
  - f. Leonard Valve Company.
  - g. Powers; a Watts Industries Co.
  - h. Symmons Industries, Inc.
  - i. Taco, Inc.
  - j. Watts Industries, Inc.; Water Products Div.
  - k. 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. 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.

- 2. Mounting: Recessed.
- 3. Material and Finish: Enameled-steel or epoxy-painted-steel or plastic box and faceplate.
- 4. 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.
- 5. Supply Shutoff Fittings: NPS 1/2 gate, globe, or ball valves and NPS 1/2 copper, water tubing.
- 6. Drain: [NPS 1-1/2] [NPS 2] standpipe and P-trap for direct waste connection to drainage piping.
- 7. Inlet Hoses: Two 60-inch- long, rubber household clothes washer inlet hoses with female, garden-hose-thread couplings. Include rubber washers.
- 8. Drain Hose: One 48-inch- long, rubber household clothes washer drain hose with hooked end.

B. Water Outlet Boxes:

- 1. Basis of Design: Water-Tite model W9200HA 6" diameter outlet box with ¼ turn valve and water hammer arrestor.
- 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Acorn Engineering Company.
  - b. IPS Corporation.
  - c. LSP Products Group, Inc.
  - d. Oatey.
  - e. Plastic Oddities; a division of Diverse Corporate Technologies.
- 3. Mounting: Recessed.
- 4. Material and Finish: Enameled-steel or epoxy-painted-steel or plastic box and faceplate.
- 5. Faucet: Valved fitting complying with ASME A112.18.1. Include NPS 1/2 or smaller copper tube outlet.
- 6. Supply Shutoff Fitting: NPS 1/2 gate, globe, or ball valve and NPS 1/2 copper, water tubing.

2.8 HOSE BIBBS

A. Hose Bibbs:

- 1. Standard: ASME A112.18.1 for sediment faucets.
- 2. Body Material: Bronze.
- 3. Seat: Bronze, replaceable.
- 4. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
- 5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
- 6. Pressure Rating: 125 psig.
- 7. Vacuum Breaker: Integral or field-installation, nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
- 8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
- 9. Finish for Service Areas: Chrome or nickel plated.
- 10. Finish for Finished Rooms: Chrome or nickel plated.

11. Operation for Equipment Rooms: Wheel handle or operating key.
12. Operation for Service Areas: Wheel handle.
13. Operation for Finished Rooms: Operating key.
14. Include operating key with each operating-key hose bibb.
15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

## 2.9 WALL HYDRANTS

### A. Nonfreeze Wall Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Josam Company.
  - b. MIFAB, Inc.
  - c. Prier Products, Inc.
  - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - e. Tyler Pipe; Wade Div.
  - f. Watts Drainage Products Inc.
  - g. Woodford Manufacturing Company.
  - h. Zurn Plumbing Products Group; Light Commercial Operation.
  - i. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
6. Inlet: NPS 3/4 or NPS 1.
7. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
8. Box: Deep, flush mounting with cover.
9. Box and Cover Finish: Polished nickel bronze.
10. Operating Keys: Two with each wall hydrant.

## 2.10 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.

## 2.11 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.

## 2.12 TRAP-SEAL PRIMER VALVES

### A. Trap Seal Primer Valves: ASSE 1018, water-supply-fed type, with the following characteristics:

1. 125-psig minimum working pressure.
2. Bronze body with atmospheric-vented drain chamber.
3. Inlet and Outlet Connections: 1/2-inch threaded, union, or solder joint.
4. Gravity Drain Outlet Connection: 1/2-inch threaded or solder joint.
5. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

## 2.13 WATER METERS

### A. Displacement-Type Water Meters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. AALIANT; a Venture Measurement product line.ABB.Badger Meter, Inc.
  - b. Carlon Meter.
  - c. Mueller Co. Ltd.; a subsidiary of Mueller Water Products Inc.
  - d. Rockwell
  - e. Schlumberger Limited; Water Services.
  - f. Sensus.
2. Description:
  - a. Standard: AWWA C700.
  - b. Pressure Rating: 150-psig working pressure.
  - c. Body Design: Nutating disc; totalization meter.
  - d. Registration: In gallons or cubic feet as required by utility company.

- e. Case: Bronze.
- f. End Connections: Threaded.

B. Compound-Type Water Meters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. ABB.
  - b. Badger Meter, Inc.
  - c. Master Meter, Inc.
  - d. Mueller Co. Ltd.; a subsidiary of Mueller Water Products Inc.
  - e. Rockwell
  - f. Schlumberger Limited; Water Services.
  - g. Sensus.
2. Description:
  - a. Standard: AWWA C702.
  - b. Pressure Rating: 150-psig working pressure.
  - c. Body Design: With integral mainline and bypass meters; totalization meter.
  - d. Registration: In gallons or cubic feet as required by utility company.
  - e. Case: Bronze.
  - f. Pipe Connections: Flanged.

- C. Remote Registration System: Direct-reading type complying with AWWA C706; modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly as required by utility company.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
  1. Locate backflow preventers in same room as connected equipment or system.
  2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
  3. Do not install bypass piping around backflow preventers.
- C. Install water control valves with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.
- D. Install balancing valves in locations where they can easily be adjusted.



- E. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
  - 1. Install thermometers and water regulators if specified.
  - 2. Install cabinet-type units recessed in or surface mounted on wall as specified.
- F. Install Y-pattern strainers for water on supply side of each control valve, water pressure-reducing valve, solenoid valve, and pump.
- G. Install outlet boxes recessed in wall. Install 2-by-4-inch fire-retardant-treated-wood blocking wall reinforcement between studs. Fire-retardant-treated-wood blocking is specified in Division 06 Section "Rough Carpentry."
- H. Install water hammer arresters in water piping according to PDI-WH 201.
- I. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
- J. Install drainage-type, trap-seal primer valves as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.
- K. Install trap-seal primer systems with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.
- L. Install water meters per manufacturers requirements.

### 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.
  - 11. Supply-type, trap-seal primer valves.

- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

#### 3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and prepare test reports:
  - 1. Test each backflow preventer according to authorities having jurisdiction and the device's reference standard.
- B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

#### 3.5 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow set points of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

**END OF SECTION**

## SECTION 22 1316

### SANITARY WASTE AND VENT PIPING

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. 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 230548 "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).

## **PART 3 - EXECUTION**

### **3.1 EARTH MOVING**

- A. Comply with requirements for excavating, trenching, and backfilling specified in Division 31 Section "Earth Moving."

### **3.2 PIPING INSTALLATION**

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Install seismic restraints on piping. Comply with SEI/ASCE 7 and with requirements for seismic-restraint devices specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- K. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and

reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

- L. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert.
- M. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:
  - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping.
  - 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
  - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- N. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
  - 1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.
- O. Install underground PVC piping according to ASTM D 2321.
- P. Install engineered soil and waste drainage and vent piping systems as follows:
  - 1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
- Q. Plumbing Specialties:
  - 1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping. Comply with requirements for cleanouts specified in Division 22 Section "Sanitary Waste Piping Specialties."
  - 2. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Division 22 Section "Sanitary Waste Piping Specialties."
  - 3. Install cleanout fitting with closure plug inside the building in sanitary force-main piping.
- R. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."
- T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."
- U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."

### 3.3 JOINT CONSTRUCTION

- A. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

- B. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
  - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
  - 2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

### 3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint devices specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for pipe hanger and support devices and installation specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
  - 1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
  - 2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
  - 3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
  - 4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
  - 5. Vertical Piping: MSS Type 8 or Type 42, clamps.
  - 6. Install individual, straight, horizontal piping runs:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
  - 7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  - 8. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support horizontal piping and tubing within 12 inches of each fitting and coupling or valve and coupling.
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
- F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
  - 2. NPS 3: 60 inches with 1/2-inch rod.
  - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
  - 4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
  - 5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.
  - 6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- G. Install supports for vertical cast-iron soil piping every 15 feet.
- H. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.



### 3.5 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:
  - 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
  - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
  - 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
  - 4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
  - 5. 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. Underground, soil, waste, and vent piping NPS 3 and smaller shall be any of the following:
1. Hubless, cast-iron soil pipe and fittings CISPI hubless-piping couplings; and coupled joints.
  2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
  3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- G. Underground, soil and waste piping NPS 4 and larger shall be any of the following:
1. Hubless, cast-iron soil pipe and fittings heavy-duty hubless-piping couplings; and coupled joints.
  2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
  3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

**END OF SECTION**

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## SECTION 22 1319

### SANITARY WASTE PIPING SPECIALTIES

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. This Section includes the following sanitary drainage piping specialties:
  - 1. Cleanouts.
  - 2. Floor drains.
  - 3. Channel drainage systems.
  - 4. Roof flashing assemblies.
  - 5. Through-penetration firestop assemblies.
  - 6. Miscellaneous sanitary drainage piping specialties.
  - 7. Flashing materials.
  - 8. Grease removal devices.
- 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. Seismic Performance: Plumbing equipment, hangers and supports shall withstand the effects of earthquake motions determined according to SEI/ASCE 7 and with the requirements specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment.

##### 1.4 DEFINITIONS

- A. 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. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for the following:
  - 1. FOG disposal systems.
  - 2. Grease removal devices.
- B. Shop Drawings: Show fabrication and installation details for frost-resistant vent terminals.
  - 1. Wiring Diagrams: Power, signal, and control wiring.
- C. 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.
- D. Field quality-control test reports.
- E. 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.
- 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.
- 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.
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:
  - a. Josam Company; Josam Div.
  - b. MIFAB, Inc.
  - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - d. Tyler Pipe; Wade Div.
  - e. Watts Drainage Products Inc.
  - f. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.6.3.
3. Body Material: Gray iron.
4. Seepage Flange: Required.
5. Anchor Flange: Not required.
6. Outlet: Bottom.
7. Trap Material: Cast iron>.
8. Trap Pattern: Deep-seal P-trap>.
9. Trap Features: Trap-seal primer valve drain connection>.



## 2.3 CHANNEL DRAINAGE SYSTEMS

### A. Plastic Channel Drainage Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Josam.
  - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - c. Zurn Plumbing Products Group; Flo-Thru Operation.
  - d. NDS Inc.
2. Type: Modular system of channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling.
  - a. Channel Sections: Interlocking-joint, SMC/GRP, HDPE or PE modular units, with end caps. Include flat, rounded, or inclined bottom, with level invert and with outlets in number, sizes, and locations indicated. Provide drain lengths indicated on drawings.
    - 1) Dimensions: 4 inches wide. Include number of units required to form total lengths indicated.
  - b. Grates: With slots or perforations and widths and thickness that fit recesses in channel sections.
    - 1) Material: Gray iron.
  - c. Supports, Anchors, and Setting Devices: Manufacturer's standard, unless otherwise indicated.
  - d. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

## 2.4 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.

## 2.5 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

### A. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.
  - a. NPS 2: 4-inch- minimum water seal.
  - b. NPS 2-1/2 and Larger: 5-inch- minimum water seal.

### B. Floor-Drain, Trap-Seal Primer Fittings:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

### 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.

## 2.6 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.

## 2.7 GREASE REMOVAL DEVICES

- A. Grease Removal Devices:
  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 ECH2O grease removal system as manufactured by API Industries or a comparable product by one of the following:
    - a. Applied Chemical Technology, Incorporated.
    - b. Grease Removal Systems.
    - c. G K & L, Inc.
    - d. International Grease Recovery Device.
    - e. Josam Company; Blucher-Josam Div.
    - f. Lowe Engineering; a division of Highland Tank & Manufacturing Co., Inc.
    - g. Thermaco, Inc.
  3. Provide system complete with in-line fixture filters, sump and lift station, and grease/oil removal unit.

## 2.8 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 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- C. Install 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 primer fittings on inlet to floor drains that require trap-seal primer connection.
  1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
  2. 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 grease removal devices on floor as required by the manufacturer complete with all controls and power wiring.
- O. Install wood-blocking reinforcement for wall-mounting-type specialties.
- P. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.
- Q. 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. Grease Removal Devices: Connect controls, electrical power, factory-furnished accessories, and inlet, outlet, and vent piping to unit.
- D. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- E. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

### 3.4 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. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
  - 1. Grease removal devices.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

### 3.6 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**

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## SECTION 22 1413

### FACILITY STORM DRAINAGE PIPING

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. This Section includes the following storm drainage piping inside the building:
  - 1. Pipe, tube, and fittings.
  - 2. Special pipe fittings.
- B. Related Sections include the following:
  - 1. Division 22 Section "Sump Pumps."

##### 1.3 DEFINITIONS

- A. LLDPE: Linear, low-density polyethylene plastic.
- B. PE: Polyethylene plastic.
- C. PVC: Polyvinyl chloride plastic.
- D. TPE: Thermoplastic elastomer.

##### 1.4 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working-pressure, unless otherwise indicated:
  - 1. Storm Drainage Piping: 10-foot head of water.
- B. Seismic Performance: Plumbing equipment, hangers and supports shall withstand the effects of earthquake motions determined according to SEI/ASCE 7 and with the requirements specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
  - 1. For components with a seismic importance factor of 1.0 the term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified."

2. For components with a seismic importance factor of 1.5 the term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified and the system will be fully operational after the seismic event."

#### 1.5 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Shop Drawings:
  1. Controlled-Flow Storm Drainage System: Include calculations, plans, and details.
- C. Field quality-control inspection and test reports.
- 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.

#### 1.6 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic drain piping and "NSF-sewer" for plastic sewer piping.

### **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 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

## 2.3 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301. All waste, vent, sewer and storm lines shall be soil pipe and fittings that conform to the requirements of CISPI Standard 301, ASTM A \*\* and shall be marked with the collective trademark of the Cast Soil Pipe Institute or Receive Prior approval of the engineer and manufactured by AB&I Foundry, Tyler Pipe, or Charlotte Pipe. In addition all Cast iron shall be American made and tested, no "non compliant" import cast iron will be permitted.
- A. 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.
- B. Heavy-Duty, Hubless-Piping Couplings:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Husky HD 2000.
    - b. Clamp-All Corp HI-TORQ 80.
    - c. Ideal HD
    - d. Mission HW.
    - e. Tyler Pipe Widebody.
  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.

## 2.4 PVC PIPE AND FITTINGS

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

## 2.5 SPECIAL PIPE FITTINGS

- A. Flexible, Nonpressure Pipe Couplings: Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition pattern. Include shear ring, ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
1. Manufacturers:
    - a. Dallas Specialty & Mfg. Co.

- b. Fernco, Inc.
- c. Logan Clay Products Company (The).
- d. Mission Rubber Co.
- e. NDS, Inc.
- f. Plastic Oddities, Inc.

2. Sleeve Materials:

- a. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
- b. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
- c. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

B. Shielded Nonpressure Pipe Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Manufacturers:

- a. Cascade Waterworks Mfg. Co.
- b. Mission Rubber Co.

### **PART 3 - EXECUTION**

#### 3.1 EXCAVATION

A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

#### 3.2 PIPING APPLICATIONS

A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.

B. Aboveground storm drainage piping shall be the following:

- 1. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and coupled joints.

C. Underground storm drainage piping shall be the following ( to 6" above finished floor):

- 1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- 2. Hub-and spigot cast-iron soil pipe, hub-and spigot cast-iron soil pipe fittings, neoprene rubber gasket, and compression joints.

#### 3.3 PIPING INSTALLATION

A. Storm sewer and drainage piping outside the building are specified in Division 33 Section "Storm Utility Drainage Piping."

B. Comply with SEI/ASCE 7 and with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

- C. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- D. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers. Cleanouts are specified in Division 22 Section "Storm Drainage Piping Specialties."
- E. Install cleanout fitting with closure plug inside the building in storm drainage force-main piping.
- F. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Fire Plumbing."
- G. 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.
- H. Make changes in direction for storm drainage piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- I. Lay buried building storm drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- J. Install storm drainage piping at the following minimum slopes, unless otherwise indicated:
  - 1. Building Storm Drain: 1 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
  - 2. Horizontal Storm-Drainage Piping: 1 percent downward in direction of flow.
- K. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- L. Install underground PVC storm drainage piping according to ASTM D 2321.
- M. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

### 3.4 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results Plumbing."
- B. Hubless Cast-Iron Soil Piping Coupled Joints: Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
- C. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

### 3.5 HANGER AND SUPPORT INSTALLATION

- A. Seismic-restraint devices are specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:
  - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
  - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer than 100 Feet: MSS Type 43, adjustable roller hangers.
    - 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. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced 1 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: 60 inches with 3/4-inch rod.
  - 5. NPS 8 to NPS 12: 60 inches with 7/8-inch rod.
  - 6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- G. Install supports for vertical cast-iron soil piping every 15 feet.
- H. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

### 3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect storm drainage piping to roof drains and storm drainage specialties.

### 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.
  - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test storm drainage piping according to procedures of authorities having jurisdiction 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 storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  - 3. Test Procedure: Test storm drainage piping 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. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
  - 5. Prepare reports for tests and required corrective action.

### 3.8 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

**END OF SECTION**

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## SECTION 22 1423

### STORM DRAINAGE PIPING SPECIALTIES

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. This Section includes the following storm drainage piping specialties:
  - 1. Cleanouts.
  - 2. Roof drains.
  - 3. Miscellaneous storm drainage piping specialties.
  - 4. Flashing materials.
- B. Related Sections include the following:
  - 1. Division 22 Section "Sanitary Waste Piping Specialties" for backwater valves, floor drains, trench drains and channel drainage systems connected to sanitary sewer, air admittance valves, FOG disposal systems, grease interceptors and removal devices, oil interceptors, and solid interceptors.

##### 1.3 DEFINITIONS

- A. PUR: Polyurethane plastic.
- B. PVC: Polyvinyl chloride plastic.

##### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.

##### 1.5 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

##### 1.6 COORDINATION

- A. 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. Sioux Chief Manufacturing Company, Inc
  - e. Tyler Pipe; Wade Div.
  - f. Watts Drainage Products Inc.
  - g. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M 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. Sioux Chief Manufacturing Company, Inc.
  - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - e. Tyler Pipe; Wade Div.
  - f. Watts Drainage Products Inc.
  - g. Zurn Plumbing Products Group; Light Commercial Operation.
  - h. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M for adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Adjustable housing.
5. Body or Ferrule: Cast iron.
6. 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: Stainless steel.
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. Sioux Chief Manufacturing Company, Inc
  - e. Tyler Pipe; Wade Div.
  - f. Watts Drainage Products Inc.
  - g. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk, 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.

## 2.2 ROOF DRAINS

A. Metal Roof 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 for drain descriptions:
  - a. Josam Company; Josam Div.
  - b. MIFAB, Inc.
  - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - d. Sioux Chief Manufacturing Company, Inc
  - e. Tyler Pipe; Wade Div.
  - f. Watts Drainage Products Inc.
  - g. Zurn Plumbing Products Group; Specification Drainage Operation.
3. Standard: ASME A112.21.2M.
4. Body Material Cast iron.
5. Combination Flashing Ring and Gravel Stop: Required.
6. Dome Material: Cast iron.
7. Extension Collars: Required.
8. Underdeck Clamp Required.
9. Sump Receiver: Required.

B. Conductor Nozzles:

1. Description: Bronze body with threaded inlet and bronze wall flange with mounting holes.
2. Size: Same as connected conductor.

## 2.3 FLASHING MATERIALS

- A. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.
- B. Fasteners: Metal compatible with material and substrate being fastened.
- C. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- D. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
  - 1. 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.
- C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- E. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions. Roofing materials are specified in Division 07.
  - 1. Install roof-drain flashing collar or flange so that there will be no leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
  - 2. Position roof drains for easy access and maintenance.
- F. Install manufactured, gray-iron downspout boots at grade with top [6 inches] [12 inches] [18 inches] above grade. Secure to building wall.
- G. Install conductor nozzles at exposed bottom of conductors where they spill onto grade.
- H. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

### 3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

### 3.3 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. Fabricate and install flashing and pans, sumps, and other drainage shapes.

### 3.4 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

**END OF SECTION**

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## SECTION 22 4000

### 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 bathtub/showers showers and sinks.
2. Flushometers.
3. Toilet seats.
4. Protective shielding guards.
5. Fixture supports.
6. Water closets.
7. Urinals.
8. Lavatories.
9. Commercial sinks.
10. Bathtubs.
11. 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 bathtub/shower and 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.
    - c. Moen, Inc.

#### 2.2 BATHTUB/SHOWER FAUCETS

- A. Bathtub/Shower Faucets:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Chicago Faucets.
    - b. Leonard Valve Company.
    - c. Moen, Inc.
    - d. Powers; a Watts Industries Co.
    - e. Symmons Industries, Inc.
    - f. T & S Brass and Bronze Works, Inc.

## 2.3 SHOWER FAUCETS

### A. Shower Faucets:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Chicago Faucets.
  - b. Leonard Valve Company.
  - c. Moen, Inc.
  - d. Powers; a Watts Industries Co.
  - e. Symmons Industries, Inc.
  - f. T & S Brass and Bronze Works, Inc.

## 2.4 SINK FAUCETS

### A. Sink Faucets:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Chicago Faucets.
  - b. Kohler Co.
  - c. Symmons Industries, Inc.
  - d. T & S Brass and Bronze Works, Inc.
  - e. Moen, Inc.
  - f. Zurn Plumbing Products Group; Commercial Brass Operation.

## 2.5 FLUSHOMETERS

### A. Flushometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Sloan Valve Company.
  - b. Zurn Plumbing Products Group; Commercial Brass Operation.
  - c. Moen, Inc.

## 2.6 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.

## 2.7 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.

## 2.8 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. Urinal Supports:

1. Description: Type I, urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture for wall-mounting, urinal-type fixture. Include steel uprights with feet.
2. Accessible-Fixture Support: Include rectangular steel uprights.

C. 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.

## 2.9 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.

## 2.10 URINALS

A. Urinals:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. American Standard Companies, Inc.
  - b. Briggs Plumbing Products, Inc.
  - c. Crane Plumbing, L.L.C./Fiat Products.
  - d. Eljer.
  - e. Kohler Co.
  - f. Sloan Valve Company.

## 2.11 LAVATORIES

A. Lavatories:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. American Standard Companies, Inc.
  - b. Briggs Plumbing Products, Inc.
  - c. Crane Plumbing, L.L.C./Fiat Products.
  - d. Eljer.
  - e. Kohler Co.

## 2.12 COMMERCIAL SINKS

### A. Commercial Sinks:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Elkay Manufacturing Co.
  - b. Just Manufacturing Company.
  - c. Kohler Co.

## 2.13 BATHTUBS

### A. Bathtubs

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. American Standard Companies, Inc.
  - b. Briggs Plumbing Products, Inc.
  - c. Crane Plumbing, L.L.C./Fiat Products.
  - d. Eljer.
  - e. Kohler Co.

## 2.14 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.

## **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. Set bathtubs and service basins in leveling bed of cement grout. Grout is specified in Division 22 Section "Common Work Results for Plumbing."
- T. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."
- U. All plumbing fixtures are to be mounted at the height specified on the Architectural drawings.

### 3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

### 3.4 FIELD QUALITY CONTROL

- A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.
- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.
- E. Install fresh batteries in sensor-operated mechanisms.

### 3.5 ADJUSTING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.
- C. Replace washers and seals of leaking and dripping faucets and stops.



- D. Install fresh batteries in sensor-operated mechanisms.

### 3.6 CLEANING

- A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:
  - 1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
  - 2. Remove sediment and debris from drains.
- B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

### 3.7 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

**END OF SECTION**

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## SECTION 22 6113

### COMPRESSED-AIR PIPING FOR LABORATORY AND HEALTHCARE FACILITIES

#### 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. Medical compressed-air piping, designated "medical air."
2. Gas-powered-tool compressed-air piping, designated "instrument air."
3. Healthcare laboratory compressed-air piping, designated "instrument air."

###### B. Related Requirements:

1. Section 115313 "Laboratory Fume Hoods" for compressed-air outlets in laboratory fume hoods.
2. Section 123553 "Laboratory Casework" for compressed-air outlets in laboratory casework.
3. Section 123570 "Healthcare Casework" for compressed-air outlets in healthcare casework.
4. Section 226119 "Compressed-Air Equipment for Laboratory and Healthcare Facilities" for air compressors and specialties.
5. Section 226400 "Medical Gas Alarms" for combined medical air, vacuum, and gas alarms.

##### 1.3 DEFINITIONS

- A. Medical compressed-air piping systems include medical air, and, instrument air.

##### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

##### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and testing agency.
- B. Seismic Qualification Certificates: For medical compressed-air manifolds, 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. Material Certificates: Signed by Installer certifying that medical compressed-air piping materials comply with requirements in NFPA 99 for positive-pressure medical gas systems.

D. Brazing certificates.

E. Field quality-control reports.

#### 1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For compressed-air piping specialties to include in emergency, operation, and maintenance manuals.

#### 1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Quick-Coupler Service Connections: Furnish complete noninterchangeable medical compressed-air pressure outlets.

- a. Medical Air: Equal to 10 percent of amount installed.
- b. Instrument Air: Equal to 10 percent of amount installed.

2. D.I.S.S. Service Connections: Furnish complete medical compressed-air pressure outlets complying with CGA V-5.

- a. Medical Air D.I.S.S. No. 1160: Equal to 10 percent of amount installed, but no fewer than 10 units.
- b. Instrument Air D.I.S.S. No. 1160: Equal to 10 percent of amount installed, but no fewer than 10 units.

#### 1.8 QUALITY ASSURANCE

A. Installer Qualifications:

1. Medical Air 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**

### **2.1 SYSTEM DESCRIPTION**

- A. Medical air operating at 50 to 55 psig.
- B. Instrument air operating at 175 psig.

### **2.2 PERFORMANCE REQUIREMENTS**

- A. Seismic Performance: Medical compressed-air manifolds shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 and with the requirements specified in Section 220548 Vibration and Seismic Controls for Plumbing Piping and Equipment.
  - 1. The term "withstand" means "the manifold will remain in place without separation of any parts when subjected to the seismic forces specified and the manifold will be fully operational after the seismic event."
  - 2. Component Importance Factor is 1.5.

### **2.3 PIPES, TUBES, AND FITTINGS**

- A. Comply with NFPA 99 for medical air piping materials.
- B. Comply with ASME B31.9, "Building Services Piping," for instrument air piping operating at 150 psig or less.
- C. 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 in blue for Type L tube.
- D. 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.
- E. Copper Unions: ASME B16.22 or MSS SP-123, wrought-copper or cast-copper alloy.
- F. 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.
- G. 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.

H. 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, provide 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.

## 2.4 JOINING MATERIALS

- A. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys.
- B. Threaded-Joint Tape: PTFE.

## 2.5 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: 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

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: 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. Tri-Tech Medical Inc.
- 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: 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. Tri-Tech Medical Inc.

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. Safety Valves:

1. Bronze body.
2. ASME-construction, poppet, pressure-relief type.
3. Settings to match system requirements.

F. 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 air pressure within 0.5 psig for each 10-psig inlet pressure.

## 2.6 MEDICAL COMPRESSED-AIR SERVICE CONNECTIONS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide Chemetron compatible outlets by one of the following:

1. Allied Healthcare Products Inc.; Chemetron Division.
2. Amico Corporation.
3. BeaconMedaes.
4. Ohio Medical Corporation.
5. Oxequip Health Industries; a division of Allied Healthcare Products Inc.
6. Tri-Tech Medical Inc.

C. General Requirements for Medical Compressed-Air Service Connections:

1. Suitable for specific medical air pressure and 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.
3. Double seals that will prevent air 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 air leakage.
3. Cover plate with gas-service label.

F. Quick-Coupler Pressure Service Connections:

1. Outlets for medical air and instrument air 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. 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.

H. Cover Plates:

1. One piece.
2. Aluminum or stainless steel.
3. Permanent, color-coded, identifying label matching corresponding service.

## 2.7 MEDICAL COMPRESSED-AIR PRESSURE CONTROL PANELS

A. Manufacturers: Subject to compliance with requirements provide products by one of 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.

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. 1160, instrument air outlet.
7. Before final assembly, provide temporary dust shield and U-tube for testing.
8. Label cover plate "Air Pressure Control."

## 2.8 NITROGEN

- A. Comply with USP 32 - NF 27 for oil-free dry nitrogen.

## PART 3 - EXECUTION

### 3.1 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.

### 3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of compressed-air piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, air-compressor 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 compressed-air 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 compressed-air 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 system pressure rating used in applications specified in "Piping Schedule" Article unless otherwise indicated.
- I. Install eccentric reducers, if available, where compressed-air piping is reduced in direction of flow, with bottoms of both pipes and reducer fitting flush.

- J. Install branch connections to compressed-air mains from top of main. Provide drain leg and drain trap at end of each main and branch and at low points.
- K. Install thermometer and pressure gage on discharge piping from each air compressor and on each receiver. Comply with requirements in Section 220519 "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.
- O. Install medical air piping to medical air service connections specified in this Section, to medical air service connections in equipment specified in Section 226313 "Gas Piping for Laboratory and Healthcare Facilities," and to equipment specified in other Sections requiring medical air service.
- P. Piping Restraint Installation: Install seismic restraints on compressed-air piping. Seismic-restraint devices are specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- Q. Install compressed-air service connections recessed in walls. Attach roughing-in assembly to substrate; attach finishing assembly to roughing-in assembly.
- R. Connect compressed-air piping to air compressors and to compressed-air outlets and equipment requiring compressed-air service.
- S. Install unions in copper compressed-air tubing adjacent to each valve and at final connection to each machine, specialty, and piece of equipment.
- T. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

### 3.3 VALVE INSTALLATION

- A. Install shutoff valve at each connection to and from compressed-air equipment and specialties.
- B. Install check valves to maintain correct direction of compressed-air flow from compressed-air 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 pressure regulators on compressed-air piping where reduced pressure is required.
- F. Install flexible pipe connectors in discharge piping and in inlet air piping from remote air-inlet filter of each air compressor.

### 3.4 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. Flanged Joints: 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.
- E. 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.

### 3.5 COMPRESSED-AIR SERVICE COMPONENT INSTALLATION

- A. Install compressed-air pressure control panel in walls. Attach to substrate.

### 3.6 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.
- B. Comply with requirements in Section 220529 "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 220529 "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.

J. Install supports for vertical copper tubing every 10 feet.

### 3.7 IDENTIFICATION

- A. Install identifying labels and devices for medical compressed-air 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 Air: Black letters on yellow background.
  2. Instrument Air: White letters on red background.
  3. Medical Laboratory Air: Black letters on yellow-and-white checkerboard background.

### 3.8 FIELD QUALITY CONTROL FOR MEDICAL COMPRESSED-AIR PIPING IN HEALTHCARE FACILITIES

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections of medical compressed-air piping in healthcare facilities and to prepare test and inspection reports.
- B. Tests and Inspections:
1. Medical Compressed-Air Testing Coordination: Perform tests, inspections, verifications, and certification of medical compressed-air piping systems concurrently with tests, inspections, and certification of medical gas 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 compressed-air piping.
    - 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. Piping particulate test.
    - g. Piping purity test.

- h. Final tie-in test.
    - i. Operational pressure test.
    - j. Medical air purity test.
    - k. 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.
  - C. Remove and replace components that do not pass tests and inspections and retest as specified above.
- 3.9 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 tubing to existing tubing with memory-metal couplings.
  - B. Flanges may be used where connection to flanged equipment is required.
  - C. Medical Air Piping and Instrument Air Piping: Type L, copper medical gas tube; wrought-copper fittings; and brazed joints.
- 3.11 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 6213

### VACUUM PIPING FOR LABORATORY AND HEALTHCARE FACILITIES

#### 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. Medical-surgical vacuum piping, designated "medical vacuum."
2. Waste anesthetic gas disposal piping, designated "WAGD."

###### B. Related Requirements:

1. Section 11 5313 "Laboratory Fume Hoods" for vacuum inlets in laboratory fume hoods.
2. Section 12 3553 "Laboratory Casework" for vacuum inlets in laboratory casework.
3. Section 12 3570 "Healthcare Casework" for vacuum inlets in healthcare casework.
4. Section 22 6219 "Vacuum Equipment for Laboratory and Healthcare Facilities" for vacuum producers and accessories.
5. Section 22 6400 "Medical Gas Alarms" for vacuum piping alarms.

##### 1.3 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.

##### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

##### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and testing agency.
- B. Material Certificates: Signed by Installer certifying that medical vacuum piping materials comply with requirements in NFPA 99.
- C. Brazing certificates.
- D. Field quality-control reports.

## 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For vacuum piping specialties to include in emergency, operation, and maintenance manuals.

## 1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. 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.

## 1.8 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

### 2.1 SYSTEM DESCRIPTION

- A. Medical vacuum operating at 15 in. Hg.
- B. WAGD operating at 15 in. Hg.

### 2.2 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.

## 2.3 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.

## 2.4 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
    - 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. Tri-Tech Medical Inc.
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. Tri-Tech Medical Inc.
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.

## 2.5 MEDICAL VACUUM SERVICE CONNECTIONS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- B. Basis-of-Design Product: Subject to compliance with requirements, provide Chemetron compatible product by one of the following:
1. Allied Healthcare Products Inc.; Chemetron Division.
  2. Amico Corporation.
  3. BeaconMedaes.
  4. Ohio Medical Corporation.
  5. Oxequip Health Industries; a division of Allied Healthcare Products Inc.
  6. Tri-Tech Medical Inc.
- 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.

## 2.6 NITROGEN

- A. Comply with USP 32 - NF 27 for oil-free dry nitrogen.

## PART 3 - EXECUTION

### 3.1 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.

### 3.2 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 220519 "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 226219 "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 220548 "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 220517 "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 220518 "Escutcheons for Plumbing Piping."

### 3.3 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.

### 3.4 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," "Braze 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.

### 3.5 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.
- B. Comply with requirements in Section 220529 "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 220529 "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.

### 3.6 IDENTIFICATION

- A. Install identifying labels and devices for laboratory vacuum piping, valves, and specialties. Comply with requirements in Section 220553 "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.

### 3.7 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. 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.
- C. Remove and replace components that do not pass tests and inspections and retest as specified above.

### 3.8 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.

### 3.9 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

## SECTION 22 6313

### GAS PIPING FOR LABORATORY AND HEALTHCARE FACILITIES

#### 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. 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. Related Requirements:

1. Section 11 5313 "Laboratory Fume Hoods" for gas outlets in laboratory fume hoods.
2. Section 12 3553 "Laboratory Casework" for gas outlets in casework.
3. Section 12 3570 "Healthcare Casework" for gas outlets in medical casework.
4. Section 22 6400 "Medical Gas Alarms" for combined medical air, vacuum, and gas alarms.

##### 1.3 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.

##### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include diagrams for power, signal, and control wiring.

##### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and testing agency.
- B. 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.
- C. Material Certificates: Signed by Installer certifying that medical gas piping materials comply with requirements in NFPA 99 for positive-pressure medical gas systems.
- D. Brazing certificates.
- E. Certificates of Shop Inspection and Data Report for Bulk Gas Storage Tanks: As required by ASME Boiler and Pressure Vessel Code.
- F. Field quality-control reports.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For medical and specialty gas piping specialties to include in emergency, operation, and maintenance manuals.

#### 1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. 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.

## 1.8 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

### 2.1 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.

## 2.2 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.

## 2.3 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.

## 2.4 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.

## 2.5 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: Subject to compliance with requirements, provide product by one of the following:
        - a) Allied Healthcare Products Inc.
        - b) Amico Corporation.
        - c) Ohio Medical Corporation.
    - 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: 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. Tri-Tech Medical Inc.
  - 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: 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. Tri-Tech Medical Inc.
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: 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. Ohio Medical Corporation.
  - e. Tri-Tech Medical Inc.
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.



## 2.6 MEDICAL GAS SERVICE CONNECTIONS

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide Chemetron Compatible product by one of the following:
  - 1. Allied Healthcare Products Inc.; Chemetron Division.
  - 2. Amico Corporation.
  - 3. BeaconMedaes.
  - 4. Ohio Medical Corporation.
  - 5. Oxequip Health Industries; a division of Allied Healthcare Products Inc.
  - 6. Tri-Tech Medical Inc.
- 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.

## 2.7 MEDICAL NITROGEN PRESSURE CONTROL PANELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of 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.
  - 4. Ohio Medical Corporation.
  - 5. Tri-Tech Medical Inc.
  
- 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."

## 2.8 MEDICAL GAS MANIFOLDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:
  - 1. Acme Cryogenics.
  - 2. Allied Healthcare Products Inc.; Chemetron Division.
  - 3. Amico Corporation.
  - 4. BeaconMedaes.
  - 5. Ohio Medical Corporation.
  - 6. Tri-Tech Medical Inc.
- 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.

## 2.9 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

### 3.1 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.

### 3.2 EARTHWORK

- A. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling and for underground warning tapes.

### 3.3 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 220548 "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 220517 "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 220517 "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 220518 "Escutcheons for Plumbing Piping."

### 3.4 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.

### 3.5 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," "Braze 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.

### 3.6 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.

### 3.7 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.
- B. Comply with requirements in Section 220529 "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 220529 "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.

### 3.8 IDENTIFICATION

- A. Install identifying labels and devices for specialty gas piping, valves, and specialties. Comply with requirements in Section 220553 "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.

### 3.9 FIELD QUALITY CONTROL FOR HEALTHCARE FACILITY MEDICAL GAS

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. 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.
- C. Remove and replace components that do not pass tests and inspections and retest as specified above.
- D. 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**

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## **DIVISION 23 - HEATING, VENTILATING, AND AIR-CONDITIONING**

Section 23 0100	Mechanical Requirements
Section 23 0150	Temporary Use of Equipment and Systems
Section 23 0500	Common Work Result for HVAC
Section 23 0523	General Duty Valves for HVAC Piping
Section 23 0529	Hangers and Supports for HVAC Piping and Equipment
Section 23 0548	Vibration and Seismic Controls for HVAC
Section 23 0553	Identification for HVAC Piping and Equipment
Section 23 0593	Testing, Adjusting, Balancing for HVAC
Section 23 0713	Duct Insulation
Section 23 0719	HVAC Piping Insulation
Section 23 2113	Hydronic Piping
Section 23 2116	Hydronic Piping Specialties
Section 23 3001	Common Duct Requirements
Section 23 3113	Metal Ducts
Section 23 3300	Air Duct Accessories
Section 23 3713	Diffusers, Registers, and Grilles
Section 23 3714	Fixed Louvers

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## SECTION 23 0100

### MECHANICAL REQUIREMENTS

#### PART 1 - GENERAL

##### 1.1 GENERAL CONDITIONS

- A. The General Conditions of the Contract, with the amendments, supplements, forms and requirements in Division 1, and herewith made a part of this Division.
- B. All sections of Division 21, 22, & 23 shall comply with the Mechanical General Requirements. The standards established in this section as to quality of materials and equipment, the type and quality of workmanship, mode of operations, safety rules, code requirements, etc., shall apply to all sections of this Division as though they were repeated in each Division.
- C. Mechanical equipment that is pre-purchased if any will be assigned to the Mechanical Contractor. By assignment to the Mechanical Contractor, the Mechanical Contractor shall accept and installed the equipment and provide all warranties and guarantees as if the Mechanical Contractor had purchased the equipment.
- D. Construction Indoor-Air Quality Management
  - 1. Comply with SMACNA's "SMACNA IAQ Guideline for Occupied Buildings under Construction."
    - a. If Owner authorizes use of permanent heating, cooling, and ventilating systems during construction period as specified in Division 01 Section "Temporary Facilities and Controls," install filter media having a MERV 8 according to ASHRAE 52.2 at each return-air inlet for the air-handling system used during construction.
    - b. Replace all air filters immediately prior to occupancy.
  - 2. 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.
- E. LEED REQUIREMENT
  - 1. The Contractor is to submit all LEED information needed by the Design Professional to demonstrate that particular credits have been achieved. In particular, credits that depend on knowing the cost and quantity of certain types of products cannot be achieved without obtaining that information from the Contractor. These include renewable content, locally sourced new products, and reused products. In addition, a form is provided for each installer to certify that they have not used adhesives, sealants, and for suppliers and installers to certify they have not used composite wood with prohibited VOC content.

## 1.2 SCOPE OF WORK

- A. The project described herein is the Layton Ambulatory Care Center. 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-2013 Edition
  - 2. International Building code- 2012 Edition
  - 3. International Mechanical Code- 2012 Edition
  - 4. International Plumbing Code- 2012 Edition
  - 5. International Fire Code- 2012 Edition
  - 6. International Energy Code- 2012 Edition
  - 7. International Fuel Gas Code- 2012 Edition
  - 8. National Electrical Code- 2011 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 2<sup>nd</sup> 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**

## SECTION 23 0150

### 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 0500

### 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.
- B. Section 019113 applies for coordination with commissioning.

##### 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, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- F. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

## 2.4 TRANSITION FITTINGS

- A. Plastic-to-Metal Transition Fittings: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
  - 1. Manufacturers:
    - a. Eslon Thermoplastics.
- B. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
  - 1. Manufacturers:
    - a. Thompson Plastics, Inc.

## 2.5 DIELECTRIC FITTINGS

- A. General: Assembly or fitting with insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.
- B. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld-neck end types and matching piping system materials.
- C. Insulating Material: Suitable for system fluid, pressure, and temperature.
- D. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
- E. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.
- F. Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
  - 1. Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig minimum working pressure as required to suit system pressures.
- G. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
- H. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.
  - 1. Manufacturers:
    - a. Capitol Manufacturing Co.
    - b. Central Plastics Company.
    - c. Watts Industries, Inc.; Water Products Div

## 2.6 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 0523

### GENERAL-DUTY VALVES FOR HVAC PIPING

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

###### A. Section Includes:

1. Bronze ball valves.
2. Iron, single-flange butterfly valves.
3. Bronze lift check valves.
4. Bronze swing check valves.
5. Iron swing check valves.
8. Bronze globe valves.
9. Iron globe valves.
10. Lubricated plug valves.
11. Chainwheels.
12. High-performance butterfly valves.

###### B. Related Sections:

1. Section 230553 "Identification for HVAC Piping and Equipment" for valve tags and schedules.

##### 1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Nonrising stem.
- E. OS&Y: Outside screw and yoke.
- F. RS: Rising stem.
- G. SWP: Steam working pressure.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of valve indicated. Body material, valve design, pressure and temperature classification, end connection details, seating materials, trim material and arrangement, dimensions and required clearances, and installation instructions. Include list indicating valve and its application.
- B. Maintenance data for valves to be included in the operation and maintenance data specified in Division 1. Include detailed manufacturer's instructions on adjusting, servicing, disassembling, and repairing.

#### 1.5 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve as listed in SUMMARY from a single source and from a single manufacturer.
- B. Compliance:
  - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
  - 2. ASME B31.1 for power piping valves.
  - 3. ASME B31.9 for building services piping valves.
  - 4. MSS Compliance: Comply with the various MSS Standard Practice documents referenced.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
  - 1. Protect internal parts against rust and corrosion.
  - 2. Protect threads, flange faces, and weld ends.
  - 3. Set angle, and globe valves closed to prevent rattling.
  - 4. Set ball and plug valves open to minimize exposure of functional surfaces.
  - 5. Set butterfly valves closed or slightly open.
  - 6. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
  - 1. Maintain valve end protection.
  - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

### **PART 2 - PRODUCTS**

#### 2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to HVAC valve schedule articles for applications of valves.

- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
  - 1. Gear Actuator: For quarter-turn valves NPS 8 and larger.
  - 2. Handwheel: For valves other than quarter-turn types.
  - 3. Handlever: For quarter-turn valves NPS 6 and smaller except plug valves.
  - 4. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 10 plug valves, for each size square plug-valve head.
  - 5. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.
- E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
  - 2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
  - 3. Butterfly Valves: With extended neck.
- F. Valve-End Connections:
  - 1. Flanged: With flanges according to ASME B16.1 for iron valves.
  - 2. Solder Joint: With sockets according to ASME B16.18.
    - a. Caution: Where soldered end connections are used, use solder having a melting point below 840 deg. For, globe, and check valves: below 421 deg. F for ball valves.
  - 3. Threaded: With threads according to ASME B1.20.1.
- G. Valve Bypass and Drain Connections: MSS SP-45.

## 2.2 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by one of the following:
  - 1. APCO Willamette Valve and Primer Corp.
  - 2. Babbitt Steam Specialty Company.
  - 3. Bray Controls.
  - 4. Center Line.
  - 5. Cla-Val Company.
  - 6. Conbraco Industries Inc.
  - 7. Crane Co.; Crane Valve Group.
  - 8. Fisher Valve by Emerson.
  - 9. Flo Fab Inc.
  - 10. Flow-Tek Inc.
  - 11. Grinnell Corporation.
  - 12. Hammond Valve.
  - 13. Jamesbury; a subsidiary of Metso Automation.
  - 14. Jomar International LTD.
  - 15. Keystone Valve USA, Inc.
  - 16. Kitz Corp.

17. Legend Valve.
18. Metraflex Company.
19. Milwaukee Valve Company.
20. Mueller Steam Specialty.
21. NIBCO Inc.
22. Red-White Valve Corp.
23. Spence Strainers International.
24. Stockham Valves and Fittings, Inc.
25. Tyco Fire/Shurjoint Piping Products.
26. Tyco/Pentair LTD.
27. Val-Matic Valve & Mfg. Corp.
28. Victaulic Company.
29. Watts Regulator Company.

## 2.4 BRONZE BALL VALVES

### C. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Description:
  - a. Standard: MSS SP-110.
  - b. SWP Rating: 150 psig.
  - c. CWP Rating: 600 psig.
  - d. Body Design: Two piece.
  - e. Body Material: Bronze.
  - f. Ends: Threaded.
  - g. Seats: PTFE or TFE.
  - h. Stem: Bronze.
  - i. Ball: Chrome-plated brass.
  - j. Port: Full.

## 2.5 IRON, SINGLE-FLANGE BUTTERFLY VALVES

### A. 150 CWP, Iron, Single-Flange (Lug) Butterfly Valves:

1. Description:
  - a. Standard: MSS SP-67, Type I.
  - b. CWP Rating: 150 psig.
  - c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
  - d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
  - e. Seat: EPDM.
  - f. Stem: One- or two-piece stainless steel.
  - g. Disc: Nylon 11 coated ductile iron.

### B. 175 CWP, Iron, Single-Flange (Lug) Butterfly Valves:

1. Description:
  - a. Standard: MSS SP-67, Type I.
  - b. CWP Rating: 175 psig.
  - c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.

- d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
- e. Seat: EPDM.
- f. Stem: One- or two-piece stainless steel.
- g. Disc: Nylon 11 coated ductile iron.

C. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Nylon 11 coated ductile Iron Disc:

1. Description:

- a. Standard: MSS SP-67, Type I.
- b. CWP Rating: 200 psig.
- c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
- d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
- e. Seat: EPDM.
- f. Stem: One- or two-piece stainless steel.
- g. Disc: Nylon 11 coated ductile iron.

D. 250 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Nylon 11 coated ductile Iron Disc:

1. Description:

- a. Standard: MSS SP-67, Type I.
- b. CWP Rating: 250 psig.
- c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
- d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
- e. Seat: EPDM.
- f. Stem: One- or two-piece stainless steel.
- g. Disc: Nylon 11 coated ductile iron.

## 2.6 BRONZE LIFT CHECK VALVES

A. Class 125, Lift Check Valve:

1. Description:

- a. Standard: MSS SP-80.
- b. CWP Rating: 200 psig.
- c. Body Design: Vertical flow.
- d. Body Material: ASTM B 61, ASTM B 62, bronze.
- e. Ends: Threaded.
- f. Disc: Bronze, Type 1.

## 2.7 BRONZE SWING CHECK VALVES

A. Class 150, Bronze Swing Check Valves with Bronze Disc:

1. Description:

- a. Standard: MSS SP-80, Type 3.

- b. CWP Rating: 300 psig.
- c. Body Design: Horizontal flow.
- d. Body Material: ASTM B 62, bronze.
- e. Ends: Threaded.
- f. Disc: Bronze.

## 2.8 IRON SWING CHECK VALVES

### A. Class 125, Iron Swing Check Valves with Metal Seats:

#### 1. Description:

- a. Standard: MSS SP-71, Type I.
- b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
- c. Body Design: Clear or full waterway.
- d. Body Material: ASTM A 126, gray iron with bolted bonnet.
- e. Ends: Flanged.
- f. Trim: Bronze.
- g. Gasket: Asbestos free.

## 2.9 BRONZE GLOBE VALVES

### A. Class 150, Bronze Globe Valves with Nonmetallic Disc:

#### 1. Description:

- a. Standard: MSS SP-80, Type 2.
- b. CWP Rating: 300 psig.
- c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
- d. Ends: Threaded.
- e. Stem: Bronze.
- f. Disc: PTFE or TFE.
- g. Packing: Teflon impregnated, asbestos free.
- h. Handwheel: Malleable iron.

## 2.10 IRON GLOBE VALVES

### A. Class 125, Iron Globe Valves:

#### 1. Description:

- a. Standard: MSS SP-85, Type I.
- b. CWP Rating: 200 psig.
- c. Body Material: ASTM A 126, gray iron with bolted bonnet.
- d. Ends: Flanged.
- e. Stem: Brass alloy. OS & Y.
- f. Disc: Renewable bronze seat.
- g. Trim: Bronze.
- h. Packing and Gasket: Teflon impregnated, asbestos free.
- i. Handwheel: Cast iron



## 2.11 LUBRICATED PLUG VALVES

### A. Class 125, Regular-Gland, Lubricated Plug Valves with Threaded Ends:

1. Description:
  - a. Standard: MSS SP-78, Type II.
  - b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
  - c. Pattern: Regular or short.
  - d. Body Material: ASTM A 48 or ASTM A 126, cast iron with lubrication-sealing system.
  - e. Plug: Cast iron or bronze with sealant groove.

## 2.12 CHAINWHEELS

### A. Description: Valve actuation assembly with sprocket rim, brackets, and chain.

1. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
2. Attachment: For connection to [ball] [butterfly] [and] [plug] valve stems.
3. Sprocket Rim with Chain Guides: Ductile or cast iron, of type and size required for valve. Include zinc coating.
4. Chain: Hot-dip, galvanized steel, of size required to fit sprocket rim.

## 2.13 HIGH-PERFORMANCE BUTTERFLY VALVES

### A. Class 300, Single-Flange, High-Performance Butterfly Valves:

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. Bray Controls; a division of Bray International.
  - c. Cooper Cameron Valves; a division of Cooper Cameron Corp.
  - d. Crane Co.; Crane Valve Group; Flowseal.
  - e. Crane Co.; Crane Valve Group; Stockham Division.
  - f. DeZurik Water Controls.
  - g. Hammond Valve.
  - h. Jamesbury; a subsidiary of Metso Automation.
  - i. Milwaukee Valve Company.
  - j. NIBCO INC.
  - k. Process Development & Control, Inc.
  - l. Tyco Valves & Controls; a unit of Tyco Flow Control.
  - m. Xomox Corporation.
2. Description:
  - a. Standard: MSS SP-68.
  - b. CWP Rating: 720 psig at 100 deg F.
  - c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
  - d. Body Material: Carbon steel, cast iron, or ductile iron.

- e. Seat: Reinforced PTFE or metal.
- f. Stem: Stainless steel; offset from seat plane.
- g. Disc: Carbon steel.
- h. Service: Bidirectional.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine piping system for compliance<sup>3</sup> with requirements for installation tolerances and other conditions affecting performance of valves. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- D. Examine threads on valve and mating pipe for form and cleanliness.
- E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- F. Do not attempt to repair defective valves; replace with new valves.

#### **3.2 VALVE INSTALLATION**

- A. Install valves as indicated, according to manufacturer's written instructions.
- B. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of piping, fittings, and specialties.
- C. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- D. Locate valves for easy access and provide separate support where necessary.
- E. Install valves in horizontal piping with stem at or above center of pipe.
- F. Install valves in position to allow full stem movement.
- G. Install chainwheels on operators for ball, butterfly globe and plug valves NPS 4 and larger and more than 96 inches above floor.
- H. Extend the chainwheels for chains to 60 inches above finished floor.
- I. Install check valves for proper direction of flow and as follows:
  - 1. Swing Check Valves: In horizontal position with hinge pin level.

2. Check Valves: In horizontal or vertical position, between flanges.
3. Lift Check Valves: With stem upright and plumb.
4. Install all check valves a minimum of five pipe diameters downstream of pump discharge or elbow to avoid flow turbulence. In extreme cases add flow straighteners as required to correct the turbulence.

### 3.3 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

### 3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
  1. Shutoff Service: Ball or butterfly valves.
  2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
  3. Throttling Service except Steam: Globe valves.
  4. Throttling Service, Steam: Globe valves.
  5. Pump-Discharge Check Valves:
    - a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.
    - b. NPS 2-1/2 and Larger: Iron swing check valves with lever and weight or with spring or iron, metal-seat check valves.
  6. Drain Service (except Steam): Two-Piece, Full Port Bronze Ball Valves with Bronze Trim. To be installed with NPS  $\frac{3}{4}$  hose thread outlet and hose cap with chain.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
  1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
  2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
  3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
  4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
  5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
  6. For Steel Piping, NPS 5 and Larger: Flanged ends.

### 3.5 CHILLED-WATER VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:
  1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
  3. Ball Valves:
    - a. Piece: Two
    - b. Port: Full.
    - c. Material/Trim: Bronze with:

- 1) Bronze trim.
- 4. Bronze Swing Check Valves:
  - a. Class 150
  - b. Bronze disc.
- 6. Bronze Globe Valves:
  - a. Class 125
  - b. Bronze disc.

B. Pipe NPS 2-1/2 and Larger:

- 1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
- 2. Iron, Single-Flange Butterfly Valves, NPS 2-1/2 to NPS 12:
  - a. 200 CWP,
  - b. Seat: EPDM.
  - c. Disc: Ductile-iron.
- 3. Iron Swing Check Valves: Class 125, metal seats.
- 4. Iron Globe Valves: Class 125.
- 5. Lubricated Plug Valves: Class 125, regular gland, flanged.

### 3.6 CONDENSER-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

- 1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
- 3. Ball Valves:
  - a. Piece: Two
  - b. Port: Full.
  - c. Material/Trim: Bronze with:
    - 1) Bronze trim.
- 4. Bronze Swing Check Valves:
  - a. Class 150
  - b. Bronze disc.
- 6. Bronze Globe Valves:
  - a. Class 125
  - b. Bronze disc.

B. Pipe NPS 2-1/2 and Larger:

- 1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
- 2. Iron, Single-Flange Butterfly Valves, NPS 2-1/2 to NPS 12:
  - a. 200 CWP,
  - b. Seat: EPDM.
  - c. Disc: Ductile-iron.
- 3. Iron Swing Check Valves: Class 125, metal seats.
- 4. Iron Swing Check Valves with Closure Control, NPS 2-1/2 to NPS 12: Class 125, lever and spring.
- 6. Iron Globe Valves: Class 125.
- 7. Lubricated Plug Valves: Class 125, regular gland, flanged.

### 3.7 HEATING-WATER VALVE SCHEDULE

#### A. Pipe NPS 2 and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
3. Ball Valves:
  - a. Piece: Two
  - b. Port: Full.
  - c. Material/Trim: Bronze with:
    - 1) Bronze trim.
4. Bronze Swing Check Valves:
  - a. Class 150
  - b. Bronze disc.
6. Bronze Globe Valves:
  - a. Class 125
  - b. Bronze disc.

#### B. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Iron, Single-Flange Butterfly Valves, NPS 2-1/2 to NPS 12:
  - a. 200 CWP,
  - b. Seat: EPDM.
  - c. Disc: Ductile-iron.
3. Iron Swing Check Valves: Class 125, metal seats.
4. Iron Globe Valves: Class 125.

### 3.8 LOW-PRESSURE STEAM VALVE SCHEDULE (15 PSIG OR LESS)

#### A. Pipe NPS 2 and Smaller:

1. Ball Valves:
  - a. Piece: Two
  - b. Port: Full.
  - c. Material/Trim: Bronze with:
    - 1) Bronze trim.
2. Bronze Swing Check Valves:
  - a. Class 150
  - b. Bronze disc.
4. Bronze Globe Valves:
  - a. Class 125
  - b. Bronze disc.

#### B. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Iron Swing Check Valves: Class 125, metal seats.
3. Iron Globe Valves: NPS 2-1/2 to NPS 12: Class 125.
4. High-Performance Butterfly Valves: Class 300, single flange.

### 3.9 HIGH-PRESSURE STEAM VALVE SCHEDULE (MORE THAN 15 PSIG)

#### A. Pipe NPS 2 and Smaller:

1. Ball Valves:
  - a. Piece: Two
  - b. Port: Full.
  - c. Material/Trim: Bronze with:
    - 1) Bronze trim.
2. Bronze Swing Check Valves:
  - a. Class 150
  - b. Bronze disc.
4. Bronze Globe Valves:
  - a. Class 125
  - b. Bronze disc.

#### B. Pipe Sizes 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 Swing Check Valves: Class 125, metal seats.
3. Iron Globe Valves: NPS 2-1/2 to NPS 12: Class 125.
4. High-Performance Butterfly Valves: Class 300, single flange.

### 3.10 STEAM-CONDENSATE VALVE SCHEDULE

#### A. Pipe NPS 2 and Smaller:

1. Ball Valves:
  - a. Piece: Two
  - b. Port: Full.
  - c. Material/Trim: Bronze with:
    - 1) Bronze trim.
2. Bronze Swing Check Valves:
  - a. Class 150
  - b. Bronze disc.
4. Bronze Globe Valves:
  - a. Class 125
  - b. Bronze disc.

#### B. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Iron Swing Check Valves: Class 125, metal seats.
3. Iron Globe Valves: NPS 2-1/2 to NPS 12: Class 125.
4. Lubricated Plug Valves: Class 125, regular gland, flanged.
5. High-Performance Butterfly Valves: Class 300, single flange.

**END OF SECTION**

## SECTION 23 0529

### 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 230548 "Vibration and Seismic Controls for HVAC" for vibration isolation devices.
3. Section 233113 "Metal Ducts" for duct hangers and supports.

##### 1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

##### 1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
  1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
  2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
  3. Design seismic-restraint hangers and supports for piping and equipment.

##### 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. GS Metals Corp.
  - e. Hilti, Inc.insert manufacturer's name.
  - f. Power-Strut Div. Tyco International.
  - g. Thomas & Betts Corporation.
  - h. Tolco Inc.
  - i. 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. Haydon Corporation.
  - e. NIBCO INC.
  - f. PHD Manufacturing, Inc.
  - g. 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 inturred 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 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, [zinc-coated] [stainless-] steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

## 2.6 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
  - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
  - 2. Design Mix: 5000-psi, 28-day compressive strength.

# PART 3 - EXECUTION

## 3.1 HANGER AND SUPPORT INSTALLATION

- A. Comply with SEI/ASCE 7 and with requirements for seismic-restraint devices in Section 230548 "Vibration and Seismic Controls for HVAC."
- B. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- C. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
  - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
  - 2. Field fabricate from ASTM A 36, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- E. 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 or mechanical-expansion anchors instead of building attachments where required in concrete construction.

**END OF SECTION**

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## SECTION 23 0548

### 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 220548 "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. Ip: Importance Factor.

E. ESSENTIAL FACILITIES, (Occupancy Category IV, IBC-2012)

1. Buildings and other structures that are intended to remain operational in the event of extreme environmental loading from flood, wind, snow or earthquakes.

F. 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.

G. 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 2012 replaces all references to IBC 2006, 2009.
- B. The following guides may be used for supplemental information on typical seismic installation practices. Where a conflict exists between the guides and these construction documents, the construction documents will preside.
  1. FEMA (Federal Emergency Management Agency) manuals 412, Installing Seismic Restraints for Mechanical Equipment and 414, Installing Seismic Restraints for Ductwork and Pipe.
  2. SMACNA (Sheet Metal and Air-conditioning Contractors' National Association) Seismic Restraint Manual Guidelines for Mechanical Systems, 3rd ed.
  3. ASHRAE (American Society for Heating, Refrigerating and Air-conditioning Engineers) A Practical Guide to Seismic Restraint
  4. MSS (Manufacturers Standardization Society of the Valve and Fittings Industry) MSS SP-127, Bracing for Piping Systems, Seismic – Wind – Dynamic, Design, Selection, Application.

## 1.6 ISOLATOR AND RESTRAINT MANUFACTURER'S RESPONSIBILITIES:

- A. Provide project specific vibration isolation and seismic restraint design prepared by a registered design professional in the state where the project is being constructed, and manufacturer certifications that the components are seismically qualified.
  1. Provide calculations to determine restraint loads resulting from seismic forces as required by IBC, Chapter 16 and ASCE 7, latest editions. Seismic calculations shall be certified by an engineer licensed in the state where the project is being constructed.
- B. Provide installation instructions and shop drawings for all materials supplied under this section of the specifications.
  1. Provide seismic restraint details with specific information relating to the materials, type, size, and locations of anchorages; materials used for bracing; attachment requirements of bracing to structure and component; and locations of transverse and longitudinal sway bracing and rod stiffeners.
  2. Provide seismic bracing layout drawings indicating the location of all seismic restraints.
    - a. Each piece of rotating isolated equipment shall be tagged to clearly identify quantity and size of vibration isolators and seismic restraints.

- C. Provide, in writing, the special inspection requirements for all Designated Seismic Systems as indicated in Chapter 17 of the IBC.
- D. Provide training for installation, operation and maintenance of isolation and restraint systems.

## 1.7 PERFORMANCE REQUIREMENTS

- A. Wind-Restraint Loading: Per the structural drawings and specifications.
- B. Flood-Restraint Loading: Per the structural drawings and specifications.
- C. 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 Response Modification Factor: Per the structural drawings and specifications.
    - c. Component Amplification Factor: Per the structural drawings and specifications.
  - 3. Design Spectral Response Acceleration at Short Periods: Per the structural drawings and specifications.
  - 4. Design Spectral Response Acceleration at 1-Second Period: Per the structural drawings and specifications.

## 1.8 ACTION SUBMITTALS

- A. Product Data: For the following:
  - 1. Submittals shall include catalog cut sheets and installation instructions for each type of anchor and seismic restraint used on equipment or components being isolated and/or restrained.
  - 2. Submittals for mountings and hangers incorporating springs shall include spring diameter and free height, rated load, rated deflection, and overload capacity for each vibration isolation device.
  - 3. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
    - a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an evaluation service member of ICC-ES.
    - b. Annotate to indicate application of each product submitted and compliance with requirements.

4. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.
- B. Shop Drawings:
1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
- C. Delegated-Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
1. "Basis for Design" report: Statement from the registered design professional that the design complies with the requirements of the ASCE 7-05 Chapter 13, IBC 2009 chapter 1912 and ACI 318. In addition, the basis for compliance must also be noted, as listed below:
    - a. Project specific design documentation prepared and submitted by a registered design professional (ASCE 7, 13.2.1.1)
    - b. Submittal of the manufacturer's certification that the isolation equipment is seismically qualified by:
    - c. An engineered analysis conforming to the requirements of Chapter 13 of ASCE 7.
    - d. Testing by a nationally recognized testing standard procedure such as ICC-ES AC 156. The substantiated seismic design capacities shall exceed the seismic demands determined by Section 13.3 of ASCE 7.
    - e. Experience data conforming to a nationally recognized procedure. The substantiated seismic design capacities shall exceed the seismic demands determined by Section 13.3 of ASCE 7.
  2. Seismic restraint load ratings must be certified and substantiated by testing or calculations under direct control of a registered professional engineer. Copies of testing and calculations must be submitted as part of submittal documents. ~~OSHPD pre-approved restraint systems are exempt from this requirement if their pre-approval is current and based upon the IBC 2009 (i.e. OPA-07 pre-approval numbers).~~
  3. Include design calculations and details for selecting vibration isolators, seismic restraints, and vibration isolation bases complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
  4. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators, seismic restraints, and for designing vibration isolation bases.
    - a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Division 23 Sections for equipment mounted outdoors.
  5. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.
  6. Vibration Isolation Base Details: Detail overall dimensions, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and

rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.

7. Seismic-Restraint Details:
  - a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
  - b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
  - c. Preapproval and Evaluation Documentation: By an evaluation service member of ICC-ES, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

## 1.9 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show coordination of seismic bracing for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and seismic restraints.
  1. Submittal drawings and calculations must be stamped by a registered professional engineer in the State where the project is being constructed who is responsible for the seismic restraint design.
  2. Calculations and restraint device submittal drawings shall specify anchor bolt type, embedment, concrete compressive strength, minimum spacing between anchors, and minimum distances of anchors from concrete edges. Concrete anchor locations shall not be near edges, stress joints, or an existing fracture. All bolts shall be ASTM A307 or better.
- B. Qualification Data: For professional engineer and testing agency.
- C. Welding certificates.
- D. Field quality-control test reports.

## 1.10 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
- B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval 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.
- 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.

### 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 [1-inch] 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 Division 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 MSS SP-127.
  4. Seismically restrain piping, with an  $I_p = 1.0$ , located in boiler rooms, mechanical equipment rooms and refrigeration equipment rooms that is 1¼" I.D. and larger.
  5. Seismically restrain all other  $I_p = 1.0$  piping 2½" diameter and larger.
  6. Seismically restrain all  $I_p = 1.5$  piping larger than 1" diameter.
  7. Branch lines may not be used to brace main lines.
  8. Exemptions:
    - a. All high deformability pipe 3" or less in diameter suspended by individual hanger rods where  $I_p = 1.0$ .
    - 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.
  2. Restrain flat oval ducts the same as rectangular ducts of the same nominal size.
  3. 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.
  4. 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.
  5. 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.
  6. If ducts are supported by angles, channels or struts, ducts shall be fastened to it at seismic brace locations in lieu of duct reinforcement.
  7. 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.
  8. 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 IDENTIFICATION

- A. Install identification tags at all seismic brace locations. Tags to include the following information:
  1. Specific seismic forces (g-force) the location was designed to resist.
  2. Maximum brace reaction at connection to structure.
  3. For single hung items, the maximum pipe/conduit size the brace location was designed to accommodate.
  4. For trapeze supported items, the maximum weight (lbs/lf) the brace location was designed to accommodate.
  5. For suspended equipment, the maximum unit operating weight (lbs) the brace location was designed to accommodate.
  6. Location identifier cross matched to that on plan set layout.
  7. Company name of installing contractor.

3.9 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	MINIMU M DEFLE CTION (IN)	BASE TYPE	ISOLA TOR TYPE	MINIMU M DEFLE CTION (IN)	BASE TYPE	ISOLA TOR TYPE	MINIMU M DEFLE CTION (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. & OVERI 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
AXIAL FLOWFANS									
FLOOR MTD.									
UP TO 15 HP	S3	1.5	SB1	S3	0.75		S3	0.75	
20 HP & OVER	S1	3.5	IB1	S3	1.5		S3	0.75	
SUSPENDED									
UP TO 15 HP	H3	1.75	SB1	H3	1		H3	1	
20 HP & OVER	H3	2.5	SB1	H3	1.75	SB1	H3	1.5	



VENT (UTILITY SETS) FLOOR MTD SUSPENDED	S3 H3	1.5 1.75	SB1 SB1	S3 H3	0.75 1		S3 H3	0.75 0.75	
CABINET FANS, FANS SECTIONS FLOOR MTD. UP TO 15 HP 20 HP & OVER SUSPENDED UP TO 15 HP 20 HP & OVER	S3 S1 H3 H3	1.5 2.5 1.75 2.5	IB1 SB1	S3 S3 H3 H3	0.75 1.5 1 1.75		S3 S3 H3 H3	0.75 0.75 0.75 1.75	
PUMPS FLOOR MTD. UP TO 15 HP 7-112 HP & OVER SUSPENDED INLINE	S3 S3 H3	0.75 1.5 1.75	IB1 IB1	S3 S3 H3	0.75 1.5 1.75	IB1 IB1	SRVD S3 H3	0.4 0.75 1	
REFRIGERATION UNITS RECIPROCATING COMPRESSORS RECIPROCATING COND. UNITS & CHILLERS HERMETIC CENTRIFUGALS OPEN CENTRIFUGALS ABSORPTION MACHINES	S1 S1 S3 S1 S3	2.5 2.5 2.5 2.5 1.5	IB1 IB1	S3 S3 S3 S3 S3	1.5 1.5 1.5 1.5 0.75	IB1	S3 S3 P1 P1 P1	0.75 0.75 0.15 0.15 0.15	IB1
AIR COMPRESSORS TANK TYPE (HORIZONTAL TANK) TANK TYPE (VERTICAL TANK)	S1 S1	2.5 2.5	IB1 IB1	S3 S3	1.5 1.5	IB1	S3 S3	0.75 0.75	
COOLING TOWERS & CLOSED CIRCUIT COOLERS UP TO 500 TONS OVER 500 TONS	S3 S3	2.5 4.5		S3 S3	0.75 2.5		P1 P1	0.15 0.15	
AIR COOLED CONDENSERS UP TO 50 TONS OVER 50 TONS	S3 S3	1.5 2.5		S3 S3	0.75 1.5		P1 P1	0.15 0.15	
ROOFTOP AIR CONDITIONING UNITS REQUIRING WEATHER SEAL UP TO 5000 CFM (12 TON) OVER 5000 CFM (12 TON) OTHER TYPES UP TO 25 TONS OVER 25 TONS	S1 S3 S3 S3	1.5 2.5 1.5 2.5	RC1 RC1	S1 S3 S3 S3	0.75 1.5 1.5 1.5	RC1 RC1			
BOILER (PACKAGE TYPE) ALL SIZES	S3	1.5		S3	0.75		P1	0.15	
ENGINE DRIVEN GENERATORS UP TO 60 HP 75 HP & OVER	S1 S1	2.5 3.5	IB1 IB1	S3 S3	1.5 2.5	IB1 IB1	S3 S3	0.75 0.75	

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

## SECTION 23 0553

### IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. Section Includes:
  - 1. Equipment labels.
  - 2. Danger, Warning and Caution signs and labels.
  - 3. Pipe labels.
  - 4. Duct labels.
  - 5. Stencils.
  - 6. Valve tags.
  - 7. Danger tags.
  - 8. Warning tags.
  - 9. Caution tags.
  - 10. Ceiling grid

##### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- C. Valve numbering scheme.
- D. Valve Schedules: For each piping system to include in maintenance manuals.

##### 1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

## PART 2 - PRODUCTS

### 2.1 EQUIPMENT LABELS

#### A. Metal Labels for Equipment:

1. Material and Minimum Thickness, predrilled or stamped holes for attachment hardware:
  - a. Brass, 0.032-inch .
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel;
  - a. Rivets or self-tapping screws
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

#### B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, and having predrilled holes for attachment hardware, 1/16 inch thick.
2. Letter Color:
  - a. Black.
3. Background Color:
  - a. White.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel;
  - a. Rivets or self-tapping screws
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

#### C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

#### D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

### 2.2 DANGER, WARNING AND CAUTION SIGNS AND LABELS

#### A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, having predrilled holes for attachment hardware; 1/16 inch thick.

- B. Danger signs, colors:
  - 1. Letter Color:
    - a. White.
  - 2. Background Color:
    - a. Red.
- C. Warning signs, colors:
  - 1. Letter Color:
    - a. Black.
  - 2. Background Color:
    - a. Orange.
- D. Caution signs, colors:
  - 1. Letter Color:
    - a. Black.
  - 2. Background Color:
    - a. Yellow.
- E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- G. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- H. Fasteners: Stainless-steel;
  - 1. Rivets or self-tapping screws
- 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 incheshigh.

## 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. Black.
- C. Background Color:
  - 1. Black.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel;
  - 1. Rivets or self-tapping screws
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.
  - 1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.
  - 2. Lettering Size: At least 1-1/2 inches high.

## 2.5 STENCILS

- A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches for ducts; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.
  - 1. Stencil Material:
    - a. Aluminum.
  - 2. Stencil Paint:
    - a. Exterior, gloss, alkyd enamel black unless otherwise indicated.
    - b. Paint may be in pressurized spray-can form.
  - 3. Identification Paint:
    - a. Exterior, alkyd enamel in colors according to ASME A13.1 unless otherwise indicated.

## 2.6 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material, predrilled or stamped holes for attachment hardware, minimum thickness:
  - a. Brass, 0.032-inch
2. Fasteners: Brass;
  - a. Wire-link or beaded chain; or S-hook

B. Valve Schedules:

1. For each piping system, on 8-1/2-by-11-inch bond paper, tabulate;
  - a. Valve number.
  - b. Piping system.
  - c. System abbreviation (as shown on valve tag).
  - d. Location of valve (room or space).
  - e. Normal-operating position (open, closed, or modulating).
  - f. Variations for identification.
  - g. Mark valves for emergency shutoff and similar special uses.
2. Valve-tag schedule:
  - a. Shall be included in operation and maintenance data.

## 2.7 DANGER TAGS

- A. Danger Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
1. Size:
    - a. 3 by 5-1/4 inches minimum
  2. Fasteners:
    - a. Brass grommet and wire.
  3. Nomenclature: Large-size primary caption such as "DANGER," and "DO NOT OPERATE."
  4. Color: Red background with white lettering.

## 2.8 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
1. Size:
    - a. 3 by 5-1/4 inches minimum
  2. Fasteners:
    - a. Brass grommet and wire.
  3. Nomenclature: Large-size primary caption such as "WARNING" and "DO NOT OPERATE."
  4. Color: Yellow background with black lettering.

## 2.9 CAUTION TAGS

- A. Caution Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
1. Size:
    - a. 3 by 5-1/4 inches minimum

2. Fasteners:
  - a. Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "CAUTION," and "DO NOT OPERATE."
4. Color: Orange background with black lettering.

#### 2.10 CEILING GRID

- A. Provide red lettering on the ceiling tile grid of the locations of all fire dampers, smoke dampers and fire/smoke dampers. Size of lettering and verbiage is to conform to IBC and NFPA standards.
- B. Provide valve identification for all HVAC valves located above the ceiling on the ceiling grid below the valve.
- C. Provide VAV box identification for all VAV boxes located above the ceiling on the ceiling grid below the VAV box.

### **PART 3 - EXECUTION**

#### 3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

#### 3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

#### 3.3 PIPE LABEL INSTALLATION

- A. Piping Color-Coding: Painting of piping is specified in Division 09.
- B. Stenciled Pipe Label Option:
  1. Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option.
  2. Install stenciled pipe labels with painted, color-coded bands or rectangles on each piping system.
    - a. Identification Paint: Use for contrasting background.
    - b. Stencil Paint: Use for pipe marking.
- C. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:



1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

D. Pipe Label Color Schedule: (See Drawing Schedules)

### 3.4 DUCT LABEL INSTALLATION

- A. Install plastic-laminated duct labels with permanent adhesive on air ducts in the following color codes:
1. Blue: For cold-air supply ducts.
  2. Yellow: For hot-air supply ducts.
  3. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
  4. ASME A13.1 Colors and Designs: For hazardous material exhaust.
- B. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

### 3.5 VALVE-TAG INSTALLATION (See Drawing Schedules.)

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

### 3.6 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

**END OF SECTION**

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## SECTION 23 0593

### 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.

##### 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. Bonneville Test and Balance

### 3.2 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
- B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine:
  - 1. Ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in:
    - a. Section 233113 "Metal Ducts"
  - 2. Verify ceiling plenums and underfloor air plenums used for supply, return or relief air are properly separated from adjacent areas.
  - 3. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

- F. Examine equipment performance data including fan and pump curves.
  - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
  - 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.
- G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- H. Examine test reports specified in individual system and equipment Sections.
- I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.
- K. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.
- L. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.
- M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- N. Examine system pumps to ensure absence of entrained air in the suction piping.
- O. Examine operating safety interlocks and controls on HVAC equipment.
- P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

### 3.3 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Complete system-readiness checks and prepare reports. Verify the following:
  - 1. Permanent electrical-power wiring is complete.
  - 2. Hydronic systems are filled, clean, and free of air.
  - 3. Automatic temperature-control systems are operational.
  - 4. Equipment and duct access doors are securely closed.
  - 5. Balance, smoke, and fire dampers are open.
  - 6. Isolating and balancing valves are open and control valves are operational.
  - 7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
  - 8. Windows and doors can be closed so indicated conditions for system operations can be met.

### 3.4 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in this section and:
  - 1. AABC's "National Standards for Total System Balance"
  - 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 230713 "Duct Insulation," Section 230716 "HVAC Equipment Insulation," and Section 230719 "HVAC Piping Insulation."
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) .

### 3.5 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.
- J. Check condensate drains for proper connections and functioning.
- K. Check for proper sealing of air-handling-unit components.
- L. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

### 3.6 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
1. Measure total airflow.
    - a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
  2. Measure fan static pressures as follows to determine actual static pressure:
    - a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
    - b. Measure static pressure directly at the fan outlet or through the flexible connection.
    - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
    - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
  3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
    - a. Report the cleanliness status of filters and the time static pressures are measured.
  4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
  5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
  6. Obtain approval from one of the following entities for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance:
    - a. Architect.
  7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
1. Measure airflow of submain and branch ducts.
    - a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
  2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.



3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- C. Measure air outlets and inlets without making adjustments.
1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
- D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.
1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
  2. Adjust patterns of adjustable outlets for proper distribution without drafts.

### 3.7 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

- A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a minimum set-point airflow with the remainder at maximum-airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced-airflow terminal units so they are distributed evenly among the branch ducts.
- B. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
1. Set outdoor-air dampers at minimum, and set return- and exhaust-air dampers at a position that simulates full-cooling load.
  2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
  3. Measure total system airflow. Adjust to within indicated airflow.
  4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.
  5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow the same as described for constant-volume air systems.
    - a. If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.
  6. Remeasure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.
  7. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure that adequate static pressure is maintained at the most critical unit.

8. Record final fan-performance data.
- C. Pressure-Dependent, Variable-Air-Volume Systems without Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
1. Balance variable-air-volume systems the same as described for constant-volume air systems.
  2. Set terminal units and supply fan at full-airflow condition.
  3. Adjust inlet dampers of each terminal unit to indicated airflow and verify operation of the static-pressure controller. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.
  4. Readjust fan airflow for final maximum readings.
  5. Measure operating static pressure at the sensor that controls the supply fan if one is installed, and verify operation of the static-pressure controller.
  6. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow the same as described for constant-volume air systems.
    - a. If air outlets are out of balance at minimum airflow, report the condition but leave the outlets balanced for maximum airflow.
  7. Measure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.
- D. Pressure-Dependent, Variable-Air-Volume Systems with Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
1. Set system at maximum indicated airflow by setting the required number of terminal units at minimum airflow. Select the reduced-airflow terminal units so they are distributed evenly among the branch ducts.
  2. Adjust supply fan to maximum indicated airflow with the variable-airflow controller set at maximum airflow.
  3. Set terminal units at full-airflow condition.
  4. Adjust terminal units starting at the supply-fan end of the system and continuing progressively to the end of the system. Adjust inlet dampers of each terminal unit to indicated airflow. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.
  5. Adjust terminal units for minimum airflow.
  6. Measure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.

### 3.8 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. Prepare test reports with pertinent design data, and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against the approved pump flow rate. Correct variations that exceed plus or minus 5 percent.
- B. Prepare schematic diagrams of systems' "as-built" piping layouts.
- C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:

1. Open all manual valves for maximum flow.
2. Check liquid level in expansion tank.
3. Check makeup water-station pressure gage for adequate pressure for highest vent.
4. Check flow-control valves for specified sequence of operation, and set at indicated flow.
5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
6. Set system controls so automatic valves are wide open to heat exchangers.
7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

### 3.9 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

- A. Measure water flow at pumps. Use the following procedures except for positive-displacement pumps:
  1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
    - a. If impeller sizes must be adjusted to achieve pump performance, obtain approval from the following entity and comply with requirements in Section 232123 "Hydronic Pumps.":
      - 1) Architect.
  2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.
    - a. Monitor motor performance during procedures and do not operate motors in overload conditions.
  3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
  4. Report flow rates that are not within plus or minus 10 percent of design.
- B. Measure flow at all automatic flow control valves to verify that valves are functioning as designed.
- C. Measure flow at all pressure-independent characterized control valves, with valves in fully open position, to verify that valves are functioning as designed.
- D. Set calibrated balancing valves, if installed, at calculated presettings.
- E. Measure flow at all stations and adjust, where necessary, to obtain first balance.
  1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.

- F. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.
- G. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:
  - 1. Determine the balancing station with the highest percentage over indicated flow.
  - 2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
  - 3. Record settings and mark balancing devices.
- H. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.
- I. Measure the differential-pressure-control-valve settings existing at the conclusion of balancing.
- J. Check settings and operation of each safety valve. Record settings.

### 3.10 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

- A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

### 3.11 PROCEDURES FOR 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

## SECTION 23 0713

### 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.
  - 5. Outdoor, concealed supply and return.
  - 6. Outdoor, exposed supply and return.
- B. Related Sections:
  - 1. Section 23 0716 "HVAC Equipment Insulation."
  - 2. Section 23 0719 "HVAC Piping Insulation."
  - 3. Section 23 3113 "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. LEED Submittals:
  - 1. Product Data for Credit IEQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content.
  - 2. 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."
- C. 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 0529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

#### 1.8 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.



- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

## **PART 2 - PRODUCTS**

### **2.1 INSULATION MATERIALS**

- A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type II for sheet materials.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Aeroflex USA, Inc.; Aerocel.
    - b. Armacell LLC; AP Armaflex.
    - c. K-Flex USA; Insul-Sheet, K-Flex Gray Duct Liner, and K-FLEX LS.
- G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. CertainTeed Corp.; SoftTouch Duct Wrap.
    - b. Johns Manville; Microlite.
    - c. Knauf Insulation; Friendly Feel Duct Wrap.
    - d. Manson Insulation Inc.; Alley Wrap.
    - e. Owens Corning; SOFTR All-Service Duct Wrap.
- H. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. CertainTeed Corp.; Commercial Board.
    - b. Fibrex Insulations Inc.; FBX.
    - c. Johns Manville; 800 Series Spin-Glas.

- d. Knauf Insulation; Insulation Board.
  - e. Manson Insulation Inc.; AK Board.
  - f. Owens Corning; Fiberglas 700 Series.
- I. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials and Type II, Grade 1 for sheet materials.
- 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Armacell LLC; Tubolit.
    - b. Nomaco Insulation; IMCOLOCK, IMCOSHEET, NOMALOCK, and NOMAPLY.

## 2.2 FIRE-RATED INSULATION SYSTEMS

- A. Fire-Rated Board: Structural-grade, press-molded, xonolite calcium silicate, fireproofing board suitable for operating temperatures up to 1700 deg F. Comply with ASTM C 656, Type II, Grade 6. Tested and certified to provide a:
- a. 2-hour fire rating by an NRTL acceptable to authorities having jurisdiction
- 1. Products: Subject to compliance with requirements, provide the following :
    - a. Johns Manville; Super Firetemp M.
- B. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a:
- a. 2-hour fire rating by an NRTL acceptable to authorities
- 1. Products: Subject to compliance with requirements, provide one of the following :
    - a. CertainTeed Corp.; FlameChek.
    - b. Johns Manville; Firetemp Wrap.
    - c. Nelson Fire Stop Products; Nelson FSB Flameshield Blanket.
    - d. Thermal Ceramics; FireMaster Duct Wrap.
    - e. 3M; Fire Barrier Wrap Products.
    - f. Unifrax Corporation; FyreWrap.

## 2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
- 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Aeroflex USA, Inc.; Aero seal.
    - 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 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 078413 "Penetration 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 078413 "Penetration 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 078413 "Penetration Firestopping."

### 3.9 FINISHES

- A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
  - 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
    - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

### 3.10 FIELD QUALITY CONTROL

- A. Testing Agency:
  - a. Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
  - 1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location (s) 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: 2 inches 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: 2 inches 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: 2 inches 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: 2 inches 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: 2 inches 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: 2 inches 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: 2 inches 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: 2 inches 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: 2 inches 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: 2 inches 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: 2 inches 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: 2 inches 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: 2 inches 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: 2 inches 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: 2 inches 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: 2 inches 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: 2 inches thick and 0.75-lb/cu. ft. nominal density.

### 3.14 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: 1 inch thick.
  - 2. Polyolefin: 1 inch thick.
- C. Exposed, round and flat-oval, return-air duct insulation shall be one of the following:
  - 1. Flexible Elastomeric: 1 inch thick.
  - 2. Polyolefin: 1 inch thick.
- D. Exposed, rectangular, supply-air duct insulation shall be one of the following:
  - 1. Flexible Elastomeric: 1 inch thick.
  - 2. Polyolefin: 1 inch thick.
- E. Exposed, rectangular, return-air duct insulation shall be one of the following:
  - 1. Flexible Elastomeric: 1 inch thick.
  - 2. Polyolefin: 1 inch thick.
- F. Exposed, supply-air plenum insulation shall be one of the following:
  - 1. Flexible Elastomeric: 1 inch thick.
  - 2. Polyolefin: 1 inch thick.
- G. Exposed, return-air plenum insulation shall be one of the following:
  - 1. Flexible Elastomeric: 1 inch thick.
  - 2. Polyolefin: 1 inch thick.

### 3.15 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. Ducts and Plenums, Concealed:
  - 1. Aluminum, Corrugated: 0.032 inch thick.
- D. Ducts and Plenums, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:
  - 1. Aluminum, Corrugated: 0.032 inch thick.
- E. Ducts and Plenums, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches:
  - 1. Aluminum, with 1-1/4-Inch- Deep Corrugations: 0.032 inch thick.

**END OF SECTION**



## SECTION 23 0719

### HVAC PIPING INSULATION

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. Section includes insulating the following HVAC piping systems:

1. Condensate drain piping.
2. Chilled-water piping.
3. Condenser-water piping.
4. Heating hot-water piping.
5. Steam and steam condensate piping.
6. Refrigerant suction and hot-gas piping.

- B. Related Sections:

1. Section 230713 "Duct Insulation."
2. Section 230716 "HVAC Equipment Insulation."

##### 1.3 DEFINITIONS:

- A. Refer to Section 230500 "Common Work Results for HVAC".

##### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

- B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content.
2. 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."

- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.

3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

#### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
  1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

#### 1.8 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

## 1.9 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

## PART 2 - PRODUCTS

### 2.1 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Insulation for below-ambient service requires a vapor-barrier.
- C. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- D. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- E. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- F. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- G. Calcium Silicate:
  - 1. Products: Subject to compliance with requirements, provide the following:
    - a. Industrial Insulation Group (IIG); Thermo-12 Gold.
  - 2. Preformed Pipe Sections: Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.
  - 3. Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.
  - 4. Prefabricated Fitting Covers: Comply with ASTM C 450 and ASTM C 585 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.
- H. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular 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-Lock, Insul-Tube, and K-FLEX LS.

- I. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553,
  - 1. Type II and ASTM C 1290, Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
  - 2. Products: Subject to compliance with requirements, provide one of the following:
    - a. CertainTeed Corp.; 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.
  
- J. Mineral-Fiber, Preformed Pipe Insulation:
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Johns Manville; Micro-Lok.
    - b. Knauf Insulation; 1000-Degree Pipe Insulation.
    - c. Manson Insulation Inc.; Alley-K.
    - d. Owens Corning; Fiberglas Pipe Insulation.
    - e. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A:
      - 1) with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
  
- K. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied:
  - 1. ASJ complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
  - 2. Products: Subject to compliance with requirements, provide one of the following:
    - a. CertainTeed Corp.; CrimpWrap.
    - b. Johns Manville; MicroFlex.
    - c. Knauf Insulation; Pipe and Tank Insulation.
    - d. Manson Insulation Inc.; AK Flex.
    - e. Owens Corning; Fiberglas Pipe and Tank Insulation.
  
- L. Prefabricated Thermal Insulating Fitting Covers: Comply with ASTM C 450 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

## 2.2 INSULATING CEMENTS

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
  - 1. Products: Subject to compliance with requirements, provide the following:
    - a. Ramco Insulation, Inc.; Super-Stik.
  
- B. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

1. Products: Subject to compliance with requirements, provide the following:
  - a. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.

## 2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Calcium Silicate Adhesive: Fibrous, sodium-silicate-based adhesive with a service temperature range of 50 to 800 deg F.

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-97.
  - b. Eagle Bridges - Marathon Industries; 290.
  - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 81-27.
  - d. Mon-Eco Industries, Inc.; 22-30.
  - e. Vimasco Corporation; 760.
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).
3. 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 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 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).
3. 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. 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).
  3. 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."
- E. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
    - b. Eagle Bridges - Marathon Industries; 225.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
    - d. Mon-Eco Industries, Inc.; 22-25.
  2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- F. PVC Jacket Adhesive: Compatible with PVC jacket.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Dow Corning Corporation; 739, Dow Silicone.
    - b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
    - c. P.I.C. Plastics, Inc.; Welding Adhesive.
    - d. Speedline Corporation; Polyco VP Adhesive.
  2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  3. 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."

## 2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
    - b. Vimasco Corporation; 749.
  2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.

3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel.
  - b. Eagle Bridges - Marathon Industries; 570.
  - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.
2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F.
4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
5. Color: White.

D. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
  - b. Eagle Bridges - Marathon Industries; 550.
  - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
  - d. Mon-Eco Industries, Inc.; 55-50.
  - e. Vimasco Corporation; WC-1/WC-5.
2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

## 2.5 SEALANTS

A. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide the following:
  - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants 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."

## 2.6 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
  - 1. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

## 2.7 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Johns Manville; Zeston.
    - b. P.I.C. Plastics, Inc.; FG Series.
    - c. Proto Corporation; LoSmoke.
    - d. Speedline Corporation; SmokeSafe.
  - 2. Adhesive: As recommended by jacket material manufacturer.
  - 3. Color: Color-code jackets based on system:
    - a. White
  - 4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
    - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
- C. Metal Jacket:
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
    - b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
    - c. RPR Products, Inc.; Insul-Mate.
  - 2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
    - a. Sheet and roll stock ready for shop or field sizing or factory cut and rolled to size.
    - b. Finish and thickness are indicated in field-applied jacket schedules.
    - c. Moisture Barrier for Indoor Applications:
      - 1) 1-mil- thick, heat-bonded polyethylene and kraft paper.
    - d. Moisture Barrier for Outdoor Applications:
      - 1) 3-mil- thick, heat-bonded polyethylene and kraft paper.
    - e. Factory-Fabricated Fitting Covers:
      - 1) Same material, finish, and thickness as jacket.



- 2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
- 3) Tee covers.
- 4) Flange and union covers.
- 5) End caps.
- 6) Beveled collars.
- 7) Valve covers.
- 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

## 2.8 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. ABI, Ideal Tape Division; 428 AWF ASJ.
- b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
- c. Compac Corporation; 104 and 105.
- d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches.

3. Thickness: 11.5 mils.

4. Adhesion: 90 ounces force/inch in width.

5. Elongation: 2 percent.

6. Tensile Strength: 40 lbf/inch in width.

7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. ABI, Ideal Tape Division; 370 White PVC tape.
- b. Compac Corporation; 130.
- c. Venture Tape; 1506 CW NS.

2. Width: 2 inches.

3. Thickness: 6 mils.

4. Adhesion: 64 ounces force/inch in width.

5. Elongation: 500 percent.

6. Tensile Strength: 18 lbf/inch in width.

C. 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.

## 2.9 SECUREMENTS

- A. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
  1. Verify that systems to be insulated have been tested and are free of defects.
  2. Verify that surfaces to be insulated are clean and dry.
  3. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
  1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
  2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

### 3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at
    - a. 2 inches o.c.
    - b. For below-ambient services, apply vapor-barrier mastic over staples.
  - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
  - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
  - 1. Vibration-control devices.
  - 2. Testing agency labels and stamps.
  - 3. Nameplates and data plates.
  - 4. Manholes.
  - 5. Handholes.
  - 6. Cleanouts.

### 3.4 PENETRATIONS

- A. Insulation Installation at 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 Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
  - 1. Pipe: Install insulation continuously through floor penetrations.

2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

### 3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
  1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
  2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
  3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
  4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
  5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
  6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
  7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
  8. For services not specified to receive a field-applied jacket except for flexible elastomeric install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
  9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
  2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
  3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
  4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
  5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

### 3.6 INSTALLATION OF CALCIUM SILICATE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure single-layer insulation with stainless-steel bands at 12-inch intervals and tighten bands without deforming insulation materials.
2. Install two-layer insulation with joints tightly butted and staggered at least 3 inches. Secure inner layer with wire spaced at 12-inch intervals. Secure outer layer with stainless-steel bands at 12-inch intervals.
3. Apply a skim coat of mineral-fiber, hydraulic-setting cement to insulation surface. When cement is dry, apply flood coat of lagging adhesive and press on one layer of glass cloth or tape. Overlap edges at least 1 inch. Apply finish coat of lagging adhesive over glass cloth or tape. Thin finish coat to achieve smooth, uniform finish.

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 cut sections of block insulation of same material and thickness as pipe insulation.
4. Finish flange insulation same as pipe insulation.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed insulation sections of insulation are not available, install mitered sections of calcium silicate insulation. Secure insulation materials with wire or bands.
3. Finish fittings insulation same as pipe insulation.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install mitered segments of calcium silicate insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
2. Install insulation to flanges as specified for flange insulation application.
3. Finish valve and specialty insulation same as pipe insulation.

### 3.7 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
1. Install pipe insulation to outer diameter of pipe flange.
  2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
  3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
  4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install mitered sections of pipe insulation.
  2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed valve covers manufactured of same material as pipe insulation when available.
  2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
  3. Install insulation to flanges as specified for flange insulation application.
  4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

### 3.8 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
  2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
  3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
  4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

### 3.9 FIELD-APPLIED JACKET INSTALLATION

A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

### 3.10 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.



3.11 Insulation shall have a k value that meets the minimum requirements of the latest International Energy Conservation Code (IECC).

### 3.12 INDOOR PIPING INSULATION SCHEDULE

#### A. Condensate and Equipment Drain Water below 60 Deg F:

1. All Pipe Sizes: Insulation shall be one of the following:
  - a. Flexible Elastomeric:
    - 1) 1/2 inch thick
  - b. Mineral-Fiber, Preformed Pipe Insulation, Type I:
    - 1) 1/2 inch thick

#### B. Chilled Water, 40 Deg F and below:

1. NPS 1-1/2 inch and Smaller: Insulation shall be the following:
  - a. Flexible Elastomeric:
    - 1) 1-1/2 inch thick.
2. NPS 2 inch and Larger: Insulation shall be the following:
  - a. Flexible Elastomeric:
    - 1) 2 inch thick
3. Insulation for runouts not exceeding 48 inches in length for connection to equipment shall be the following:
  - a. Flexible Elastomeric: 1 inch thick.

#### C. Chilled Water, above 40 Deg F:

1. NPS 1-1/2 inch and Smaller: Insulation shall be the following:
  - a. Flexible Elastomeric:
    - 1) 1-1/2 inch thick.
  - b. Mineral-Fiber, Preformed Pipe, Type I:
    - 1) 1-1/2 inches thick.
2. NPS 2 inch and Larger: Insulation shall be the following:
  - a. Flexible Elastomeric:
    - 1) 2 inch thick.
  - b. Mineral-Fiber, Preformed Pipe, Type I:
    - 1) 2 inch thick.
3. Insulation runouts not exceeding 48 inches in length for connection to equipment shall be one of the following:
  - a. Flexible Elastomeric: 1 inch thick.
  - b. Mineral-Fiber, Preformed Pipe, Type I: 1 inch thick
4. Condenser-water supply and return piping located indoors and operating in range of 55 to 105 deg F (13 to 41 deg C) is not always insulated. If condenser-water system operates as part of a water-side economizer cycle or if Project requires condensation control, piping should be insulated.

#### D. Condenser-Water Supply and Return:

1. All Pipe Sizes: Insulation shall be one of the following:
    - a. Flexible Elastomeric: 1 inch thick.
    - b. Mineral-Fiber, Preformed Pipe, Type I:
      - 1) 1 inch thick
- E. Heating-Hot-Water Supply and Return, 200 Deg F and Below:
1. NPS 1 1/2 and Smaller: Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe, Type I:
      - 1) 1-1/2 inch thick
  2. Greater than NPS 1-1/2 inch : Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe, Type I or Pipe and Tank Insulation:
      - 1) 2 inches thick
  3. Insulation for runouts not exceeding 48 inches in length for connection to equipment shall be the following:
    - a. Mineral-Fiber, Preformed Pipe, Type I: 1 inch thick.
- F. Heating-Hot-Water Supply and Return, above 200 Deg F:
1. NPS 1 and Smaller: Insulation shall be one of the following:
    - a. Calcium Silicate:
      - 1) 2 inches thick
    - b. Mineral-Fiber, Preformed Pipe, Type I or II:
      - 1) 1-1/2 inches thick
  2. NPS 1-1/4 and Larger: Insulation shall be one of the following:
    - a. Calcium Silicate:
      - 1) 3 inches thick
    - b. Mineral-Fiber, Preformed Pipe, Type I or II:
      - 1) 2 inches thick
  3. Insulation runouts not exceeding 48 inches in length for connection to equipment shall be the following:
    - a. Mineral-Fiber, Preformed Pipe, Type I: 1-1/2 inch thick.
- G. Steam and Steam Condensate, 0 to 15 PSI, 200 Deg F to 250 Deg F :
1. NPS 1 and Smaller: Insulation shall be one of the following:
    - a. Calcium Silicate:
      - 1) 2 inches thick
    - b. Mineral-Fiber, Preformed Pipe, Type I or II:
      - 1) 1-1/2 inches thick
  2. NPS 1-1/4 and Larger: Insulation shall be one of the following:
    - a. Calcium Silicate:
      - 1) 3 inches
    - b. Mineral-Fiber, Preformed Pipe, Type I or II or Pipe and Tank Insulation:

- 1) 2 inches thick
  - 3. Insulation for runouts not exceeding 48" in length for connection to equipment shall be the following:
    - a. Mineral-Fiber, Preformed Pipe, Type I: 1-1/2 inch thick.
  - H. Steam and Steam Condensate, 16 to 60 PSI, 251 Deg F to 305 Deg F :
    - 1. NPS 1 and Smaller: Insulation shall be one of the following:
      - a. Calcium Silicate: 3 inches thick.
      - b. Mineral-Fiber, Preformed Pipe, Type I or II: 2 inches thick.
    - 2. NPS 1-1/4 and Larger: Insulation shall be one of the following:
      - a. Calcium Silicate: 3 inches thick.
      - b. Mineral-Fiber, Preformed Pipe, Type I or II or Pipe and Tank Insulation: 2 inches thick.
    - 3. Insulation for runouts not exceeding 48inches in length for connection to equipment shall be the following:
      - a. Mineral-Fiber, Preformed Pipe, Type I: 1-1/2 inch thick.
  - I. Refrigerant Suction and Hot-Gas Piping:
    - 1. All Pipe Sizes: Insulation shall be one of the following:
      - a. Flexible Elastomeric: 1 inch thick.
  - J. Refrigerant Suction and Hot-Gas Flexible Tubing:
    - 1. All Pipe Sizes: Insulation shall be the following:
      - a. Flexible Elastomeric: 1 inch thick.
- 3.13 INDOOR, FIELD-APPLIED JACKET SCHEDULE
- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
  - B. If more than one material is listed, selection from materials listed is Contractor's option.
  - C. Piping, Concealed:
    - 1. None.
  - D. Piping, Exposed:
    - 1. PVC:
      - a. White: 30 mils thick.
  - E. Steam Piping, Exposed:
    - 1. Aluminum, Stucco Embossed: 0.016 inch thick.

3.14 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. Aluminum, Stucco Embossed: 0.016 inch thick.

3.15 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

- A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

**END OF SECTION**

## SECTION 23 2113

### HYDRONIC PIPING

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. Section includes pipe and fitting materials and joining methods for the following:
  - 1. Hot-water heating piping.
  - 2. Chilled-water piping.
  - 3. Condenser-water piping.
  - 4. Makeup-water piping.
  - 5. Condensate-drain piping.
  - 6. Air-vent piping.
  - 7. Dielectric fittings.

##### 1.3 SEISMIC REQUIREMENTS

- A. All other components shall be assigned a component importance factor,  $I_p$ , equal to 1.0.
- B. Seismic Performance: Pipe hangers and supports shall withstand the effects of earthquake motions determined according to SEI/ASCE 7 <Insert requirement> and with the requirements specified in Section 230548 "Vibration and Seismic Controls for HVAC."
  - 1. For piping 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 piping 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."

##### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of the following:
  - 1. Steel pipe and fittings.
  - 2. Copper pipe, tubing and fittings.
  - 3. Dielectric fittings.
- B. 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 4.1: For solvent cements and adhesive primers, documentation indicating that products comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. 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.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Piping layout, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.
2. Other building services.
3. Structural members.

B. Qualification Data: For Installer.

C. Welding certificates.

D. Field quality-control reports: Written reports as specified in Part 3 of this section including:

1. Test procedures used.
2. Test results showing compliance with specified requirements.
3. Failed test results with corrective action taken to achieve compliance with specified requirements.

1.6 QUALITY ASSURANCE

A. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

1. Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

## 1.7 COORDINATION

- A. Coordinate layout and installation of hydronic piping and suspension system components with other construction, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.
- B. Coordinate pipe sleeve installations for foundation wall penetrations.
- C. Coordinate piping installation with roof curbs, equipment supports, and roof penetrations. Roof specialties are specified in Division 7 Sections.
- D. Coordinate pipe fitting pressure classes with products specified in related sections.
- E. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into base. Concrete, reinforcement, and formwork requirements are specified in Division 3 Sections.
- F. Coordinate installation of pipe sleeves for penetrations through exterior walls and floor assemblies. Coordinate with requirements for firestopping specified in Division 7 Section "Through-Penetration Firestop Systems" for fire and smoke wall and floor assemblies.

## PART 2 - PRODUCTS

### 2.1 COPPER TUBE AND FITTINGS

- A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.
- B. Grooved, Mechanical-Joint, Wrought-Copper Fittings: ASME B16.22.
  - 1. Grooved-End Copper Fittings: ASTM B 75, copper tube or ASTM B 584, bronze casting.
  - 2. Grooved-End-Tube Couplings: Coupling housings shall be cast with offsetting, angle-pattern bolt pads to provide joint rigidity and support and hanging in accordance with ANSI B31.1 and B31.9. Ductile-iron housing with keys matching pipe and fitting grooves, EPDM gasket rated for minimum 230 deg F without use of special lubricants. For use with housing, and ASTM A449 electroplated steel nuts and bolts.

### 2.2 STEEL PIPE AND FITTINGS

- A. Steel Pipe: ASTM A 53, black steel with plain ends; welded and seamless, Grade B, and wall thickness as indicated in "Piping Applications" Article.
- B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250 as indicated in "Piping Applications" Article.
- C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300 as indicated in "Piping Applications" Article.
- D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in "Piping Applications" Article.

- E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced as indicated in "Piping Applications" Article.
- F. Wrought-Steel Fittings: ASTM A 234, wall thickness to match adjoining pipe.
- G. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
  - 1. Material Group: 1.1.
  - 2. End Connections: Butt welding.
  - 3. Facings: Raised face.
- H. Forged Steel "Olet" Type Fittings, Welding, Socket-Welding and Threaded: ASME B16.11 and ASTM A105.
  - 1. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- I. Steel Pipe Nipples: ASTM A 733, made of same materials and wall thicknesses as pipe in which they are installed.
- J. Grooved Mechanical-Joint Fittings and Couplings:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following provide products by one of the following:
    - a. Victaulic Company.
    - b. Anvil International, Inc.
    - c. Tyco-Grinnel
  - 2. Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 53, Type F, E, or S, Grade B factory-fabricated steel; or ASTM A 234, Grade WPB steel fittings with grooves or shoulders designed and constructed to accept grooved-end couplings.
  - 3. Couplings: Two Ductile- housing and synthetic rubber gasket of central cavity pressure-responsive design; with ASTM A449 electroplated steel nuts and bolts to secure grooved pipe and fittings. Couplings shall comply with ASTM F1476 Standard Specification for the Performance of Gasketed Mechanical Couplings for Use in Piping Applications.
    - a. Rigid Type: Coupling housings shall be cast with offsetting, angle-pattern bolt pads to provide joint rigidity and support and hanging in accordance with ANSI B31.1 and B31.9.
    - b. Gasket: High temperature EPDM gasket, suitable for water service to +250 deg F, without use of special lubricants.
    - c. Flexible Type: For use in locations where vibration attenuation and stress relief are required, and for the elimination of flexible connectors.
    - d. 14" and Larger: Two –segment coupling, with lead-in chamfer on housing key and a wide-width gasket having a center-leg.
  - 4. Combinations of grooved mechanical-joint couplings and short nipples may also be used.

## 2.3 JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.



1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch (3.2-mm) maximum thickness unless otherwise indicated.
  - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
  - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- D. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.
- E. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

## 2.4 DIELECTRIC FITTINGS

- A. General: Assembly or fitting with insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.
  1. Manufacturers:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc. Capitol Manufacturing Co.
    - c. Capitol Manufacturing Company.
    - d. Central Plastics Company.
    - e. Elster Perfection.
    - f. Grinnell Mechanical Products.
    - g. Matco-Norca.
    - h. Pipeline Seal and Insulator, Inc.
    - i. Precision Plumbing Products, Inc.
    - j. Victaulic Company.
    - k. Watts Regulator Co.
    - l. Zurn Industries, LLC.
  - B. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld-neck end types and matching piping system materials.
  - C. Insulating Material: Suitable for system fluid, pressure, and temperature.
  - D. End Connections: Threaded, or flanged.
  - E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
  - F. Dielectric Nipples or Waterways: Electroplated steel with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

## PART 3 - EXECUTION

### 3.1 PIPING APPLICATIONS

- A. Hot-water heating piping, aboveground, NPS 2 and smaller shall be any of the following:
  - 1. Type L drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
  - 2. Schedule 40, Grade B, Type 96 steel pipe; Class 125, cast-iron fittings; cast-iron flanges and flange fittings; and threaded joints.
- B. Hot-water heating piping, aboveground, NPS 2-1/2 and larger, shall be any of the following:
  - 1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
  - 2. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
  - 3. Schedule 40 steel pipe; grooved, mechanical joint coupling and fittings; and grooved, mechanical joints.
- C. Chilled-water piping, aboveground, NPS 2 and smaller, shall be any of the following:
  - 1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
  - 2. Schedule 40, Grade B, Type 96 steel pipe; Class 125, cast-iron fittings; cast-iron flanges and flange fittings; and threaded joints.
- D. Chilled-water piping, aboveground, NPS 2-1/2 and larger, shall be any of the following:
  - 1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
  - 2. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
  - 3. Schedule 40 steel pipe; grooved, mechanical joint coupling and fittings; and grooved, mechanical joints.
- E. Condenser-water piping, aboveground, NPS 2 and smaller, shall be any of the following:
  - 1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
  - 2. Schedule 40, Grade B, Type 96 steel pipe; Class 125, cast-iron fittings; cast-iron flanges and flange fittings; and threaded joints.
- F. Condenser-water piping, aboveground, NPS 2-1/2 and larger, shall be any of the following:
  - 1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
  - 2. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
  - 3. Schedule 40 steel pipe; grooved, mechanical joint coupling and fittings; and grooved, mechanical joints.
- G. Glycol cooling-water piping, aboveground, NPS 2 and smaller, shall be any of the following:
  - 1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

2. Schedule 40, Grade B, Type 96 steel pipe; Class 125, cast-iron fittings; cast-iron flanges and flange fittings; and threaded joints.
- H. Glycol cooling-water piping, aboveground, NPS 2-1/2 and larger, shall be any of the following:
1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
  2. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
  3. Schedule 40 steel pipe; grooved, mechanical joint coupling and fittings; and grooved, mechanical joints.
- I. Makeup-water piping installed aboveground shall be the following:
1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
- J. Condensate-drain piping shall be the following:
1. Type M, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
- K. Blowdown-Drain Piping: Same materials and joining methods as for piping specified for the service in which blowdown drain is installed.
- L. Air-Vent Piping:
1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to piping manufacturer's written instructions.
  2. Outlet: Type K, annealed-temper copper tubing with soldered or flared joints.
- M. Safety-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed with metal-to-plastic transition fittings for plastic piping systems according to piping manufacturer's written instructions.

### 3.2 PIPING INSTALLATIONS

#### A. PRE-WORK / PRE-REQUISITES

1. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
2. The Contractor shall study the architectural, structural, mechanical, electrical and other drawings to eliminate conflict of piping with other structure lighting or other services.

#### B. CONDITION

1. All installed pipe lines shall be free from dents, scars, and burrs, with ends reamed smooth.
2. All piping shall be clean and free from acids and loose dirt when installed and shall be kept clean during the completion of the installation.

3. Install piping free of sags and bends.
4. All installed pipe lines shall remain straight against strains tending to cause distortion during system operation. The contractor shall make proper allowance for pipe line expansion and contraction so that no unsightly distortion, noise, damage or improper operation results therefrom.

C. SELECTION

1. Select system components with pressure rating equal to or greater than system operating pressure.
2. No street type fittings shall be used.
3. No short nipples shall be used except at drain valves.
4. Plugs of rags, wools, cottons, waste, or similar materials may not be used for plugging.

D. ROUTING/ARRANGEMENT

1. Piping installations shall be neatly organized.
2. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
3. Install groups of pipes parallel to each other.
4. Install piping spaced to permit application of insulation.
5. Install piping parallel and spaced to permit the servicing of valves.
6. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls or axis of the building.
7. Diagonal runs are prohibited unless specifically indicated otherwise.
8. Install fittings for all changes in direction.
9. No piping shall be run above any electrical panels, electrical equipment or access clearances for electrical for electrical panels or equipment. No piping shall be allowed to run through any electrical rooms.
10. Piping shall be arranged, placed and installed to facilitate equipment maintenance and shall be so arranged to not interfere with the installation of the air-conditioning equipment, ducts, or the removal of other equipment or devices. All specialties shall be so placed to permit easy operation and access.
11. All piping shall be so installed to insure noiseless circulation.
12. Install fittings for all branch connections.
13. Unless otherwise indicated, install branch connections to mains using [mechanically formed] tee fittings or forged steel branch fittings in main pipe, with the branch connected to the bottom of the main pipe.

14. For up-feed risers, connect the branch to the top of the main pipe.
15. Forged branch fittings shall be installed per the manufacturer's recommendations.

E. ACCESS / ARRANGEMENT

1. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal. All piping shall be so arranged to not block access to manholes, access openings, etc.
2. Install piping at indicated slopes. If not indicated, install piping at a uniform grade of 0.2 percent where possible, upward in direction of flow. Traps are to be avoided where-ever possible.
3. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
4. When insulated pipes are supported by a roller hanger they shall be protected from damage by suitable pipe covering protection saddles. Saddles shall support pipe on roller and shall be packed with insulation.
5. Install valves according to Section 230523 "General-Duty Valves for HVAC Piping."
6. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, at each coil on all sides of automatic valves where valves do not have union connections, elsewhere as indicated, and wherever necessary to prevent undue difficulty in making repairs or replacement. Unions are not required at flanged connections.
7. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated. Install flanges on valves, apparatus, and equipment having 2 ½ inch NPS and larger connections. Flanges or unions as applicable for the type of piping specified, shall be provided in the piping at connections to all items of equipment.
8. Install shutoff valve immediately upstream of each dielectric fitting. Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.
9. Comply with requirements in Section 230516 "Expansion Fittings and Loops for HVAC Piping" for installation of expansion loops, expansion joints, anchors, and pipe alignment guides. Anchor piping for proper direction of expansion and contraction.
10. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
11. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
12. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."
13. Install strainers on supply side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS ¾ nipple and ball valve in blow-down connection of strainers NPS 2) and larger. Match size of strainer blow-off connection for strainers smaller than NPS 2).

14. Install flexible connectors at inlet and discharge connections to pumps (except inline pumps) and other vibration-producing equipment.
15. Polypropylene pipe in or passing through plenums must be fire wrapped or installed in a metal conduit.

#### F. DRAINAGE

1. Drain valves shall be installed at all low points in all piping systems to allow for complete drainage of piping systems.
2. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
3. All piping systems shall be installed so that they can be easily drained by means of drainage of low points of all piping without disconnecting pipe.
4. If not specifically indicated on the drawings, the frequency of draining shall determine whether drain caps, plugs, cocks, or valves are to be used.

#### G. IDENTIFICATION

1. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for identifying piping.

### 3.3 DIELECTRIC FITTING INSTALLATION

#### A. Make connections according to the following, unless otherwise indicated:

1. Install dielectric nipples or waterways in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install waterways, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Install Dielectric Fittings into Hydronic Piping Systems: Install dielectric nipples, waterways or couplings to connect piping materials of dissimilar metals.
4. End Connections: Threaded, or flanged.

### 3.4 HANGERS AND SUPPORTS

- A. Comply with requirements in Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for hanger, support, and anchor devices. Comply with the following requirements for maximum spacing of supports.
- B. Comply with requirements in Section 230548 "Vibration and Seismic Controls for HVAC" for seismic restraints.
- C. Steel roof deck shall not be used to support loads from piping, ductwork or equipment, unless noted otherwise. Hanger loads less than 50 lbs. may be hung from the steel roof deck in cases when hanging from the steel roof deck cannot be avoided; the attachment method must distribute the load across the deck as approved by the Structural Engineer.

- D. Install the following pipe attachments:
1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
  2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
  3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
  4. Spring hangers to support vertical runs.
  5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
  6. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.
- E. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
1. NPS 3/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
  2. NPS 1: Maximum span, 7 feet; minimum rod size, 3/8 inch.
  3. NPS 1-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
  4. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
  5. NPS 2-1/2: Maximum span, 11 feet; minimum rod size, 1/2 inch.
  6. NPS 3 and Larger: Maximum span, 12 feet; minimum rod size, 1/2 inch.
- F. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:
1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
  2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
  3. NPS 1-1/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
  4. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
  5. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
  6. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
  7. NPS 3 and Larger: Maximum span, 10 feet; minimum rod size, 3/8 inch.
- G. Fiberglass Piping Hanger Spacing: Space hangers according to pipe manufacturer's written instructions for service conditions. Avoid point loading. Space and install hangers with the fewest practical rigid anchor points.
- H. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.
- I. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

### 3.5 PIPE JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

- E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- F. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
- G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- H. Grooved Joints: Assemble joints with coupling and gasket, lubricant, and bolts.
  - 1. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. Use grooved-end fittings and rigid, grooved-end-pipe couplings.
  - 2. Installed in accordance with the manufacturer's written recommendations.
  - 3. Ends shall be clean and free from indentations, projections or roll marks.
  - 4. The gasket shall be molded and produced by the coupling manufacturer of an elastomer suitable for the intended service.
  - 5. Unions and flanges for servicing and disconnect are not required in installations using grooved joint couplings.
  - 6. Training: The coupling manufacturer's factory-direct trained representative shall provide on-site training for the contractor's field personnel in the use of grooving tools and installation of product. The representative shall periodically visit the job site to ensure best practices in grooved product installation are being followed. The distributor's representative will not be acceptable.

### 3.6 TERMINAL EQUIPMENT CONNECTIONS

- A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.
- B. Install control valves in accessible locations close to connected equipment.

### 3.7 FIELD QUALITY CONTROL

- A. Prepare hydronic piping according to ASME B31.9 and as follows:
  - 1. Leave joints, including welds, uninsulated and exposed for examination during test.
  - 2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
  - 3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
  - 4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
  - 5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.
- B. Perform the following tests on hydronic piping:



1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
  2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
  3. Isolate expansion tanks and determine that hydronic system is full of water.
  4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times the "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
  5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
  6. Prepare written report of testing.
- C. Perform the following before operating the system:
1. Open manual valves fully.
  2. Inspect pumps for proper rotation.
  3. Set makeup pressure-reducing valves for required system pressure.
  4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
  5. Set temperature controls so all coils are calling for full flow.
  6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
  7. Verify lubrication of motors and bearings.

**END OF SECTION**

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## SECTION 23 2116

### HYDRONIC PIPING SPECIALTIES

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. Section includes special-duty valves and specialties for the following:
  1. Hot-water heating piping.
  2. Chilled-water piping.
  3. Condenser-water piping.
  4. Makeup-water piping.
  5. Condensate-drain piping.
  6. Air-vent piping.
  7. Steel, hydronic buffer tanks.

##### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of the following:
  1. Valves: Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
  2. Air-control devices.
  3. Hydronic specialties.

##### 1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air-control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.

##### 1.5 QUALITY ASSURANCE

- A. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
  1. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

## PART 2 - PRODUCTS

### 2.1 VALVES

- A. Globe, Check, Ball, and Butterfly Valves: Comply with requirements specified in Section 230523 "General-Duty Valves for HVAC Piping. Gate valves are not allowed on this project.
- B. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Section 23 0900 "Instrumentation and Control for HVAC.
- C. Refer to Part 3 "Valve Applications" Article for applications of each valve.
- D. Bronze, Calibrated-Orifice or Venturi, Balancing Valves, NPS 2 and smaller:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Armstrong Pumps, Inc.
    - b. Bell & Gossett Domestic Pump.
    - c. Flow Design Inc.
    - d. Gerand Engineering Co.
    - e. Griswold Controls.
    - f. Taco.
    - g. Tour & Andersson; available through Victaulic Company.
    - h. Tyco-Grinnell
  - 2. Body: Bronze, ball or plug type with calibrated orifice or venturi.
  - 3. Ball: Brass or stainless steel.
  - 4. Plug: Resin.
  - 5. Seat: PTFE.
  - 6. End Connections: Threaded or socket.
  - 7. Pressure Gage Connections: Integral seals for portable differential pressure meter.
  - 8. Handle Style: Lever, with memory stop to retain set position.
  - 9. CWP Rating: Minimum 125 psig.
  - 10. Maximum Operating Temperature: 250 deg F.
- E. Cast-Iron or Steel, Calibrated-Orifice or Venturi, Balancing Valves, NPS 2 ½ and larger:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Amtrol, Inc.
    - b. Armstrong Pumps, Inc.
    - c. Bell & Gossett Domestic Pump.
    - d. Flow Design Inc.
    - e. Gerand Engineering Co.
    - f. Grinnell.
    - g. Griswold Controls.
    - h. Taco.
    - i. Tour & Andersson; available through Victaulic Company.
    - j. Spence Engineering Company Inc.
    - k. Watts Regulator Co.

2. Body: Cast-iron or steel body, ball, plug, or globe pattern with calibrated orifice or venturi.
3. Ball: Brass or stainless steel.
4. Stem Seals: EPDM O-rings.
5. Disc: Glass and carbon-filled PTFE.
6. Seat: PTFE.
7. End Connections: Flanged or grooved.
8. Pressure Gage Connections: Integral seals for portable differential pressure meter.
9. Handle Style: Lever, with memory stop to retain set position.
10. CWP Rating: Minimum 125 psig.
11. Maximum Operating Temperature: 250 deg F.

F. Diaphragm-Operated, Pressure-Reducing Valves: ASME labeled.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Amtrol, Inc.
  - b. Armstrong Pumps, Inc.
  - c. Bell & Gossett Domestic Pump.
  - d. Conbraco Industries, Inc.
  - e. Spence Engineering Company, Inc.
  - f. Watts Regulator Co.
2. Body: Bronze or brass.
3. Disc: Glass and carbon-filled PTFE.
4. Seat: Brass.
5. Stem Seals: EPDM O-rings.
6. Diaphragm: EPT.
7. Low inlet-pressure check valve.
8. Inlet Strainer: Brass, removable without system shutdown.
9. Valve Seat and Stem: Noncorrosive.
10. Valve Size, Capacity, and Operating Pressure: Selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

G. Diaphragm-Operated Safety Valves: ASME labeled.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Amtrol, Inc.
  - b. Armstrong Pumps, Inc.
  - c. Bell & Gossett Domestic Pump.
  - d. Conbraco Industries, Inc.
  - e. Kunkle.
  - f. Spence Engineering Company, Inc.
2. Body: Bronze or brass.
3. Disc: Glass and carbon-filled PTFE.
4. Seat: Brass.
5. Stem Seals: EPDM O-rings.
6. Diaphragm: EPT.
7. Wetted, Internal Work Parts: Brass and rubber.
8. Inlet Strainer: Brass, removable without system shutdown.
9. Valve Seat and Stem: Noncorrosive.

10. Valve Size, Capacity, and Operating Pressure: Comply with ASME Boiler and Pressure Vessel Code: Section IV, and selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

H. Automatic Flow-Control Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Armstrong Pumps, Inc.
  - b. Bell & Gossett Domestic Pump.
  - c. Flow Design Inc.
  - d. Griswold Controls.
  - e. Taco
2. Body: Brass or ferrous metal.
3. Piston and Spring Assembly: Tamper proof, self-cleaning, and removable, for inspections and replacement.
  - a. Corrosion resistant.
4. Combination Assemblies: Include bronze or brass-alloy ball valve.
5. Identification Tag: Attached by chain and marked with zone identification, valve number, and flow rate.
6. Size: Same as pipe in which installed.
7. Performance: Maintain constant flow, plus or minus 5 percent over system pressure fluctuations:
  - a. Minimum CWP Rating: 175 psig.
8. Maximum Operating Temperature: 200 deg F.
9. Fitted with pressure and temperature test valves.
10. Equipped with a readout kit including flow meter, probes, hoses, flow charts, and carrying case.

## 2.2 AIR-CONTROL DEVICES

A. Manual Air Vents:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Amtrol, Inc.
  - b. Armstrong Pumps, Inc.
  - c. Bell & Gossett Domestic Pump.
  - d. Taco, Inc.
2. Body: Bronze.
3. Internal Parts: Nonferrous.
4. Operator: Screwdriver or thumbscrew.
5. Manually operated with ball valve in the down position.
6. Inlet Connection: NPS 1/2.
7. Discharge Connection: NPS 1/8.
8. CWP Rating: 150 psig.
9. Maximum Operating Temperature: 225 deg F.

B. Automatic Air Vents:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Amtrol, Inc.
  - b. Bell & Gossett Domestic Pump.
  - c. Hoffman Specialty ITT; Fluid Handling Div.
  - d. Spirax-Sarco.
  - e. Spirovent.
  - f. Taco, Inc.
  - g. Honeywell-Baukman.
2. Body: Bronze or cast iron.
3. Internal Parts: Nonferrous.
4. Operator: Noncorrosive metal float.
5. Inlet Connection: NPS 1/2.
6. Discharge Connection: NPS 1/4.
7. CWP Rating: 150 psig.
8. Maximum Operating Temperature: 240 deg F.

C. Bladder -Type Expansion Tanks:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Amtrol, Inc.
  - b. Armstrong Pumps, Inc.
  - c. Bell & Gossett Domestic Pump.
  - d. Taco, Inc.
  - e. Zilmet
2. Tank: Welded steel, rated for 125-psig working pressure and 240 deg F maximum operating temperature. Factory test after taps are fabricated and supports installed and are labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
3. Bladder : Securely sealed into tank to separate air charge from system water to maintain required expansion capacity.
4. Air-Charge Fittings: Schrader valve, stainless steel with EPDM seats.
5. Access: Drain fitting and taps for pressure gage.
6. Support:
  - a. Vertical tanks with steel legs or base.
  - b. Horizontal tanks with steel saddles.

D. Tangential-Type Air Separators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Amtrol, Inc.
  - b. Armstrong Pumps, Inc.
  - c. Bell & Gossett Domestic Pump.
  - d. Taco, Inc.
2. Tank: Welded steel; ASME constructed and labeled for 125-psig minimum working pressure and 240 deg F maximum operating temperature.

3. Air Collector Tube: Perforated stainless steel, constructed to direct released air into expansion tank.
4. Tangential Inlet and Outlet Connections: Threaded for NPS 2 and smaller; flanged connections for NPS 2-1/2 and larger.
5. Blowdown Connection: Threaded.
6. Size: Match system flow capacity.

## 2.3 HYDRONIC PIPING SPECIALTIES

### A. Y-Pattern Strainers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Armstrong Machine Works.
  - b. Hoffman Specialty ITT; Fluid Handling Div.
  - c. Metraflex Co.
  - d. Mueller
  - e. Spirax Sarco.
  - f. Trane Co.
  - g. Tyco-Grinnell.
  - h. Tour & Andersson; available through Victaulic Company.
  - i. Watts Regulator Co.
2. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
3. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
4. Strainer Screen: Stainless-steel, or perforated stainless-steel basket:
  - a. 20-mesh strainer.
5. CWP Rating: 125 psig.

### B. Basket Strainers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Crane Co.
  - b. Metraflex Co.
  - c. Mueller
  - d. Spirax Sarco.
  - e. Tyco-Grinnell.
  - f. Tour & Andersson; available through Victaulic Company.
2. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
3. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
4. Strainer Screen: Perforated stainless-steel basket with 50 percent free area:
  - a. 40-mesh startup strainer.
5. CWP Rating: 125 psig.

### C. Stainless-Steel Braided-Corrugated, Flexible Connectors:



1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Amber-Booth.
  - b. Mason Industries.
  - c. Metraflex Co.
  - d. Flex-Weld.
  - e. Fugate.
  - f. Twin City Hose.
2. Body: 321 Stainless-steel close pitch corrugated hose with woven, flexible, 304 Stainless-steel, protective jacket.
3. End Connections: Flanged, ANSI Class 150 carbon steel
4. Performance: Permanent Offset; 3/8 inch, Intermittent Offset; 1/8 inch.
5. Safe Working Pressure: 175 psig. (For 8 inch diameter)
6. Maximum Operating Temperature: 200 deg F. (For 8 inch diameter)

D. Spherical, Rubber, Flexible Connectors:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Amber-Booth.
  - b. Mason Industries.
  - c. Metraflex Co.
  - d. Flex-Weld.
  - e. Proco.
  - f. Fugate.
  - g. Twin City Hose.
2. Body: Double-sphere fiber-reinforced EPDM rubber body.
3. End Connections: Steel flanges drilled to align with Classes 150 and 300 steel flanges.
4. Performance: Capable of misalignment.
5. CWP Rating: 150 psig.
6. Maximum Operating Temperature: 250 deg F.

E. Diverting Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Amtrol, Inc.
  - b. Armstrong Pumps, Inc.
  - c. Bell & Gossett Domestic Pump.
  - d. Taco, Inc.
2. Body: Cast Iron or Wrought Copper
3. Ends: Threaded or Soldered
4. Flow Direction: Indicated on fitting.
5. CWP Rating: 125 psig.
6. Maximum Operating Temperature: 250 deg F.

## 2.4 STEEL, HYDRONIC BUFFER TANKS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Hanson Tank
  - 2. Lochinvar Corporation.
  - 3. Taco Confort Solutions
  - 4. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
  - 5. Weben-Jarco, Inc.
  - 6. Wessels Company.
- B. Description: Steel, horizontal or vertical buffer tank, pressure-rated tank with cylindrical sidewalls. See drawings for tank type.
- C. Fabricate supports and attachments to tank with reinforcement strong enough to resist tank movement during seismic event when tank supports are anchored to building structure.
- D. Construction:
  - 1. ASME Boiler and Pressure Vessels Code Section VIII code, steel, constructed with welded joints, 450°F temperature and a pressure rating of:
    - a. 125 PSIG
- E. Manhole: Watertight, for tank more than 36 inches in diameter; same pressure rating as tank.
- F. Tappings: Factory-fabricated, welded to tank before testing and labeling.
  - 1. Hot water buffer tanks shall have four tappings.
    - a. NPS 2 and Smaller: ASME B1.20.1, with female thread.
    - b. NPS 2-1/2 and Larger: ASME B16.5, flanged.
  - 2. Chilled water buffer tanks shall have two tappings.
    - a. NPS 2 and Smaller: ASME B1.20.1, with female thread.
    - b. NPS 2-1/2 and Larger: ASME B16.5, flanged.
- G. Specialties and Accessories: Include tappings in tank and the following:
  - 1. Pressure gage.
  - 2. Thermometer.
- H. Horizontal Tank Supports: Factory-fabricated steel saddles, welded to tank before testing and labeling.
- I. Vertical Tank Supports: Factory-fabricated steel legs or steel skirt, welded to tank before testing and labeling.
- J. Exterior Coating: Manufacturer's standard enamel paint.
- K. Insulation: Factory-installed fiberglass or polyurethane foam; surrounding entire tank except connections and other openings; suitable for tank operating temperature; and complying with ASHRAE/IESNA 90.1.
- L. Jacket: Steel, with manufacturer's standard finish unless otherwise indicated.

## **PART 3 - EXECUTION**

### **3.1 VALVE APPLICATIONS**

- A. Install shut off-duty valves at each branch connection to supply mains and at supply connection to each piece of equipment.
- B. Install calibrated-orifice, balancing valves at each branch connection to return main.
- C. Install calibrated-orifice, balancing valves in the return pipe of each heating or cooling terminal.
- D. Install check valves at each pump discharge and elsewhere as required to control flow direction.
- E. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.
- F. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.

### **3.2 HYDRONIC SPECIALTIES INSTALLATION**

- A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.
- B. Automatic air vents may cause damage to ceilings and other finished surfaces. Air vents aid in system filling. Air removal after initial startup is accomplished by air separator or boiler diptube. Manual air vents may be a better solution.
- C. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Install manual vents at heat-transfer coils and elsewhere as required for air venting.
- D. Install piping from boiler air outlet, air separator, or air purger to expansion tank with a 2 percent upward slope toward tank.
- E. Install in-line air separators in pump suction. Install drain valve on air separators NPS 2 and larger.
- F. Install tangential air separator in pump suction. Install blowdown piping with full-port ball valve; extend full size to nearest floor drain.
- G. Install expansion tanks above the air separator. Install tank fitting in tank bottom and charge tank. Use manual vent for initial fill to establish proper water level in tank.
  - 1. Install tank fittings that are shipped loose.
  - 2. Support tank from floor or structure above with sufficient strength to carry weight of tank, piping connections, fittings, plus tank full of water. Do not overload building components and structural members.
- H. Install expansion tanks on the floor. Vent and purge air from hydronic system, and ensure that tank is properly charged with air to suit system Project requirements.
- I. Install buffer tanks on the floor per manufacturer's instructions.

**END OF SECTION**

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## SECTION 23 3001

### COMMON DUCT REQUIREMENTS

#### PART 1 - GENERAL

##### 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 0500: Common Work Results for HVAC
3. Section 23 0593: 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 hangers per SMACNA requirements.
  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 3113

### 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 and flat-oval ducts and fittings.
4. Double-wall round and flat-oval ducts and fittings.
5. Exhaust Air Stacks
6. Guy wires and connectors.
7. Sheet metal materials.
8. Duct liner.
9. Sealants and gaskets.
10. Hangers and supports.

- B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 233119 "HVAC Casings" for factory- and field-fabricated casings for mechanical equipment.
3. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.
4. Section 230713 "Duct Insulation" for duct insulation and fire wrap.

##### 1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.
- B. 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 230548 "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, seismic restraints, and vibration isolation.

13. 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. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

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 AND FLAT-OVAL 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. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).
- D. 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.
- E. Longitudinal Seams: Not allowed.
- F. 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 DOUBLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

- A. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension) of 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," Chapter 3, "Round, Oval, and Flexible Duct," based on static-pressure class unless otherwise indicated.
  - 1. 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."
    - a. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
  - 2. Longitudinal Seams: Not allowed.
  - 3. 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."
- D. Inner Duct: Minimum 0.028-inch solid sheet steel.
  - 1. Perforated inner ducts exposed to air movement shall not be used in supply air ducts upstream of the following rooms: Operating rooms, trauma rooms, LDR rooms, NICU nurseries, ICU nurseries, positive pressure isolation rooms, cath labs, bone marrow, triage rooms, angiogram rooms, fluoroscopy rooms, linear accelerators, decontamination areas and any invasive procedure rooms where the duct insulation could be a source of contamination.
  - 2. Inner duct shall be solid sheet steel a minimum of 10 feet downstream of humidifiers and/or air washers.
- E. 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.
- F. 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.

## 2.5 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: [Four] <Insert number> [stainless steel]
    - 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. [Three].
  - 4. Angle Iron: Two galvanized steel, 2 by 2 by 0.25 inch. [Three].

## 2.6 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. 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.
- 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.

## 2.7 DUCT LINER

- A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. CertainTeed Corporation; Insulation Group.
    - b. Johns Manville.
    - c. Knauf Insulation.
    - d. Owens Corning.
  - 2. Maximum Thermal Conductivity:
    - a. Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
    - b. Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
  - 3. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
  - 4. Water-Based Liner Adhesive:
    - a. Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
    - b. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
    - 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."



- B. 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."
- C. 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.
- D. 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.

## 2.8 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.

## 2.9 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 and flat-oval ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.
- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 2 inch, plus allowance for insulation thickness.
- I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
- K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.

- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines".
- M. Where ducts pass through sound-rated walls, fill the opening between the partition and duct with insulation and seal the opening.

### 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. [20 feet]
- 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 2012 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 230713 "Duct Insulation".
- F. Provide approved fire-wrap insulation that meets ASTM C 656.

### 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 inchesthick.
  - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inchesthick.
  - 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 230548 "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 233300 "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

### 3.8 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 099113 "Exterior Painting" and Section 099123 "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. Ducts with a Pressure Class Higher Than 3-Inch wg: Test representative duct sections, selected by Architect from sections installed, totaling no less than 25 percent of total installed duct area for each designated pressure class.
    - b. 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.
    - c. 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.

- d. 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.
  - e. 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. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
    - a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.
  3. 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 233300 "Air Duct Accessories" for access panels and doors.
  2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
  3. Remove and reinstall ceiling to gain access during the cleaning process.
- C. Particulate Collection and Odor Control:
  1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.



2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

### 3.11 START UP

- A. Air Balance: Comply with requirements in Section 230593 "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. BSL-3 Ducts:

1. Supply and exhaust ducts serving BSL-3 areas :
    - a. Type 304 .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: Welded seams, joints, and penetrations.
    - d. SMACNA Leakage Class: 2.
    - e. Supply ducts outside of BSL-3 area shall transition to galvanized.
- D. MRI Ducts:
1. All ducts Connected to and serving MRI Areas:
    - a. All ductwork shall be aluminum with non-ferrous hardware and accessories.
    - 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. 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. SMACNA Leakage Class for Rectangular: 16.
    - d. SMACNA Leakage Class for Round and Flat Oval: 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 and Flat Oval: 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 and Flat Oval: 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 and Flat Oval: 2.

F. 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 and Flat Oval: 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 and Flat Oval: 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 and Flat Oval: 4.

G. 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 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 and Flat Oval: 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 and Flat Oval: 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.
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. Pressure Class: Positive or negative 3-inch wg.
  - c. Concealed: No. 2D finish.
  - d. Welded seams and flanged joints with watertight EPDM gaskets.
  - e. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations, flanged joints class A.
  - f. SMACNA Leakage Class: 2.
7. 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 Cage Wash Areas:

- 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: Welded seams, joints, and penetrations.
  - d. SMACNA Leakage Class: 2.
9. 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.
10. 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 and Flat Oval: 2
- H. 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 and Flat Oval: 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 and Flat Oval: 4.

I. 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.

J. Duct Liner Restrictions:

- 1. Duct liner exposed to air movement shall not be used in supply air ducts serving the following rooms: Operating rooms, trauma rooms, LDR rooms, NICU nurseries, ICU nurseries, positive pressure isolation rooms, cath labs, bone marrow, triage rooms, angiogram rooms, fluoroscopy rooms, linear accelerators, decontamination areas and any invasive procedure rooms where the duct insulation could be a source of contamination.
- 2. Duct Liner exposed to air movement shall not be used on medium pressure ductwork (2000 to 4000 FPM velocity). See section 230713 "Duct Insulation" for insulation requirements.
- 3. Duct Liner exposed to air movement shall not be used on high pressure ductwork (Greater than 4000 FPM velocity). See section 230713 "Duct Insulation" for insulation requirements.
- 4. All duct liner shall meet all of the requirements found in 2012 IECC

K. Liner:

- 1. Low Pressure Supply Air Ducts (Less than 2000 FPM velocity): Fibrous glass, Type I, 1-1/2 inch thick with a minimum R value of 6.0.
- 2. Return Air Ducts: Fibrous glass, Type I, 1-1/2 inch thick with a minimum R value of 6.0.
- 3. Exhaust Air Ducts: Fibrous glass, Type I, 1-1/2 inch thick with a minimum R value of 6.0.
- 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 [or flexible elastomeric], 1-1/2 inch thick with a minimum R value of 6.0.

L. 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.

M. 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.

N. 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.

O. 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 and Flat Oval:

- 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 3300

### 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 security bars.
16. Duct accessory hardware.
17. High efficiency take-offs.

- B. Related Requirements:

1. Division 23 "HVAC Gravity Ventilators" for roof-mounted ventilator caps.
2. Division 23 "Diffusers, Registers and Grilles".
3. Division 28 "Digital, Addressable Fire-Alarm System" for duct-mounted fire and smoke detectors.
4. Division 28 "Zoned (DC-Loop) Fire-Alarm System" for duct-mounted fire and smoke detectors.

##### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.

- B. LEED Submittals:
  - 1. Product Data for Prerequisite IEQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
  - 2. Product Data for Prerequisite EA 2: Documentation indicating that duct insulation R-values comply with tables in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air Conditioning."
- C. 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.
- 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.
- 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. Standard, Aluminum, 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, 0.10-inch- thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts.
  5. Blades:
    - a. Multiple or single blade.
    - b. Parallel- or opposed-blade design.
    - c. Stiffen damper blades for stability.
    - d. Roll-Formed Aluminum Blades: 0.10-inch- thick aluminum sheet.
    - e. Extruded-Aluminum Blades: 0.050-inch- thick extruded aluminum.
  6. Blade Axles: Nonferrous metal.
  7. 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.
  8. Tie Bars and Brackets: Aluminum.

C. 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.

D. Low-Leakage, Aluminum, 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. Nailor Industries Inc.
  - c. McGill AirFlow LLC.



- 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: Hat-shaped, 0.10-inch- thick, aluminum sheet channels; frames with 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. Roll-Formed Aluminum Blades: 0.10-inch- thick aluminum sheet.
    - d. Extruded-Aluminum Blades: 0.050-inch- thick extruded aluminum.
  7. Blade Axles: 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: Neoprene.
  10. Jamb Seals: Cambered aluminum.
  11. Tie Bars and Brackets: Aluminum.
  12. Accessories:
    - a. Include locking device to hold single-blade dampers in a fixed position without vibration.

E. 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.

F. 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.
- C. Frame: Galvanized sheet steel. With or without mounting flange as required.
1. Thickness:
    - a. Hat-shaped, 16GA-0.064-inch.
  2. Corners:
    - a. Welded.
- D. Blades: Horizontal, galvanized sheet steel.
1. Section;
    - a. Roll-formed.
  2. Fit:
    - a. Interlocking.
  3. Thickness:
    - a. 14GA-0.079-inch.
- E. Leakage:
1. Class II.
- F. Seals:
1. Blade: Inflatable silicone fiberglass material to maintain smoke leakage rating to a minimum of 450 deg F.
- G. Rated pressure and velocity to exceed design airflow conditions.
- H. Mounting Sleeve: Factory-installed, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone caulking.
1. Minimum 17-inches long.
  2. Thickness:
    - a. 0.05-inch-.
- I. Damper Motors: Damper motors to be Belimo or approved equal. Honeywell motors are not allowed.
1. Action:
    - a. Two-position
  2. Mode: Fail close.
  3. Mounting: External.
- J. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
1. Electrical Connection: 115 V, single phase, 60 Hz .
- K. 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 caulking.
  - 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:
    - a. Two-position.

3. Voltage: to match fire alarm system (coordinate).
  4. Listed: UL, as part of damper assembly.
  5. Outdoor Motors and Motors in Outside-Air Intakes:
    - a. Gaskets: O-ring gaskets designed to make motors weatherproof.
    - b. Internal heaters: Equip to permit normal operation at minus 40 deg F .
- M. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
1. Electrical Connection: 115 V, single phase, 60 Hz.
- N. Accessories:
2. Auxiliary switches:
    - a. Signaling.
    - b. Position indication.
  3. Test Switch type:
    - a. Momentary test switch.
  4. Test Switch Mounting:
    - a. Damper.

## 2.11 DUCT SILENCERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Industrial Acoustics Company.
  2. Ruskin Company.
  3. SEMCO Incorporated.
  4. Vibro-Acoustics.
- B. General Requirements:
1. Factory fabricated.
  2. Fire-Performance Characteristics: Adhesives, sealants, packing materials, and accessory materials shall have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested according to ASTM E 84.
  3. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- C. Shape:
1. Rectangular straight with splitters or baffles.
  2. Round straight with center bodies or pods.
  3. Rectangular elbow with splitters or baffles.
  4. Round elbow with center bodies or pods.
  5. Rectangular transitional with splitters or baffles.
- D. Rectangular Silencer Outer Casing: Galvanized sheet steel.
1. ASTM A 653:
    - a. G60.
  2. Thickness:
    - a. 22GA-0.034 inch.

- E. Round Silencer Outer Casing: Galvanized sheet steel.
  - 1. ASTM A 653:
    - a. G60.
  - 2. Sheet Metal Thickness for Units up to 24 Inches in Diameter: 22GA-0.034 inch thick.
  - 3. Sheet Metal Thickness for Units 26 through 40 Inches in Diameter: 20GA-0.040 inch thick.
  - 4. Sheet Metal Thickness for Units 42 through 52 Inches in Diameter: 18GA-0.05 inch thick.
  - 5. Sheet Metal Thickness for Units 54 through 60 Inches in Diameter: 16GA-0.064 inch thick.
- F. Inner Casing and Baffles: Galvanized sheet metal with 1/8-inch- diameter perforations.
  - 1. ASTM A 653:
    - a. G60.
  - 2. Thickness:
    - a. 22GA-0.034 inch.
- G. Special Construction:
  - 1. Suitable for outdoor use.
  - 2. High transmission loss to achieve STC 45.
- H. Connection Sizes: Match connecting ductwork unless otherwise indicated.
- I. Principal Sound-Absorbing Mechanism:
  - 1. Controlled impedance membranes and broadly tuned resonators without absorptive media.
  - 2. Dissipative or Film-lined type with fill material:
    - a. Fill Material: Inert and vermin-proof fibrous material, packed under not less than 15 percent compression
    - b. Erosion Barrier: Polymer bag enclosing fill, and heat sealed before assembly.
    - c. Prohibited: Mineral wool will not be permitted as a substitute for glass fiber.
  - 3. Lining:
    - a. Material:
      - 1) Tedlar
    - b. Prohibited: Mesh, screen or corrugated perforated liner will not be acceptable as a substitute for the specified spacer.
- J. Fabricate silencers to form rigid units that will not pulsate, vibrate, rattle, or otherwise react to system pressure variations. Do not use mechanical fasteners for unit assemblies.
  - 1. Joints:
    - a. Lock formed and sealed.
  - 2. Suspended Units: Factory-installed suspension hooks or lugs attached to frame in quantities and spaced to prevent deflection or distortion.
  - 3. Reinforcement: Cross or trapeze angles for rigid suspension.
  - 4. Structural Criteria: The silencers shall not fail structurally when subjected to a differential air pressure of 8 inches water gage.
  - 5. Spot Welds: All spot welds shall be painted.
- K. Accessories:

1. Integral 1-1/2-hour fire damper with access door. Access door to be high transmission loss to match silencer.
2. Factory-installed end caps to prevent contamination during shipping.
3. Removable splitters.
4. Airflow measuring devices.

## 2.12 TURNING VANES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. METALAIRE, Inc.
  2. SEMCO Incorporated.
  3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
1. Fabricate single blade vanes to comply with SMACNA's "HVAC Duct Construction Standards-Metal and Flexible."
  2. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
- C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
- D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "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.

## 2.13 REMOTE DAMPER OPERATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Pottorff.
  2. Ruskin Company; Tomkins PLC.
- B. Cable Type:
1. Description: Cable system designed for remote manual damper adjustment.
  2. Tubing/Sheathing: Galvanized, Brass, Copper or Aluminum.
  3. Cable: Stainless steel or Steel.



4. Wall-Box Mounting: Coordinate with Architect.
5. Wall-Box Cover-Plate Material: Coordinate with Architect.

C. Activated Electric Type:

1. Description: Electrically activated zone control damper for remote adjustment. When an adjustment is needed the system is powered up.
2. Means: Factory mounted actuator factory wired to damper.
3. Portable 9 volt system. No field power requirement.
4. Mounting: Recessed Wall Box or Diffuser or Hand Held.
5. Wall-Box Cover Finish: Coordinate with Architect.
6. Wall-Box Porting: 1 to 6 ports or more.

2.14 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.
2. McGill AirFlow LLC.
3. Pottorff.
4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
5. Ruskin Company

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."

1. Door:

- a. Double wall, rectangular.
- b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
- ~~c. Vision panel.~~
- d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
- e. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.

3. Number of Hinges and Locks:

- a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
- b. Access Doors up to 18 Inches Square:
  - 1) Hinges:
    - a) Two hinges and two sash locks.
- c. Access Doors up to 24 by 48 Inches, provide outside and inside handles:
  - 1) Hinges:
    - a) Three hinges and two compression latches.
- d. Access Doors Larger Than 24 by 48 Inches, provide outside and inside handles:
  - 1) Hinges:
    - a) Continuous and two compression latches with outside and inside handles.

## 2.15 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.
- 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.

## 2.16 DUCT SECURITY BARS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Carnes.
  - 2. KEES, Inc.
  - 3. Lloyd Industries, Inc.
  - 4. Metal Form Manufacturing, Inc.
  - 5. Price Industries.
  - 6. Titus
  - 7. Krueger
- B. Description: Factory-fabricated and field-installed duct security bars.
- C. Configuration:
  - 1. Frame: 1-1/2 by 1-1/2 by 3/16 inch angle.
  - 2. Sleeve: 3/16-inch, continuously welded steel frames with 1-1/2-by-1-1/2-by-1/8- angle frame furnished loose for field welding on other end. To be poured in place or set with

concrete block or welded or bolted to wall, one side only. Duct connections on both sides.

3. Horizontal Bars: 3/4 inch steel.
4. Vertical Bars: 3/4 inch steel
5. Bar Spacing: 6 inches.
6. Mounting: Ductwork or other framing.

- D. Finish:
1. White

## 2.17 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.

## 2.18 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.

## 2.19 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.
- E. Zeros VOC's

## 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 duct security bars. Construct duct security bars from 3/16-inch steel sleeve, continuously welded at all joints and 3/4-inch- diameter steel bars, 6 inches o.c. in each direction in center of sleeve. Weld each bar to steel sleeve and each crossing bar. Weld 1-1/2-by-1-1/2-by-1/8- steel angle to 4 sides and both ends of sleeve. Connect duct security bars to ducts with flexible connections. Provide 12-by-12-inch hinged access panel with cam lock in duct in each side of sleeve.
- E. 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

- F. Install flexible connectors to connect ducts to equipment.
- G. 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.
- H. Where flexible duct is indicated, use insulated flexible duct for supply air return and exhaust air.
- I. Flexible ductwork shall be run in straight lengths.
- J. Provide support in flexible duct every three feet.
- K. Flexible ducts shall have compression fittings on both ends.
- L. 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.
- M. Flexible ducts shall connect to trunk duct with high efficiency takeoffs.
- N. Connect flexible ducts to metal ducts with draw bands.
- O. Connect ducts to duct silencers:
  - 1. With flexible duct connectors.
- P. Connect terminal units to supply ducts:
  - 1. With maximum 12-inch lengths of flexible duct.
- Q. Do not use flexible ducts to change directions.
- R. 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

- S. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- T. Install pressure relief damper immediately upstream of main fire damper.

#### Volume Damper

- U. 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.
- V. Set dampers to fully open position before testing, adjusting, and balancing. Exception: Pressure relief damper.
- W. A balance damper with locking quadrant will be provided downstream of take-off from trunk duct.

### Fans And Test Holes

- X. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- Y. 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.
- Z. Install duct test holes where required for testing and balancing purposes.
- AA. Install test holes at fan inlets and outlets and elsewhere as indicated.

### FIRE, SMOKE AND FIRE-SMOKE DAMPERS

- BB. Install fire and smoke dampers according to UL listing.
  - 1. Install fusible links in fire dampers.
- CC. For round ductwork 24-inch and smaller a true round fire damper with the same rating may be used.

### Access Doors

- DD. 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.
  - 12. On upstream side of duct reheat coils. (between Phoenix valve and reheat coil)
- EE. Install access doors with swing against duct static pressure.
- FF. 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.

- GG. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

### 3.2 FIELD QUALITY CONTROL

#### A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.
5. Operate remote damper operators to verify full range of movement of operator and damper.

### 3.3 ADJUSTING

- A. Adjust duct accessories for proper settings.
- B. Adjust fire and smoke dampers for proper action.
- C. Final positioning of manual-volume dampers is specified in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

**END OF SECTION**

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## SECTION 23 3713

### 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 233714 "Fixed Louvers" for fixed and louvers and wall vents, whether or not they are connected to ducts.
  - 2. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.
  - 3. Section 230594 "General Testing, Adjusting and Balancing" for balancing diffusers, registers, and grilles.

##### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated, include the following:
  - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
  - 2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

##### 1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
  - 1. Ceiling suspension assembly members.
  - 2. Method of attaching hangers to building structure.
  - 3. Size and location of initial access modules for acoustical tile.
  - 4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
  - 5. Duct access panels.
- B. Source quality-control reports.

## 1.5 QUALITY ASSURANCE

- A. Product Options: Drawings and schedules indicate specific requirements of diffusers, registers, and grilles and are based on the specific requirements of the systems indicated.
- B. NFPA Compliance: Install diffusers, registers, and grilles according to NFPA 90A, "Standard for the Installation of Air-Conditioning and Ventilating Systems."
- C. Airborne Noise:
  - 1. Comply with ANSI / AHRI 880 - Performance Rating of Air Terminals

## 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.

### 2.2 REGISTERS, GRILLES, & DIFFUSERS

- A. General: The frames for all registers, grilles, and diffusers shall match type of ceiling where they are to be installed. Special frames shall be provided for narrow T-bar ceilings. Refer to reflected ceiling plan and other specification divisions for ceiling type. See drawings AND schedules for additional information.

### 2.3 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb, according to manufacturer's written instructions, coordination drawings, original design, and referenced standards.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

### 3.3 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

### 3.4 CLEANING

- A. After installation of diffusers, registers, and grilles, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace diffusers, registers, and grilles that have damaged finishes.

**END OF SECTION**

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## SECTION 23 3714

### FIXED LOUVERS

#### 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. Fixed, extruded-aluminum louvers.
- B. Related Requirements:
  - 1. Section 09 9113 "Exterior Painting" for field painting louvers.

##### 1.3 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
- B. Horizontal Louver: Louver with horizontal blades (i.e., the axes of the blades are horizontal).
- C. Vertical Louver: Louver with vertical blades (i.e., the axes of the blades are vertical).
- D. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

##### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
- B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
  - 1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.
  - 2. Show mullion profiles and locations.
- C. Samples: For each type of metal finish required.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.

## 1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

## 1.7 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

## **PART 2 - PRODUCTS**

### 2.1 MANUFACTURERS

- A. Source Limitations: Obtain louvers from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Louvers, including attachments to other construction, shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
  - 1. Design Spectral Response Acceleration at Short Periods: Per the structural drawings and specifications.
  - 2. Component Importance Factor: 1.5.
- B. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.
- C. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

### 2.3 FIXED, EXTRUDED-ALUMINUM LOUVERS

- A. Horizontal, Drainable-Blade Louver :
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Airolite Company, LLC (The).
    - b. Pottorff.

- c. Ruskin Company; Tomkins PLC.
- 2. Louver Performance Ratings:
  - a. Free Area: Not less than 8.5 sq. ft. for 48-inch- wide by 48-inch- high louver.
  - b. Point of Beginning Water Penetration: Not less than 1250 fpm.
  - c. Air Performance – intake: Not more than 0.10-inch wg static pressure drop at 900-fpm free-area velocity.
  - d. Air Performance – exhaust: Not more than 0.15-inch wg static pressure drop at 1000-fpm free-area velocity.
- 3. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

## 2.4 LOUVER SCREENS

- A. General: Provide screen at each exterior louver.
  - 1. Screen Location for Fixed Louvers: Interior face.
  - 2. Screening Type: Bird screening.
- B. Secure screen frames to louver frames with machine screws with heads finished to match louver, spaced a maximum of 6 inches from each corner and at 12 inches o.c.
- C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.
  - 1. Metal: Same type and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.
  - 2. Finish: Same finish as louver frames to which louver screens are attached.
  - 3. Type: Rewirable frames with a driven spline or insert.
- D. Louver Screening for Aluminum Louvers:

## 2.5 MATERIALS

- A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5, T-52, or T6.
- B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Fasteners: Use types and sizes to suit unit installation conditions.
  - 1. Contractor shall use Phillips flat-head or hex-head or Phillips pan-head screws for exposed fasteners unless otherwise indicated.
  - 2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
  - 3. For color-finished louvers, use fasteners with heads that match color of louvers.
- D. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed for masonry, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

## 2.6 FABRICATION

- A. Factory assemble louvers to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.
- C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
  - 1. Frame Type: Channel unless otherwise indicated.
- D. Include supports, anchorages, and accessories required for complete assembly.
- E. Join frame members to each other and to fixed louver blades with fillet welds concealed from view unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

## 2.7 ALUMINUM FINISHES

- A. Finish louvers after assembly.
- B. Color Anodic Finish: AAMA 611, or thicker.
  - 1. Color: As selected by Architect from full range of industry colors and color densities.
- C. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
  - 1. Color and Gloss: As selected by Architect from manufacturer's full range.

## **PART 3 - EXECUTION**

### 3.1 EXAMINATION

- A. Examine substrates and openings, with Installer present, 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 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.



### 3.3 INSTALLATION

- A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weather-tight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Protect unpainted galvanized and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.
- F. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weather-tight louver joints are required. Comply with Section 079200 "Joint Sealants" for sealants applied during louver installation.

### 3.4 ADJUSTING AND CLEANING

- A. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.
- B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- C. Restore louvers damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
  - 1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

**END OF SECTION**

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## **DIVISION 26 - ELECTRICAL**

Section 26 0519	Low-Voltage Electrical Power Conductors and Cables
Section 26 0526	Grounding and Bonding for Electrical Systems
Section 26 0529	Hangers and Supports for Electrical Systems
Section 26 0533	Raceways and Boxes for Electrical Systems
Section 26 0544	Sleeves and Sleeve Seals for Electrical Raceways and Cabling
Section 26 0548	Seismic Controls for Electrical Systems
Section 26 0553	Identification for Electrical Systems
Section 26 0923	Lighting Control Devices
Section 26 2726	Wiring Devices
Section 26 5119	LED Interior Lighting

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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.

### 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).
  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.

## 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.

## 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 or stranded 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.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- 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. **Specification Writer's Comment – Installation of more than 3 circuits in a homerun conduit, as a Value Engineering possibility, has been discussed with the Design-Assist Electrical Contractor but has not yet been approved.**
- 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.

### 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.

### 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.

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## SECTION 26 05 26

### GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. Section includes grounding and bonding systems and equipment.
- B. Section includes grounding and bonding systems and equipment, plus the following special applications:
  - 1. Installation and Bonding of Grounding Electrodes including:
    - a. Metal Underground Water Pipe
    - b. Metal Frame of the Structure
    - c. Concrete-Encased Electrodes including UFER Grounds
    - d. Ground Ring
    - e. Rod Electrodes
  - 2. Ground bonding common with lightning protection system.
  - 3. Foundation steel electrodes.
  - 4. Electrical Room Ground Bus.
- C. Installation and bonding of grounding electrodes including bonding of the metal frame of the structure, concrete-encased electrodes including UFER grounds, ground ring and rod electrodes is provided under previous bid package 3.01.

##### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

##### 1.4 INFORMATIONAL SUBMITTALS

- A. As-Built Data: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:
  - 1. Test wells.
  - 2. Grounding Electrodes
  - 3. Bonding Jumpers
  - 4. Electrical Room Grounding Bus.
  - 5. TEC and TDR Grounding Bus.
- B. Field quality-control reports.

## 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.
  - 1. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:
    - a. Instructions for periodic testing and inspection of grounding features at test wells based on NFPA 70B.
      - 1) Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
      - 2) Include recommended testing intervals.

## 1.6 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

## PART 2 - PRODUCTS

### 2.1 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

### 2.2 CONDUCTORS

- A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
  - 1. Stranded Conductors: ASTM B 8.
  - 2. Tinned Conductors: ASTM B 33.
  - 3. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
- C. Electrical Room Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches (6.3 by 100 mm) in cross section, with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V. Length as required for all specified terminations plus 25% spare but not less than 20 inches.
- D. TEC and TDR Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches (6.3 by 100 mm) in cross section, with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V. Length as required for all specified terminations plus 25% spare but not less than 12 inches.

## 2.3 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

## 2.4 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet (19 mm by 3 m).

## PART 3 - EXECUTION

### 3.1 APPLICATIONS

- A. Conductors: Install stranded conductors unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 4/0 AWG minimum.
  - 1. Bury at least 18 inches (600 mm) below grade.
- C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- D. Grounding Bus: Install in Normal Power Electrical Room, Essential Power Electrical Room, TEC and all TDR. Install bus horizontally, on insulated spacers 2 inches (50 mm) minimum from wall, 96 inches (2400 mm) above finished floor unless otherwise indicated.
- E. Conductor Terminations and Connections:
  - 1. Pipe Terminations: Bolted connectors.
  - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
  - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
  - 4. Connections to Structural Steel: Welded connectors.

### 3.2 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with IEEE C2 grounding requirements.
- B. Pad-Mounted Transformers and Switches: Install tinned-copper conductor not less than No. 4/0 AWG from equipment grounding terminals to ground ring. Bury ground ring not less 18 inches below finished grade.

### 3.3 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
  - 1. Feeders and branch circuits.
  - 2. Lighting circuits.
  - 3. Receptacle circuits.
  - 4. Single-phase motor and appliance branch circuits.
  - 5. Three-phase motor and appliance branch circuits.
  - 6. Flexible raceway runs.
  - 7. Armored and metal-clad cable runs.
  - 8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
  - 9. X-Ray Equipment Circuits: Install insulated equipment grounding conductor in circuits supplying x-ray equipment.
- C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.
- F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.
- G. Metallic Fences: Comply with requirements of IEEE C2.
  - 1. Grounding Conductor: Bare, tinned copper, not less than No. 8 AWG.
  - 2. Gates: Shall be bonded to the grounding conductor with a flexible bonding jumper.

### 3.4 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service



grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

- C. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade unless otherwise indicated.
  - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
- D. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are shall be at least 12 inches (300 mm) deep, with cover.
  - 1. Test Wells: Install one test well at the ground rod location indicated on the drawings.
- E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through concrete footings.
  - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
  - 2. Use exothermic-welded connectors; if a disconnect-type connection is required, use a bolted clamp.
- F. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate interior and exterior columns at distances not more than 60 feet (18 m) apart.
  - 1.
- G. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod.
  - 1. Install tinned-copper conductor not less than No. 4/0 AWG for bond to ground ring and for taps to building steel.
  - 2. Bury ground ring not less than 24 inches (600 mm) from building's foundation.
- H. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; use a minimum of 20 feet (6 m) of bare copper conductor not smaller than No. 4/0 AWG.
  - 1. If concrete foundation is less than 20 feet (6 m) long, coil excess conductor within base of foundation.
  - 2. Bond grounding conductor to reinforcing steel in at least four locations in mat footing and at four spread footing locations evenly distributed throughout building. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.
- I. Grounding and Bonding for Piping:
  - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
  - 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
  - 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

### 3.5 FIELD QUALITY CONTROL

- A. Tests and Inspections:
1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
  2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
  3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding conductor, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.
    - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    - b. Perform tests by fall-of-potential method according to IEEE 81.
  4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
- B. Grounding system will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.
- D. Report measured ground resistances that exceed 3 ohms.
- E. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION

## 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 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. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
  - 1. To Wood: Fasten with lag screws or through bolts.
  - 2. To New Concrete: Bolt to concrete inserts.
  - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  - 4. To Existing Concrete: Expansion anchor fasteners.
  - 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
  - 6. To Steel: 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.
- E. 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

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## 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. GRC: Galvanized rigid steel conduit.
- C. IMC: Intermediate metal 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. LFNC: Comply with UL 1660.
- D. Continuous HDPE: Comply with UL 651B.
- E. RTRC: Comply with UL 1684A and NEMA TC 14.
- F. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
- G. Fittings for LFNC: Comply with UL 514B.
- H. 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).
- I. 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 27 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.
  - 11.
- 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 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 engineer.
- C. Welding certificates.
- D. Field quality-control reports.

#### **1.5 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.

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## 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.
  - 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. 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.
- B. 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
- C. 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.
- D. Install instructional sign, including the color code for grounded and ungrounded conductors using adhesive-film-type labels.
  - E. 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.
  - F. Control-Circuit Conductor Termination Identification: For identification at terminations, provide self-adhesive vinyl labels with the conductor designation.
  - G. Conductors To Be Extended in the Future: Attach write-on tags to conductors and list source.
  - H. 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.
  - I. 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.
  - J. 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.
  - K. 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.
- L. 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.
- M. 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.
- N. 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.
- O. 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.



## 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 the sensor or the local switch is/are marked "VS" 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.
  - 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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**GSECTION 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. Isolated-ground receptacles.
  - 5. Hospital-grade receptacles.
  - 6. Tamper-resistant receptacles.
  - 7. Weather-resistant receptacles.
  - 8. Snap switches and wall-box dimmers.
  - 9. Floor service outlets (floor boxes) and poke-through assemblies.
  - 10. Pendant Cord Connector Devices (Drop Cords).
  - 11. 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. Isolated-Ground, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
  - 1. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent



electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

- C. 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.
- 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 and Food Service Kitchen: 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 Unfinished Spaces: Galvanized steel.
  5. 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
FB4	Flush, Dual Service, one piece finish flange. Four gang capacity. One .75” conduit for power and one 2”	Legrand EFG45S Hubbell

	conduit for data cabling. See plans for circuits and data drops. Finish selected by architect.	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	Legrand 4AT Evolution Hubbell S1R4PT

	circuits and data drops. Receptacles shall be NEMA 5-20R, Finish selected by architect.	
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

## 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.
  10. All 120 volt receptacles to be hospital grand tamper resistant.
- 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 260553 "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).
- D. Wiring device will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

END OF SECTION





## 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. Samples: For each luminaire and for each color and texture with standard factory-applied finish.
- E. Samples for Initial Selection: For each type of luminaire with custom factory-applied finishes.
1. Include Samples of luminaires and accessories involving color and finish selection.
- F. Samples for Verification: For each type of luminaire.
1. Include Samples of luminaires and accessories to verify finish selection.
- G. 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. Globes and Guards: One for every 20 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

## DIVISION 27 - COMMUNICATIONS

Section 27 0000	Common General Conditions for Communications
Section 27 0100	Operation and Maintenance of Communication Systems
Section 27 0113	Warranty Product and Systems
Section 27 0119	Field Testing and Reporting
Section 27 0133	Shop Drawings, Product Data, and Samples
Section 27 0143	Qualifications and Required Training for Contractors and Installers
Section 27 0171	Responsibility and Workmanship of Contractor
Section 27 0500	Common Work Results for Communications
Section 27 0526	Grounding and Bonding for Communications Systems
Section 27 0528	Pathways for Communications Systems
Section 27 0529	Hangers and Supports for Communication Systems
Section 27 0533	Conduits and Back Boxes for Communication Systems
Section 27 0536	Cable Trays for Communication Systems
Section 27 0543.46	Underground Ducts, Utility Poles, and Raceways for Inter-Building/Campus Cable Routing
Section 27 0553	Identification for Low-Voltage Cables and Labeling
Section 27 1100	Equipment Room Fittings
Section 27 1116	Cabinets, Racks, Frames, and Enclosures
Section 27 1119	Termination Blocks and Patch Panels
Section 27 1300	Backbone Cabling
Section 27 1500	Horizontal Cabling
Section 27 1513	Copper Cable
Section 27 1543	Faceplates and Connectors
Section 27 1619	Patch Cables
Section 27 5113	Overhead Paging
Section 27 5223	Nurse Call System
Section 27 5319	Internal Cellular, Paging and Antenna Systems
Section 27 6001	Appendix 01 – Deviation Request Process
Section 27 6002	Appendix 02 – Document Refresh Process
Section 27 6003	Appendix 03 – Data Center, TEC, TDR Part Numbers
Section 27 6004	Appendix 04 – Reference Standards
Section 27 6005	Appendix 05 – Definitions and Abbreviations
Section 27 6006	Appendix 06 – Material Suppliers
Section 27 6007	Appendix 07 – Siemon Certified Installation Firms
Section 27 6008	Appendix 08 – Lead Wall Penetrations

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## SECTION 27000

### GENERAL COMMON CONDITIONS FOR ALL COMMUNICATION SECTIONS

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, and other documents as designated, apply to this Document.
- B. See Division 7 and section 27 01 00 Part 3 for additional requirements.

##### 1.2 RELATED SECTIONS

- A. Specifications throughout all Divisions of the Project Manual are directly applicable to this section, and this section is directly applicable to them.
  - 1. All Division 27 Sections
  - 2. Requirements of the following Division 26 sections apply to this section
    - a. Basic electrical requirements
    - b. Basic electrical materials and methods
    - c. Grounding, earthing, and bonding
  - 3. Division 21 Fire Suppression
  - 4. Division 22 Plumbing
  - 5. Division 23 HVAC
  - 6. Division 28 Electronic Safety and Security

##### 1.3 SUMMARY

- A. The work on many processes in this section are not part of the Division 27 contract. The respective trades shall include their portions, and administration topics that are applicable to all Division 27 Sections in their proposals.
- B. This document is based upon the 2018 Construction Specification Institute (CSI) Master Format numbers and titles for sections within Division 27: Communications.
- C. Where IT or Owner representation is stipulated in this Division, it shall be provided by the Data Center Operations Infrastructure Cabling team.

##### 1.4 SUBMITTALS

- A. Product data shall be supplied for any parts/equipment that does not match the specified part number.
- B. Shop drawings
  - 1. Labeling schedules and layouts in owner designated electronic format
  - 2. Cabling administrative drawings

##### 1.5 CONDITIONS

- A. Drawings and General provisions of the contract, including Uniform General Conditions, Supplementary General Conditions, architectural plans and specifications, requirements of Division 1, electrical, mechanical, plumbing, audio visual, security and telecommunications specifications and plans apply to the communications section, and shall be consider a part of this section. The contractor shall read all sections in their entirety and apply them as appropriate for work in this section.
- B. Prior to beginning installation, a kick-off meeting to properly coordinate the tray installation and expectations should be held. It should be arranged by the General

Contractor, and at a minimum include representatives of the following trades: FP&D, Electrical (Div. 26), Structured cable, Nurse Call, paging, building automation and control, plumbing, HVAC, fire sprinkler, framing, and others as applicable. The Data Center Operations Infrastructure Cabling Team will lead the meeting.

C. Conflicts:

1. Drawings and specifications are to be used in conjunction with one another and to supplement one another. In general, the drawings determine the nature and quality of the installation, materials, and tests. The quantities are derived from the drawings, details, listings, and manufacturer's directions.
  - a. Final order counts and distances are the contractor's responsibility.
2. If there is an apparent conflict between the drawings and specifications, or between specification sections, the items with the greater quality or quantity shall be submitted, estimated, and installed.
3. Clarification with the Owner and/or Owner's Representative about these items shall be made prior to the ordering and installation.

D. Owner / Contractor

1. The Architect/Project Manager will submit appropriate scope of work information that will allow the contractor to appropriately plan and bid the project.

E. Contractor

1. Furnish all labor, materials, tools, equipment and services for the installation described herein. Provide add/deduct unit pricing for all components as part of the bid response. Base fixed price add/deduct units on an average cable length of 175 linear feet.
2. The Contractor shall procure and maintain for the duration of this agreement, insurance against claims.
3. Use of Subcontractors: Successful bidder shall inform the Owner's contact and/or General Contractor in writing about the intention to use Subcontractors and the scope of work for which they are being hired. The Owner or Owner's designated contact must approve the chosen Subcontractors in writing prior to the Subcontractor's hiring and start of any work. The low voltage Subcontractor must be approved and certified. Refer to the listing in appendix 7.
4. Use of Subcontractors: The Contractor's designated project manager will be recognized as the single point of contact. The Project manager shall oversee all work performed to ensure compliance with specifications as outlined in bid documents (which includes all specifications and drawings) to ensure a quality installation.

## 1.6 SCOPE OF WORK:

A. This establishes a communications infrastructure to be used as signal pathways for voice, high-speed data transmission, and other low voltage services. Contractor shall:

1. Comply with all Master Specifications documents and the following requirements for a complete project installation.
2. Provide a structured cabling system as described hereafter that includes, but is not limited to, supplying, installing, labeling and testing of fiber backbone, fiber and voice riser cable; data copper, fiber, and voice copper horizontal cabling, cable connectors, communications outlets and terminations, patch cables, and equipment racks/cabinets for networking hardware and patch panels.
3. All requirements and specifications will be enforced. Cable pathways and runs to individual outlets are not shown in their entirety but shall be provided as if shown in their entirety.
4. Coordinate with electrical tradespersons to verify conduit routing does not cause cabling to exceed allowable link length.
5. Follow industry standard installation procedures, including BICSI Installation Standard and guidelines as well as specified manufacturers standard recommended procedures and installation practices for communications cable to

assure that the mechanical and electrical transmission characteristics of this cable plant and equipment are maintained.

6. The Division 27 work shall be performed by an approved, certified installer.
7. The low voltage communications Subcontractor shall complete non-concealed work.

#### 1.7 REFERENCE STANDARDS:

- A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
- B. All reference amendments adopted prior to the effective date of the Contract shall be applicable to this Project.
- C. The publications listed below form a part of this specification. The publications are referred to in the text by basic designation only.
- D. Specific reference in specifications to codes, rules, regulations, standards, manufacturer's instructions, or requirements of regulatory agencies shall mean reference to the latest printed edition of each in effect at the date of contract.
- E. Codes and Standards (Most recent editions with addenda/TSB, etc.) All materials, installation and workmanship shall meet or exceed the applicable requirements and standards addressed within the references listed in **Appendix 04**.

#### 1.8 DEFINITIONS:

- A. Definitions and Abbreviations are listed in **Appendix 05**:

### PART 2 - PRODUCTS

#### 2.1 PRODUCTS AND WORK NOT included BY DIVISION 27

- A. Others shall separately purchase and/or provide certain equipment and miscellaneous items that will be installed during the installation process. Such items may not be indicated in the documents. Contractor shall coordinate with the Owner and his suppliers when considering:
  1. Provision and installation of phone systems, computer hardware, and related networking software and equipment.
  2. Provision and installation of multi-port routers, hubs in communications rooms.
    - a. TEC/TDR UPS's are owner provided.
  3. Communications grounding bus bars and grounding wires connecting to the main building electrode system by Division 26.
  4. Dedicated power panels, ground bus bars, circuits and utility outlets.
  5. Installation and finishing of fire-rated plywood backboards.
  6. Building mechanical ductwork, cooling/heating system, and environmental control sensors.
  7. Communication pathway devices such as, conduits, conduit sleeves, back boxes, and penetrations in walls and floors. Including, but not limited to concealed work, office spaces and open areas.
  8. Provision and installation of modular furniture and millwork.

### PART 3 - PENETRATIONS

#### 3.1 THE WORK IN THIS SECTION IS IN DIVISION 7 CONTRACT; AND VERIFIED COMPLETE AT PROJECT TURNOVER.

- A. Wall Penetrations - Fire - Smoke – Sound
  1. All fire, smoke, and sound wall penetrations must be correctly made to protect the safety of patients and employees. A facility is designed/architected and built with fire integrity that must not be lost as the building is modified over its lifetime.

2. The items listed often penetrate 1 – and 2 – hour fire-resistance-rated (FRR) assemblies. General requirements for filling the space between the item in question and the wall are found in NFPC 101® Section 8.2.3.2.4.2. There is the option to either fill the space with appropriately rated fire-stop material or protect the space with an approved device designed to maintain the fire resistance of the wall.
  3. If a sleeve is used around the item that transverses the wall, the sleeve must be installed into the wall without any opening between the sleeve and the wall. The open space within the sleeve must then be filled with appropriately rated fire stop.
- B. All items listed in 1 through 2 must have penetrations in fire-resistance-rated assemblies filled to maintain the integrity of the fire barrier.
1. Conduits
    - a. When conduit passes through a wall that is either rated or must be fire-stopped due to lack of sprinklers in the compartment, it is essential to fill any gap around the conduit as described above.
  2. Cables/Wires
    - a. Sometimes cables or wires are passed through a penetration contained in a fire wall as a single installation. This often happens in a health care organization with communication cables. Even in these cases, the penetration must be patched appropriately.
  3. NOTE: Fire, smoke, and sound wall penetrations are also governed by local and state building codes.
  4. NOTE: This requirement applies to all departments, organizations, employees, and/or vendors who perform structured cable work in the facilities for:
    - a. Telephony and Computer networks, fire, smoke, and sound wall penetrations, alarm systems, security systems, HVAC Control or sensors, patient entertainment systems, announcing systems, nurse call, telemetry, RFID, etc.
  5. NOTE: While this document is written specifically for low voltage wiring, the JCAHO standards apply for any fire or smoke wall penetration. As you perform work in the facility, if you note any existing penetrations that are not up to standard, please notify the construction Project Manager immediately.
  6. While Facility Engineering has the overall responsibility, each department, organization, employee, and/or vendor has the responsibility to follow the process in obtaining a permit from facility engineering before work is started and to follow the guidelines to maintain the fire/smoke wall integrity.
- C. Process:
1. NOTE: This process applies to any person, group, and/or vendor who perform low voltage cable installations at any Intermountain facility or clinic.
    - a. Fire/Smoke Walls
      - 1) Any Vendor, department, and/or person needing to do any cable work that involves wall penetrations, adding to existing or new, are required to obtain a “Low Voltage Cable Work Permit” from Facility Engineer.
    - b. Above Ceiling Work
      - 1) Any vendor, department, and/or person needing to do any cable work above ceiling tiles, adding to existing or new, are required to obtain all required permits.
    - c. Above Ceiling Permit to be obtained from Facilities Management
      - 1) The permit requires detail information as to what work is being done, where the work will be done. The permit will also state the current approved sealing compound for the facility and specific requirements for conduits etc.
      - 2) There may also be specific rules regarding how work may be conducted in certain areas of the hospital. NOTE: Different manufacture’s sealing products can NOT be used in the same penetration. Therefore, if an additional cable is added to an



existing penetration, and you don't have the same brand of caulk, you must remove all of the caulk and re-do the seal completely.

- d. ICRA Permit to be obtain from Infectious Preventionist
  - e. Hot Work Permit to be obtain from Facilities Engineer
2. Quality of Work
- a. Facility Engineering Orientation

### 3.2 MEASUREMENT PROCEDURES:

- A. The Contractor shall
- 1. Coordinate supports, adjacent construction, and fixture locations to ensure actual dimensions correspond to established dimensions.
  - 2. Verify dimensions in areas of installation by field measurements before fabrication and indicate measurements and scale on shop drawings.
  - 3. Coordinate fabrication schedule with construction progress to avoid delaying the work.
  - 4. Where field measurements cannot be made without delaying the work, establish dimensions and coordinate with the General Contractor.
  - 5. When approved, proceed with fabricating units without field measurements.

### 3.3 CHANGES

A. ALTERNATES:

- 1. If an alternate material is proposed that is equal to or exceeds specified requirements, Contractor shall provide manufacturers' specifications in writing for Owner approval prior to purchase and installation.
- 2. Substitutions of material by the Contractor shall be in writing complete with written manufacturers' specifications. The material substituted shall not void, alter or change manufacturers' structured cabling system warranty.
- 3. Contractor shall:
  - a. Provide a complete cabling infrastructure according to these written specifications and drawings. If the Owner changes the scope of work to be performed by the Contractor, it shall be in writing.
  - b. Promptly respond to these changes with a complete material list, including pricing, and labor in writing presented to the Owner for approval. Also include unit pricing.
  - c. Do not proceed with any additional scope of work without a signed approval by the Owner.
- 4. Owner will not pay for additional work performed by the Contractor without signed approval of these changes. Contractor will submit a copy of signed change order upon billing.
- 5. The Owner's Infrastructure Cable team will be the final judge of acceptability, with review by Owner's Representative and the distribution of the acceptance by the Architect. No substitute shall be ordered, installed or utilized without the

Architect's prior written verification of acceptance from the Owner's Infrastructure Cable team.

B. SUBSTITUTION PROCEDURES

- 1. Substitution may be considered when a product becomes unavailable through no fault of the Contractor.
- 2. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Include in each request for substitution:
  - a. Product identification, manufacturer's name and address.
  - b. Product Data: Description, performance and test data, reference standards, finishes and colors.
  - c. Samples: Finishes

- d. Complete and accurate drawings indicating construction revisions required (if any) to accommodate substitutions.
  - e. Data relating to changes required in construction schedule.
  - f. Cost comparison between specified and proposed substitution.
- 3. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.
  - 4. The Owner will be the final judge of acceptability, with review by Owner's Representative and the distribution of the acceptance by the Architect.
  - 5. No substitute shall be ordered, installed or utilized without the Architect's prior written verification of acceptance from the Owner's Infrastructure Cable team.

PART 4 - EXECUTION

4.1 QUALITY ASSURANCE

- A. Regulatory Requirements:
  - 1. Contractor shall supply all city, county, and state telecommunication cabling permits required by appropriate governing agency.
  - 2. Prior to commencing work, the Contractor and staff shall secure all required Intermountain Healthcare permits including, but not limited to; facility sign in, ceiling work permits, hot work permits, and confined space permits.
  - 3. Contractor shall be city, county, and state-licensed and/or bonded as required for communications/low voltage cabling systems work.
- B. Certifications:
  - 1. Contractor shall submit an up-to-date and valid certification verifying qualifications of the Contractor and installers to perform the work specified herein at time of bid submission.
  - 2. Contractor shall have a complete working knowledge of low voltage cabling applications such as, but not limited to data, voice and video network systems.
  - 3. Contracting firm shall have installed similar-sized systems in at least ten (10) other projects in the last five years prior to this bid and be regularly engaged in the business of installation of the types of systems specified in this document. Certification shall include, but not be limited to, items such as name and location of project contacts and numbers, total square footage, total number of cables/drops, types of media, etc.
  - 4. Contractor shall provide certificates for the appropriate insurance coverage as defined in contract documents.
  - 5. All installer personnel that will be assigned to this project shall be listed in a qualification document. 50% of the personnel working on the job site shall have a minimum of 3 years' experience in the installation of the types of systems, equipment, and cables specified in this document. Any personnel substitutions shall be noted in writing to Owner's Data Center Operations Infrastructure
    - Cabling representative prior to commencement of work.
  - 6. BICSI ITS Cabling Installation Program Installer Level 1 or 2 or Technician certifications may be substituted in lieu of the 3-year requirement. All cabling installers shall be trained and certified by the cable manufacturer for communication cabling installations and maintenance of said materials.
  - 7. Refer also to General Conditions.
- C. Administrative Requirements and Coordination:
  - 1. The Contractor shall:
    - a. Ensure that all technicians performing work have obtain badge access 48 hours prior to scheduled start.
    - b. Provide a specified contact person (name and contact number) for coordination to attend project meetings with the communication consultant, the Owner and others.
    - c. Coordinate work of this section with Owner's system specifications, workstations, equipment suppliers, and installers.

- d. Coordinate installation work with other crafts (examples include ceiling grid contractors, HVAC and sheet metal contractors, etc.) under the direction of the General Contractor to resolve procedures and installation placement for cable trays and cable bundle pathways. The goal of this coordination will be to establish priority pathways for critical data/voice network cable infrastructure, materials, associated hardware, as well as mitigate delays to the project and to allow service access for communications and HVAC components. Damage by Contractor to the craftwork of others will be remediated at the Contractor's expense in a timely manner.
  - e. Exchange information and agree on details of equipment arrangements and installation interfaces. Record agreements reached in meetings and distribute record to other participants, Owner and communication consultant.
  - f. Arrangement, layout, and locations of distribution frames, patch panels, and cross-connect blocks in equipment rooms and racks to accommodate and optimize arrangement and space requirements of any service provider equipment, telephone system, and LAN equipment as directed by Data Center Operations. Tasks shall be coordinated with the Owner's Data Center Operations team, and other trades' installation representatives.
  - g. Where installed, confirm exact locations and method of mounting outlets in modular furniture. Follow furniture manufacturers' written instructions for installing cable and devices in modular partitions. Obtain modular furniture and power pole locations from the General Contractor. Wiring locations noted in plans along walls for modular furniture are approximate and will have to be determined by Contractor at time of installation. Field condition adjustments for installation may have to be made and coordination efforts with the mechanical and electrical contractor for pathway must take place early in the project to comply with maximum 40% conduit fill factor requirements.
  - h. When requested by Owner or Owner's representative, furnish extra materials that match specified products and that are factory packaged with protective covering for storage and identified with labels describing contents. Unit pricing shall apply.
- D. Contract Administration:
- 1. Change orders shall be submitted to the Owner/Project Manager complete with price breakdown and description for approval before any work is done.
  - 2. Owner's Data Center Operations Representative will provide job field reports upon inspection of Contractor's installation, materials, supporting hardware, coordination with other trades and progress to schedule to the Owner's project manager.
  - 3. Job Field Report outline:
    - a. General installation progress in relation to scheduled work made by the Contractor up to that date.
    - b. All deficiencies noted in the cable installation to be corrected by the Contractor.
- E. Pre-Installation Meetings - Contractor shall:
- 1. Attend and/or arrange a scheduled pre-installation conference prior to beginning any work of this section.
    - a. Agenda: This venue is to ask and clarify questions in writing related to work to be performed, scheduling, coordination, etc. with consultant and/or project manager/and Data Center Operations Infrastructure Cabling representative.
    - b. Attendance: Communications project manager/supervisor shall attend meetings arranged by General Contractor, Owner's Data Center Operations Infrastructure Cabling representatives, and other parties affected by work of this document.

- c. All individuals who will be installers of communication cables and equipment in an on-site supervisory capacity shall be required to attend the pre-installation conference. Individuals who do not attend the conference will not be permitted to supervise the installation of, or install, terminate, or test communications cables on the project. This includes supervisors, project managers, and lead installers of this project.
- F. Request for Change (RFC)
  - 1. A Request for Change shall be opened and approved by the Change Approval Board prior to any modifications, attachments, or other activities that may affect production systems.
    - a. Policy and details available through the Data Center Operations Infrastructure Cable Representative.
- G. Post-Installation Meetings:
  - 1. Schedule Div. 27 Final Inspection
  - 2. At the time of substantial completion, or shortly thereafter, the low voltage Sub-Contractor shall call and arrange for a post-installation meeting to present and review all submittal documents to include, but not limited to as-built drawings, test reports, warranty documentation, etc. Attendees shall be Owner staff, Owner's Representative, General Contractor, and others that the General Contractor deems appropriate.
  - 3. At this meeting the Contractor shall present and explain all documentation, including test results, and ask for feedback on its completeness. Any discrepancies or deviations noted by and agreed to by participants shall be remedied by Contractor and resubmitted within one week of meeting.

#### 4.2 DELIVERY, STORAGE, AND HANDLING:

- A. Coordination with delivery companies, drivers, site address, and contact person(s) will be the responsibility of the Contractor.
- B. Contractor Shall:
  - 1. Be responsible for prompt material deliveries to meet contracted completion date.
  - 2. Coordinate deliveries and submittals with the General Contractor to ensure a timely installation.
  - 3. No equipment materials shall be delivered to the job site more than three weeks prior to the commencement of its installation.
  - 4. Equipment shall be delivered in original packages with labels intact and identification clearly marked.
  - 5. Materials shall not be damaged in any way and shall comply with manufacturer's operating specifications.
  - 6. Equipment and components shall be protected from the weather, humidity, temperature variations, dirt, dust, or other contaminants. Equipment damaged prior to system acceptance shall be replaced at no cost to the Owner.
  - 7. Material Contractor shall be responsible for all handling and control of equipment.
  - 8. Material Contractor is liable for any material loss due to delivery and storage problems.
- C. Owner/General Contractor shall supply a list of security requirements for Contractor to follow.

#### 4.3 PROJECT/SITE CONDITIONS

- A. For all environmental recommendations, refer to master Architectural section.
- B. For all security recommendations, refer to related Division 01.
- C. After completing system installation, including outlet fittings and devices, inspect exposed finish. Contractor will remove burrs, dirt, and construction debris. If applicable, the Contractor will repair damaged finishes, including chips, scratches, and abrasions.
- D. Contractor shall provide daily a clean work environment, free from trash/rubbish accumulated during and after cabling installation.

- E. Food and drink are not permitted in work areas. They shall be stored, prepared, and consumed only in designated break or cafeteria areas.
- F. Contractor shall keep all liquids (drinks, sodas, etc.) off finished floors, carpets, and tiles. If any liquid or other detriment (cuts, soils, stains, etc.) damages the above finishes, Contractor shall provide professional services to clean or repair scratched/soiled finishes, at Contractor's expense.

#### 4.4 CLEANING

- A. Work areas will be kept in a broom clean condition throughout the duration of the installation process.
- B. Remove all unnecessary tools and equipment, unused materials, packing materials, and debris from each area where work has been performed daily, unless designated for storage.
- C. The Contractor will damp clean all surfaces prior to final acceptance by Owner.

END OF SECTION

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## SECTION 270100

### OPERATION AND MAINTENANCE OF COMMUNICATIONS SYSTEMS

#### PART 1 - GENERAL

##### 1.1 INTRODUCTION

- A. To make the approval of such a large topic possible, the structured cable topic has been broken into its subcomponents and each subcomponent was completed, reviewed, and approved in turn. The result is this comprehensive guideline that should provide adequate guidance on this topic.

#### PART 2 - PRODUCT

##### 2.1 KEY POINTS

- A. Category 6A shielded foil over unshielded twisted pair (F/UTP) is the only approved standard for cabling.
  - 1. Specifically, Siemon category CAT6A F/UTP (foil over unshielded twisted pair) cable and associated patch panels, wall plates and jacks; for data centers, and all clinical and hospital campus'.
  - 2. Only Siemon certified contractors or certified Intermountain Healthcare cable technicians will install structured cable at Intermountain Healthcare facilities.

##### 2.2 IMPLEMENTATION

- A. This guide is to be used for New Construction and Remodels. These standards will be implemented over time in existing cabling environments as rework is performed.
- B. If there is a current need to connect servers at 10GBaseT and the only option is copper, CAT6A F/UTP is required. New Server connections shall be a minimum OS1 Single Mode Fiber.
- C. Installations already in place are not required to remove or replace existing cabling CAT5e or newer. All new cabling shall follow the recommendation to use CAT6A F/UTP cabling.

##### 2.3 STANDARD PRODUCT

- A. The Approved cable type for horizontal cabling is CAT 6A F/UTP.
  - 1. The Approved Standard Manufacturer for Intermountain Healthcare's horizontal cabling is:
    - a. **Siemon Company USA**  
101 Siemon Company Drive  
Watertown, CT 06795
  - 2. Approved Suppliers of Siemon cable, patch panels, jacks, and parts are listed in Appendix 06:

#### PART 3 - EXECUTION

##### 3.1 Horizontal Cabling

- A. Horizontal Subsystem is the portion of the cabling system that extends from (and includes) the work area telecommunications outlet/connector to the Floor Distributor (FD)/Horizontal Cross-connect (HC) in the telecommunications room (TDR). It consists of the communications outlet/connector, the horizontal cable, optional consolidation point, and that portion of the cross-connect in the telecommunications room serving the

horizontal cable. Each floor of a building should be served by its own Floor Distributor/Horizontal (FD/HC) Subsystem located in the telecommunications Room (TDR).

1. NOTE: Cable installers have rigorous requirements to be certified for Siemon cables and products. Validation of certification is required prior to accepting a bid.
  2. Current Siemon Approved/Certified Cable Installers for Siemon Network are listed in Appendix 07.
- B. Reliability of the horizontal cabling system is critical to the operation of IS equipment throughout a facility. Installing the cable is extremely labor intensive and there are several learned skills used to correctly install the cable. Cable installers are certified, and installers must demonstrate the ability to install the cable correctly to be certified. If the cable is installed by a certified installer and is installed in accordance with the manufacturer's guidelines, the manufacturer will warranty the cable installation.
- C. The manufacturer also requires the cables to be individually labeled and 100% tested and certified. Cable testing and certification equipment is usually expensive and is not commonly available at the facility or by many telecom installers. Certified Installer companies are required by the manufacturer to be knowledgeable in the use of "Qualified" Field Testing equipment and provide test results for warranty registration.
1. Contractor is to verify with the manufacturer the current "Qualified" tester manufacturers and the current operating software.
  2. Contractors will provide test results in the operating software format (not PDF, text or Word) to Intermountain Healthcare upon completion.
- D. Much of the cable is installed in walls and in the ceiling and usually lasts the lifespan of the building. As with most technology, the lifespan of cable is its usability and applicability to its use on future computing technology.

END OF SECTION



## SECTION 270113

### WARRANTY, PRODUCT AND SYSTEM

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them, including but not limited to the listing found in Section 27 00 00.

#### PART 2 - PRODUCTS

##### 2.1 STANDARD WARRANTY

- A. Contractor shall provide a minimum one (1) year warranty on installation and workmanship PLUS an Extended Product Warranty and System Assurance Warranty for this wiring system and shall commit to make available local support for the product and system during the Warranty period.
- B. System Certification: Upon successful completion of the installation and subsequent inspection, the customer shall be provided with a Manufacture Warranty certificate.
- C. Either a permanent link or channel model configuration may be applied to the horizontal and/or backbone sub-systems of the structured cabling system. Applications assurance is only applied to a channel model configuration. All channels are to be qualified for linear transmission performance up to 500 MHz to ensure that high-frequency voltage phase and magnitude contributions do not prove cumulative or adversely affect channel performance.

##### 2.2 EXTENDED WARRANTY

- A. The manufacturer of passive telecommunications equipment used in a manner not associated with the Systems Warranty must have a minimum five (5) year Component Warranty on all its product. The Products Warranty covers the components against defects in material or workmanship under normal and proper use.
  - 1. Special Project Warranty: A full end-to-end written warranty mutually executed by manufacturer and the principal Installer, agreeing to replace and install voice/data distribution system components that fail in materials or workmanship, or do not meet manufacturer's official published specifications and performance criteria within the special Project warranty period specified below. This shall cover applications assurance, cable, and connecting hardware including both labor and materials. This warranty shall be in addition to, and not a limitation of, other rights and remedies the Owner may have against the Contractor under the Contract Documents.
- B. A twenty (20) year warranty available for the Category 6A Z-MAX copper structured cabling system shall be provided for an end-to-end channel model installation which covers applications assurance, cable, connecting hardware and the labor cost for the repair or replacement thereof. The fiber warranty will be an XGLO twenty (20) year warranty, which is based on using laser optimized single mode fiber as minimum.
  - 1. Performance claims based on worst case testing and channel configurations.
  - 2. Special Project Warranty Period: 20 years minimum, beginning on the date of Substantial Completion.
  - 3. Siemon Certified Warranty Requirements:

- a. Upon Completion of the project, Intermountain Healthcare must receive the Full Warranty Documentation from The Siemon Company before final retention funds are released to the general contractor, electrical contractor and structured cabling subcontractor if applicable.

### **2.3 MAINTENANCE**

- A. Support Availability: The Contractor shall commit to make available local support for the product and system during the Warranty or Extended Warranty period.

END OF SECTION

## SECTION 270119

### FIELD TESTING AND REPORTING

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them, including but not limited to the listing found in Section 27 00 00.

##### 1.2 SYSTEM DESCRIPTION

- A. Owner reserves the right to be present during any or all testing.
- B. The objective of this project is to provide a complete communications cabling infrastructure system installation including, but not limited to: fiber backbone, riser system, horizontal data and voice cabling with associated terminations, mounting equipment, cable pathway and management systems, testing and other items/materials, as specified in drawings, these specifications, and contract documents.
- C. The Contractor's BICSI Registered Communications Distribution Designer (RCDD) supervisor shall review, approve and stamp all documents prior to submitting. The Contractor's RCDD shall warrant in writing that 100% of the installation meets the requirements specified herein upon completion of all work.
- D. Product Certificates shall be signed by manufacturers of cables, connectors, and terminal equipment certifying that products furnished comply with requirements.
- E. Contractor shall submit the required Field Test Reports in the format and media specified, upon completion of testing the installed system.
- F. Contractor shall deliver manufacturer's signed long-term Warranty of installed cabling system to include all components that comprise the complete cabling system. Delivery to be affected within two weeks of the time of final punch list review. Failure of any component to pass system component tests shall be promptly corrected, repaired or replaced to meet standards compliance.

##### 1.3 PREFERRED OWNER INSPECTION & TEST CHECKPOINTS

- A. DCO & ICT Inspection Milestones & Responsibilities need to be coordinated into master project plan to allow the GC to make timely arrangements. All are per floor and/or phase.
  - 1. ICT & DCO = Framing, during and/or after boxes & conduits are in place; prior to sheetrock.
  - 2. ICT = When cable basket is starting to be installed.
  - 3. ICT = When cable basket is ready, but prior to starting to pull cable.
  - 4. ICT & DCO = When TDR's are ready for racks and ladders.
  - 5. DCO = When anchoring racks and laying out equipment.
  - 6. ICT & DCO = When TDR environmental requirements are ready, room is dust free, and securable.
    - a. The TEC and TDRs must be high on the build timeline and be completed early in the construction to accommodate the building systems to be tested and commissioned, such as BAS, Security, and Wireless Network.
  - 7. ICT = When trim and testing are in progress.
  - 8. OTHERS
    - a. Depending on project, the manufacturer will inspect 1 or 2 times.
    - b. DCO or ICT = When problems or questions arise.

#### PART 2 - PRODUCTS

## 2.1 SITE TESTS & INSPECTIONS

- A. Prior to pulling cable, the cabling contractor shall schedule an inspection of the pathways with a member of the Data Center Operations Infrastructure cabling team.
- B. Upon completion of the communications infrastructure systems, including all pathways and grounding, the Contractor shall test the system.
  - 1. Cables and termination modules shall be affixed, mounted or installed to the designed/specified permanent location prior to testing.
  - 2. Any removal and reinstallation of any component in a circuit, including faceplates, shall require retesting of that circuit and any other disturbed or affected circuits.
  - 3. Approved instruments, apparatus, services, and qualified personnel shall be utilized.
  - 4. If tests fail, Contractor shall correct as required to produce a legitimate passing test.
  - 5. Manipulation of tester parameters on a failing test in order to achieve a passing test is unacceptable.
- C. These specifications will be strictly enforced. The Contractor must verify that the requirements of the specifications are fully met through testing with an approved tester (rated for testing the cable type in use), and documentation as specified below. This includes confirmation of requirements by demonstration, testing and inspection. Demonstration shall be provided at final walk-through in soft copy.
- D. Notification of the likelihood of a cable exceeding standardized lengths must be made prior to installation of the cable. Without contractor's prior written notice and written approval by the Owner, testing that shows some or all pairs of cable not meeting specifications, shall be replaced at Contractor's expense (including respective connectors).
- E. Testing is still required for non-compliant cabling. The tests shall be for wire-mapping, opens, cable-pair shorts, and shorts-to-ground. The test results must be within acceptable tolerances and shall be submitted with the Owner's acceptance document.

## 2.2 CABLE TESTING PLAN

- A. The Contractor shall:
  - 1. Provide a complete and detailed test plan for approval of the cabling system specified herein, including a complete list of test equipment for copper and fiber optic components and accessories prior to beginning cable testing. The following minimal items shall be submitted for review:
    - a. All testing methods that clearly describes procedures and methods.
    - b. Product data for test equipment
    - c. Certifications and qualifications of all persons conducting the testing.
    - d. Calibration certificates indicating that equipment calibration meets National Institute of Standards and Technology (NIST) standards and has been calibrated at least once in the previous year of the testing date.
  - 2. Include validation, and testing. Owner will require that the telecommunications cabling system installed by the Contractor be fully certified to meet all necessary requirements to be compliant with referenced IEEE and TIA specifications and vendor's warranty.
  - 3. Will determine the source/cause of test failure readings and correct malfunctioning component and/or workmanship within each channel or permanent link and retest to demonstrate compliance until corrected failure produces a passing result.

## 2.3 CABLE TESTING REPORTS

- A. The Contractor shall submit cable test reports as follows:
  - 1. Submit certified test reports of Contractor-performed tests.

- a. The tests shall clearly demonstrate that the media and its components fully comply with the requirements specified herein.
- b. (1) set of electronic test reports shall be submitted and clearly identified with cable identification.

### **PART 3 - EXECUTION**

#### **3.1 TEST EQUIPMENT**

- A. All transmission testing of balanced twisted-pair cables shall be performed with an approved Level III balance twisted pair tester found on the Siemon Ally Website. The latest version of software shall be installed prior to performing testing. Refer to the Siemon Warranty Documents for proper testing requirements of associated cable and components.
- B. All balanced twisted-pair field testers shall be factory calibrated each calendar year by the field test equipment manufacturer as stipulated by the manuals provided with the field test unit. The calibration certificate shall be provided for review prior to the start of testing
- C. Auto test settings provided in the field tester for testing the installed cabling shall be set to the default parameters
- D. Test settings selected from options provided in the field testers shall be compatible with the installed cable under test.

#### **3.2 TEST METHOD / CRITERIA**

- A. Copper Testing
  - 1. Testing of all newly installed cable channels shall be performed prior to system cutover.
    - a. Visually inspect F/UTP and optical fiber cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments and inspect cabling connections for compliance with TIA/EIA-568-C.1.
    - b. Visually confirm Category 6A marking of outlets, cover plates, outlet/connectors, and patch panels.
    - c. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
    - d. Test F/UTP copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
    - e. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-C, and those required by manufacturer to validate and start warranty.
  - 2. Copper Testing all 500 MHz category 6A field-testing shall be performed with an approved level 111e balanced twisted-pair field test device, that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex (Level IIe or IIIe balanced twisted pair field test device). Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
  - 3. All installed 500 MHz category 6A channels shall perform equal to or better than the minimum requirements as specified below:
    - a. Category 3, balanced twisted-pair backbone cables, for the channel shall be 100 percent tested according to ANSI/TIA/EIA-568-C.1. Test parameters include wire map plus F/UTP (ScTP) shield continuity (when present), insertion loss, length and NEXT loss (pair-to-pair). NEXT testing shall be done in both directions.
    - b. 500 MHZ Category 6A balanced twisted-pair horizontal and backbone cables, shall be 100 percent tested.

4. F/UTP Performance Tests
    - a. Wire map.
    - b. Length (physical vs. electrical, and length requirements)
    - c. Insertion loss
    - d. Near-end crosstalk (NEXT) loss
    - e. Power sum near-end crosstalk (PSNEXT) loss
    - f. Equal-level far-end crosstalk (ELFEXT)
    - g. Power sum equal-level far-end crosstalk (PSELFEXT)
    - h. Return loss
    - i. Propagation delay
    - j. Delay skew
    - k. F/UTP Shield continuity
  5. Final Verification Tests: Perform verification tests for F/UTP systems after the complete communications cabling and workstation outlet/connectors are installed.
  6. Document data for each measurement. Data for submittals shall be printed in a summary report.
  7. End-to-end cabling will be considered defective if it does not pass tests and inspections.
  8. Prepare and submit test and inspection reports.
- B. Horizontal Fiber Testing
1. Fiber horizontal cables shall be 100% tested for insertion loss and length.
  2. Insertion loss shall be tested at 850 nm or 1300 nm for 50/125 $\mu$ m and 62.5/125 $\mu$ m multimode cabling in at least one direction using the Method B (1-jumper) test procedure as specified in ANSI/TIA/EIA-526-14A.
  3. Length shall be tested using an OTDR, optical length test measurement device or sequential cable measurement markings.
  4. The horizontal link performance guarantees are based on an optical fiber calculation for the appropriate fiber solution. Optical fiber calculations shall be determined using the Siemon Fiber Loss Calculator found on the Siemon Ally Website.
- C. Backbone Fiber Testing
1. Fiber backbone cables shall be 100% tested for insertion loss.
  2. Insertion loss shall be tested at both 850 nm and 1300 nm for 50/125 $\mu$ m and 62.5/125 $\mu$ m multimode cabling and both 1310 nm and 1550 nm for 8.5/125 $\mu$ m single mode cabling and in at least one direction using the Method B (1-jumper) test procedure as specified in ANSI/TIA/EIA-526-14A.
  3. Insertion loss shall be tested at 1310 and 1550 for single-mode cabling in at least one direction using the Method A.1 (1-jumper) test procedure as specified in ANSI/TIA/EIA-526-7.
  4. Length shall be tested using an OTDR, optical length test measurement device or sequential cable measurement markings.
  5. The backbone link performance guarantees are based on an optical fiber calculation for the appropriate fiber solution. Optical fiber calculations for any fiber cable greater than 90m (295 ft.) shall be determined using the Siemon Fiber Loss Calculator found on the Siemon Ally Website.

### 3.3 DEMONSTRATION

- A. Include training for appropriate IT staff in numbering system and documentation system methods and record keeping. Proper fiber terminations and fiber jumper installations.

END OF SECTION

## SECTION 270133

### SHOP DRAWINGS, PRODUCT DATA, SAMPLES DESIGN RECORDS & EXISTING CONDITIONS

#### PART 1 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

##### 1.1 SUBMITTALS

- A. The Contractor:
  - 1. Shall not perform any portion of the work requiring submittal and review of shop drawings, product data, or samples until Owner has approved the respective submittal. Such work shall be in accordance with approved submittals.
    - a. Shop drawings as required by the owner or as a minimum to include a minimum of two sets of a plan view and elevations of all work to be installed. The Contractor shall make any corrections required by the owner or the owner's representative or consultant team, file with him two corrected copies and furnish such other copies as may be needed. The consultant's approval of such drawings or schedules shall not relieve the Contractor from responsibility for deviations from drawings or specifications, unless he has in writing and called to the Architect's attention such deviations at the time of submission, nor shall it relieve him from responsibility for errors of any sort in shop drawings or schedules.
- B. The Contractor shall provide a copy of the Certified Test Data Sheet, available from the delivering distribution warehouse for either a full run or cut piece from the Master Reel of the fiber cable to be installed
  - 1. The Certified Test Data Sheet shall include the Master Reel number, cable description, a passing test result with details, test equipment description, date certified, and a certificate of compliance stamp, and shall be included in the O&M Manual as a component of the final deliverables submittal package.

##### 1.2 DRAWINGS

- A. Shop Drawings
  - 1. The Contractor shall:
    - a. Submit catalogue cut sheets that include manufacturer, trade name, and complete model number for each product specified. Model number shall be handwritten, marked with an arrow or underlined to indicate exact selection.
    - b. Identify applicable specification section reference for each product performance for each component specified for approval prior to purchase and installation.
- B. Record Drawings
  - 1. Drawings for the cabling system infrastructure elements shall be maintained and kept on file by the Siemon Certified Installer (Company) for the entire term of the warranty. Drawings shall include:
    - a. Horizontal cable routing and terminations
    - b. Telecommunications outlets/connectors
    - c. Backbone cable routing and terminations
    - d. Telecommunication Spaces (TS)
- C. Samples
  - 1. For workstation outlet connectors, jack assemblies, housing and faceplates for color selection and evaluation of technical specifications and requirements. Confirm with Architect, interior designer, and Owner representative for color before purchasing materials. Face plates shall match the electrical face plates in Color and material type.
  - 2. Upon request, provide samples for workstation outlets, jacks, jack assemblies, in specified finish, one for each size and outlet configuration

3. Sample mock-up rooms may be required in some areas to ensure proper equipment placement and fit.
- D. Qualifications:
1. The Contractor shall provide the appropriate documentation to comply with the requirements set forth in Section 01 43 23 Qualifications, included with, and at the time of, bid submittal.

## **PART 2 - SUSTAINABLE DESIGN RECORDS AND REPORTS**

### **2.1 DRAWINGS**

- A. Closeout Submittals (As-built Drawings):
1. Communications Design drawings are to be supplied to the Architect to prepare the master "As-Built" drawings.
  2. As-Built drawings shall be in a format that is compatible with the format used by the Architect and consultant. Dimensions and scale of the drawing sheets submitted shall match the size of the drawing used for the contract documents and shall include the cable numbers labeled in accordance with this document.
  3. Utilize normal recognized drafting procedures that match standards, Architect and consultant guidelines and methodology.
  4. The As-Built drawings shall incorporate all changes made to the building identified in, but not limited to, addendum, change notices, site instructions or deviations resulting from site conditions.
- B. Contractor shall:
1. Clearly identify any resubmitted drawing sheets, documents or cut sheets either by using a color to highlight or cloud around resubmitted information.
  2. Maintain drawing numbering or page/sheet scheme consistency as per previously issued drawings/documents.
  3. Provide dimensioned plan and elevation views of networking components, showing:
    - a. All communications data/voice outlet locations complete with outlet/cable labeling.
    - b. Cable routing paths of communications cables to identified infrastructure pathways.
    - c. All rack and cabinet locations and labeling thereof.
    - d. One-line diagram of equipment/device interconnecting data/voice cabling of the data and voice systems.
    - e. Standard or typical installation details of installations unique to Owner's requirements.
    - f. Graphic symbols and component identification on detail drawing shall conform to the latest ANSI/TIA 568-C, ANSI/TIA 569-B, ANSI/TIA 606-A and ANSI/NECA/BICSI 607-A conventions.
  4. Submit one soft (compatible with Microsoft software) and hard copy with project deliverables within three weeks subsequent to substantial completion.
  5. Hard copy of floor plans for record shall be plotted to a standard, saleable, identified drawing scale.

### **2.2 RECORDS AND REPORTS**

- A. All records shall be created by the installation contractor and turned over at the completion of work.
1. The format shall be computer based
    - a. Soft copies and hard copies shall be part of the As-built package.
    - b. The minimum requirements include:
      - 1) Cable records must contain the identifier, cable type, termination positions at both ends, splice information as well as any damaged pairs/conductors.
      - 2) Connecting hardware and connecting hardware position records must contain the identifier, type, damaged position numbers, and



- references to the cable identifier attached to it.
2. Test documentation on all cable types shall be included as part of the As-built package.
- B. All Siemon Warranty Registration documents shall be included.
- C. All reports shall be generated from the computer-based program used to create the records above. These reports should include but not limited to:
1. Cable Reports
  2. Cross-connect Reports
  3. Connecting Hardware Reports

### **PART 3 - EXISTING CONDITIONS SITE SURVEY**

#### **3.1 SITE SURVEY**

- A. Prior to placing any cable pathways or cable, the contractor shall survey the site to determine job conditions will not impose any obstructions that would interfere with
- B. the safe and satisfactory placement of the cables. The arrangements to remove any obstructions with the Project Manager need to be determined at that time.

END OF SECTION

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## SECTION 270143

### QUALIFICATIONS AND REQUIRED TRAINING FOR CONTRACTORS AND INSTALLERS

#### PART 1 - GENERAL INSTALLER QUALIFICATIONS

##### 1.1 ENTITIES

- A. Communications contractors
  - 1. The Communications Contractor shall at a minimum possess the following qualifications:
    - a. Contractor shall be a Siemon Certified Contractor with valid up to date contract certification and in good standing with the Siemon Company.
    - b. Be in business a minimum of five (5) years.
    - c. Contractor shall demonstrate satisfaction of sound financial condition and can be adequately bonded and insured if the project deems necessary.
    - d. Possess those licenses/permits required to perform telecommunications installations in the specified jurisdiction.
    - e. Use personnel knowledgeable in local, state, province and national codes and regulations. All work shall comply with the latest revision of the codes or regulations. When conflict exists between local or national codes or regulations, the most stringent codes or regulations shall be followed.
  - 2. Contractor must possess current liability and workers compensation insurance certificates.
  - 3. Contractor must be registered with BICSI and have at least one RCDD on staff or ITS Cabling Installer Program Technician certification and Installer Level 1 & 2 for a minimum of 75 percent of staff.

##### 1.2 TRAINING

- A. The Contractor shall be fully conversant and capable in the cabling of low voltage applications such as, but not limited to data, voice and imaging network systems. The Contractor shall at a minimum possess the following qualifications:
  - 1. Personnel trained and certified in the design of the Siemon Cabling System®.
  - 2. Personnel trained and certified to install the Siemon Cabling System®.
  - 3. The Designer and Installer shall show proof of current certification of the Siemon Cabling System® via an updated certificate given after attending the Certified Installer training course or an on-line re-certification class given every two years.
  - 4. Provide references of the type of installation provided in this specification.
  - 5. Personnel trained and certified in the installation of copper cable and in the use of Level IIIe Copper Transmission Performance testers, fiber optic cabling, splicing, termination and testing techniques. Personnel must have experience using an optical light source and power meter plus an OTDR.
  - 6. Personnel trained in the installation of pathways and supports for housing horizontal and backbone cabling.
- B. Facilities Orientation

END OF SECTION

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## SECTION 270171

### RESPONSIBILITY AND WORKMANSHIP OF CONTRACTOR

#### PART 1 - GENERAL

##### 1.1 CONTRACTOR RESPONSIBILITY

- A. Contractor shall be obligated to exercise the highest standard of care in performing its obligations as defined in a request for proposal. All work shall be done in a workman like fashion of the highest standards in the telecommunications industry.
- B. All equipment and materials are to be installed in a neat and secure manner, while cables are to be properly dressed in accordance with standards recommendation for a specific type of media (i.e. UTP vs. F/UTP @ 10 Gigabit)
- C. Workers must clean any debris and trash at the close of each job and workday.
- D. Contractor acknowledges that Intermountain Healthcare will rely on contractor's expertise, ability and knowledge of the system being proposed and shall be obligated to exercise the highest standard of care in performing contractual obligation as defined in the Scope of Work.
- E. Contractor must submit The Siemon warranty, Cable Records, As Built Drawings and Test Results at the completion of work. Note: Intermountain Healthcare reserves the right to withhold final payments until all registration documents are approved by the Siemon Company and received by Intermountain Healthcare.

##### 1.2 CONTRACTOR AND EMPLOYEE RESPONSIBILITY

- A. Contractors, their employees, and installers will attend annually Intermountain Healthcare required Infection Control training.
- B. Contractors, their employees, and installers will complete Reprax registration.
- C. Contractors, their employees, and installers will attend Intermountain Healthcare required site and job specific orientation.
- D. Contractors, their employees, and installers will maintain Intermountain Healthcare required immunizations.
- E. Contractors, their employees, and installers will keep their Intermountain Healthcare required confidentiality agreements current.
- F. Contractors, their employees, and installers always agree to follow all Intermountain Healthcare Policies and procedures and wear the appropriate ID while on any of Intermountain properties.
- G. Contractor will determine with Owner the appropriate level of Environmental Containment precautions to utilize for each work location. Infection Control Risk Assessments and permits will be performed as required.
- H. Upon request, provide qualification data for all qualified layout technicians, installation supervisors, and field inspector
  - 1. Siemon issued qualification badges shall be readily available for this purpose.

##### 1.3 EXAMINATION

- A. Field Measurements: Verify dimensions in areas of installation by field measurements before fabrication and indicate measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the work.
- B. Established Dimensions: Where field measurements cannot be made without delaying the work, establish dimensions and proceed with fabricating units without field measurements. Coordinate supports, adjacent construction, and fixture locations to ensure actual dimensions correspond to established dimensions.

##### 1.4 PREPARATION

- A. Pre-installation inspection
  - 1. The Contractor shall visually inspect all cables, cable reels, and shipping cartons to detect possible cable damage incurred during shipping and transport. Visibly damaged goods are not acceptable and shall be replaced by the contractor at no additional cost to the Owner.

## 1.5 MISCELLANEOUS CONTRACTOR RESPONSIBILITIES

- A. Contractor will maintain unobstructed egress in work areas.
- B. Contractor will keep an access for all Emergency Services.
- C. Contractor will maintain training for Personnel in alternate exits if needed.
- D. Contractor will maintain Temporary construction partitions, as required, that are smoke tight and built of non-combustible materials.
- E. Additional Fire Extinguishers may be required and will be properly maintained and inspected.
- F. Construction site will be maintained clean and orderly.
- G. Contractor will observe Intermountain Healthcare's Tobacco Use Policy. (All forms of tobacco use are strictly prohibited)
- H. All Electrical Extension cords will be grounded, and in good condition and, plugged into approved GFI Receptacles.
- I. Construction site will be restricted. (Approved personnel Only)
- J. Required Personal Protective Equipment (PPE) will be worn as required. (i.e. hard hats, safety glasses, safety shoes, fluorescent vest, in accordance with general contractor's safety policy)
- K. Tools will be unplugged, and power secured at the end of each working day.
- L. All employees and contractors will understand how to obtain MSDS sheets.
- M. Contractor will notify proper personnel of any fire system shut down. A 48-hour notification is required.
- N. Contractor will address all vibration concerns with Intermountain Healthcare and general contractor's staff.
- O. Contractor will address all Noise Issues with Intermountain Healthcare and general contractor's staff.
- P. Contractor will fill out a Hot Work permit and keep it on site daily as needed.
- Q. Contractor will fill out an Above Ceiling Work Permit and keep it on site daily as needed.
- R. Contractor will obtain a Confined Space Permit, when required, and keep it on site.
- S. Contractor shall notify Information Systems 72 hours in advance of any shutdown or known interruption of required environmental services. Follow up by notifying the Service Desk.
- T. Demolition of low voltage cabling shall be performed by the Low Voltage installation contractor.
  - 1. To prevent accidental removal of in-use circuits.
  - 2. To allow for re-use of circuits where practical.

END OF SECTION

## SECTION 270500

### COMMON WORK RESULTS FOR COMMUNICATONS

#### 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

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## SECTION 270526

### GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. This work shall be provided by Division 26.
  - 1. Division 26 shall provide and install the communications system grounding bus bar.
  - 2. Systems other than the voice/data system shall be bonded by their respective installers or Division 26.
- B. Exception: Division 27 shall bond racks, ladders, and other conductive IT equipment and enclosures as required.
- C. Requirements of the following Division 26 Sections apply to this section:
  - 1. Basic Electrical Requirements
  - 2. Basic Electrical Materials and Methods
  - 3. Grounding and Bonding for Electrical Systems

##### 1.2 SUMMARY

- A. This Section includes methods and materials for grounding and bonding Communications systems.
- B. All grounding / earthing and bonding shall be done to applicable codes and regulations. It is recommended that the requirements of IEC/TR 61000-5-2: 1.0, ANSI-J-STD-607-A, or both be observed throughout the entire cabling system.

#### PART 2 - PRODUCTS

##### 2.1 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
  - 1. Stranded conductors No. 6 AWG.

##### 2.2 CONNECTORS

- A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
- B. Compression fitting – 2-hole strap.

#### PART 3 - EXECUTION

##### 3.1 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70 (NEC), Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

##### 3.2 APPLICATIONS

- A. Conductors: Install stranded conductors for No. 6 AWG and larger, unless otherwise indicated.

### 3.3 INSTALLATION

- A. Grounding Conductors
  - 1. Route along shortest and straightest paths possible, unless otherwise indicated or required by Code.
  - 2. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
    - a. Jumper across all tray junctions use two-hole crimp lugs with a bolt, lock washer and nut to prevent loosening of ground connections over time.
    - b. Contractor to remove small area of powder coat or paint to create a metal to metal bonding connection.
    - c. Per current BICSI TDMM "Grounding, Bonding and Electrical Protection":
      - 1) Grounding and bonding connectors should be one of the following: Tin plated copper, copper or copper alloy
      - 2) Connections should be made using crimp connectors, or exothermic welding.
    - d. Per TIA/EIA 607-A the TBB (Telecommunications Bonding Backbone) connections "shall be made using irreversible compression-type connectors, exothermic welding or equivalent."

END OF SECTION

## SECTION 270528

### PATHWAYS FOR 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 270529.
  - 4. Note: Surface mounted raceway and power poles should be installed only when other pathway choices are not feasible.

## 2.2 EQUIPMENT

- A. Compatibility
  - 1. All material and equipment as provided should be the standard Commercial-Off-The-Shelf (COTS) products of a manufacturer engaged in the manufacturing of such products. All shall be typical commercial designs that comply with the requirements specified. All material and equipment shall be readily available through manufacturers and/or distributors.
    - a. All equipment shall be standard catalogued items of the manufacturer and shall be supplied complete with any optional items required for proper installation.
    - b. Coordinate the features of materials and equipment so they form an integrated system. Match components and interconnections for optimum future performance and backward compatibility
- B. Horizontal cables shall be installed in "clean, dry" locations that provide protection from moisture levels above the intended operating range of inside plant (ISP) cables
  - 1. Cable pathways shall be installed to provide protection from the elements (i.e. moisture) and other hazards.
  - 2. Cables and cable pathways shall be protected from detritus elements such as paints, adhesives, water and cleaners.
    - a. In case of contamination, cables shall be replaced at the General Contractors expense. Cleaning is not acceptable.
  - 3. Pathways shall not have exposed sharp edges that may come into contact with telecommunications cables.
- C. Pathways shall not be in elevator shafts.
- D. Grounding / Earthing and bonding of pathways shall comply with applicable codes and regulations. It is recommended that the requirements of IEC/TR3 61000-5-2 - Ed. 1.0, ANSI-J-STD-607-B, or both be observed throughout the entire cabling system.

## 2.3 SURFACE MOUNTING

- A. Surface Mount Cable Runs and Faceplate Boxes
  - 1. Surface mounting of cable pathway runs and/or boxes for outlets/faceplates are only authorized as a last resort and exception to running cables through the wall and above the ceiling.
  - 2. If surface mount cable runs are used:
    - a. Burrs will be removed from the inside of the plastic or metal surface mount pathway to prevent damage to cables pulled through the run.
    - b. Raceway manufacturer plastic bushings shall be installed at all outlet openings in raceway to prevent damage to cable.
    - c. "T", Splice, and corner pieces will be used to join runs. Runs will not be butted together without the appropriate joining pieces.

## PART 3 - EXECUTION

### 3.1 HORIZONTAL PARAMETERS

- A. Allowable Cable Bend Radius and Pull Tension:
  - 1. In general, communications cable cannot tolerate sharp bends or excessive pull tension during installation.
    - a. Bend radius for 4 pair UTP and F/UTP under no load (no pulling tension) shall not exceed four (4) times the outside diameter of the cable and eight (8) times the outside diameter of the cable under load (110N/25lbf). Note: Cable bend radius and pulling tensions for cables other than 4 pair cable increase with the diameter and type of cable refer to the manufacturer's recommendations for specific requirements.
  - 2. After installation, exposed cable and other surfaces must be cleaned free of lubricant residue. Use only lubricants specifically designed for cable installation.

- B. Pull Strings:
  - 1. Horizontal and Vertical Pathways
    - a. The pathway installer shall:
      - 1) Provide pull strings in all new conduits, including all conduits with cable installed as part of this contract.
      - 2) Provide pull strings in all new cable trays.
      - 3) Pull string shall have a rated average breaking strength of 200 pounds.
      - 4) During pulling sessions, pull strings must move freely to prevent cable jacket/cable damage.
      - 5) Free moving pull strings shall be provided in all locations where they are utilized as part of this contract.
- C. Conduit Fill:
  - 1. Reference manufacturer's Design Installation Guidelines manual.
  - 2. Comply with requirements of NFPA 70 (NEC)
  - 3. The number of cables placed in a pathway shall not exceed manufacture specifications, nor, will the geometric shape of a cable be affected.
    - a. Conduit pathways shall have a maximum fill ratio of 40% to allow for proper pulling tension and lay of the CAT6A F/UTP cable. A minimum of a 1" diameter conduit is required for new construction. Existing conduits will require the reduction of the number of cables placed in the conduit to meet the required fill ratio.

### 3.2 INTRA-BUILDING CABLE ROUTING

- A. Pathways
  - 1. The backbone subsystem shall include cable installed in a vertical manner between floor telecommunications rooms and the main or intermediate cross-connect in a multi-story building and cable installed horizontally between telecommunications rooms and the main or intermediate cross-connect in a long single-story building.
  - 2. Adequate riser sleeve/slot space shall be available with the ability to ingress the area later in all telecommunications rooms, such that no drilling of additional sleeves/slots is necessary. Proper fire stopping is required for all sleeves/slots per national and local codes. Install fire stop material designed specifically for the building construction conditions and to meet the existing fire stop material as directed by the building engineer.
  - 3. Backbone pathways shall be installed or selected such that the minimum bend radius of backbone cables is kept within manufacturer specifications both during and after installation.
  - 4. Where redundant paths are required, they shall be separated by a minimum of 24".
    - a. Separate innerducts and/or armored fiber are required for each leg of the redundant path.
    - b. Separate physical routing for each path shall be utilized where possible.
  - 5. Building backbone cables shall be installed in "dry" locations that provide protection from moisture levels above the intended operating range of inside plant (ISP) cables. "Slab-on-Grade" building designs wherein pathways are installed underground on/in the poured concrete slabs that are in direct contact with the soil are considered wet locations and hence are not permitted.

END OF SECTION

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## SECTION 270529

### HANGERS AND SUPPORTS FOR COMMUNICATION SYSTEMS

#### PART 1 - PRODUCTS

##### 1.1 APPROVED PRODUCT

- A. The J-hooks shall meet or exceed the below characteristics of construction and features
  - 1. Provide broad based support for cabling to aid in maintaining overall system performance.
  - 2. Be available in 50.8mm (2") and 101.6mm (4") options
  - 3. Come equipped with a cable retention clip
  - 4. Offers a full line of mounting accessories.

##### 1.2 APPROVED MANUFACTURERS

- A. Ericson / Caddy
- B. B-Line
- C. Stiffy

#### PART 2 - EXECUTION

##### 2.1 J-HOOKS AND OTHER SUPPORTS SHALL BE INSTALLED SUCH THAT THEY:

- A. Shall be supported with devices designed for this purpose and shall be installed independently of any other structural component. J-Hooks shall not use the suspended ceiling support wires or lighting fixture support wires.
- B. The number of cables placed into the J-hooks shall be limited to a number that will not cause a change to the geometric shape of the cables.
  - 1. Limit to a 40% fill in new construction.
- C. J-hooks shall not be spaced farther than 1.5 meters (5 ft.) apart, with a recommendation that they be spaced at 1 meter (3 ft.) apart. Note: Construction may require distances to exceed the maximum and are considered an exception requiring approval of project manager or building engineer.
- D. J-hooks or better must be installed without exception.

##### 2.2 UNACCEPTABLE INSTALLATIONS

- A. Free flight of cables
- B. Resting or attaching of cables on pipes, conduits, HVAC duct work, fire sprinkler systems, basket tray, basket tray supports or on the ceiling tiles/grid.

END OF SECTION

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## SECTION 270533

### CONDUITS AND BACK BOXES FOR COMMUNICATIONS SYSTEMS

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Division 26 – Electrical work

#### PART 2 - PRODUCTS

##### 2.1 APPROVED PRODUCT

- A. Conduits and Back boxes shall meet the construction requirements of the NEC for the type of structure and space in which they are installed and will be of the diameter and size to provide adequate fill, bend radius and connector space. Refer to section 270528.

#### PART 3 - EXECUTION

##### 3.1 CONDUIT SIZING

- A. Conduit size shall be based on the type of cable installed and the required fill ratio and bend radius associated with the type of cable specified.
  - 1. Minimum conduit size to back box for CAT6A F/UTP shall be 1-inch EMT.
- B. Conduit and installation shall be provided by Division 26.
- C. All conduit stubs shall be installed with plastic bushings appropriate for the size of conduit used.
- D. Conduits that stub to accessible ceiling shall be installed in the direction to provide the shortest path to the TDR, complete with pull string.

##### 3.2 BACK BOX SIZING

- A. New work back boxes for CAT6A F/UTP shall be a minimum of trade size 4-11/16" x 4-11/16" x 3" (depth) plus a 5/8" plaster ring to allow for proper bend radius and connector termination/installation. Side knockouts shall be avoided.
- B. Back boxes for rework shall meet the same specification as for new work.
  - 1. If existing back boxes or back boxes that are smaller due to construction restrictions, then devices such as extension rings, bezels or faceplates shall be used to modify the back box to insure proper bend radius and connector termination/installation.
    - a. Verification and approval of the size change must have DCO Infrastructure Cabling and engineering approval.

##### 3.3 BACK BOX COMPOSITION

- A. All back boxes for IT systems shall be UL/CSA listed and approved for the purpose.
  - 1. Non-metal back boxes shall not be used for any interior IT related device.

**3.4 SPECIAL CONDITIONS – LEAD LINED WALLS FOR RADIATION CONTROL**

- A. Refer to the complete IT Lead Lined Wall Procedure – Attachment Appendix 8

END OF SECTION

## SECTION 270536

### CABLE TRAY FOR COMMUNICATIONS SYSTEMS

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. This section shall be coordinated with Sections 270528, 270539, and 270543\_46

##### 1.2 COORDINATION

- A. Prior to beginning installation, a kick-off meeting to properly coordinate the tray installation and expectations should be held. It should be arranged by the General Contractor, and at a minimum include representatives of the following trades: FP&D, Electrical (Div 26), Structured cable, Nurse Call, paging, building automation and control, plumbing, HVAC, fire sprinkler, framing, and others as applicable. The Data Center Operations Infrastructure Cabling Team will lead the meeting.
- B. The wire basket tray routing shall be approved by the low voltage CI cable contractor (Div. 27 sub-contractor), and the Data Center Operations.
- C. Where adequate space is available a Triple tier J-Hook pathway shall parallel the basket trays for other services
  - 1. The triple tier J-Hooks shall be installed by the cable tray installer.
- D. Single J-Hooks as needed to extend beyond the triple tier, shall be installed by the trade that will be utilizing them.
- E. Cable tray shall be a high priority installation to allow adequate time for proper and complete cable installation prior to ceiling grid.

#### PART 2 - PRODUCTS

##### 2.1 APPROVED PRODUCT

- A. The Cable Tray shall meet or exceed the below characteristics of construction and features:
  - 1. It shall be fully welded and available in a galvanized silver or powder coat black finish
  - 2. Have an optional construction using "elongated" shaped wires offering a more broad-based support for installed cables.
  - 3. Cable ladder shall be used in data rooms for horizontal management above the racks.
  - 4. Ladder shall match the manufacturer of the data racks or exact equal.
  - 5. Ladder shall be assembled with manufacturer approved parts and methods.
- B. APPROVED MANUFACTURES
  - 1. WBT – Wire Basket Tray (preferred)
  - 2. Siemon RouteIT™ Wire Mesh Cable Tray, or equal basket type tray
  - 3. Cabofil per owner's approval

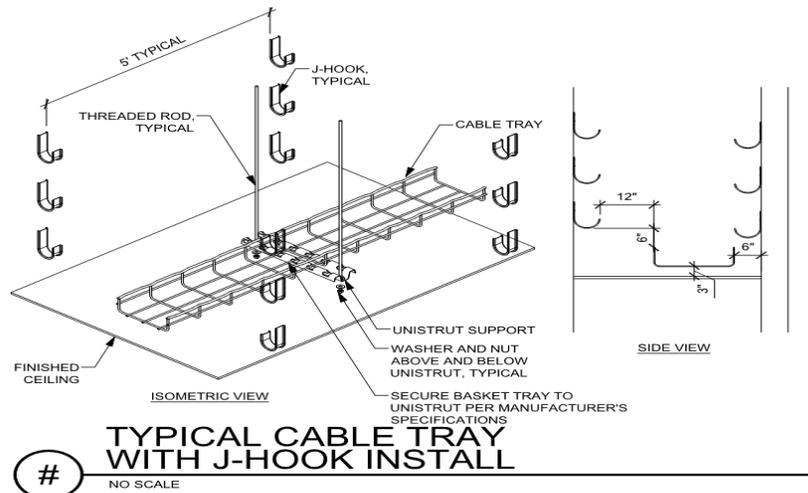
##### 2.2 PART NUMBERS (SUBMITTAL REQUIRED)

- A. Cable Tray
  - 1. Refer to plans for part numbers.

#### PART 3 - EXECUTION

##### 3.1 PATHWAY INSTALLATION

- A. Supports
1. Installed per Manufacturer's Specifications and utilize components specific to the maintenance of proper access in and out of the cable tray using bend delimiters.
  2. Distance between supports shall not exceed 5 feet
    - a. Less distance between supports required if per manufacturer's instructions.
    - b. Minimum of one support required within 24" on each side of any junction point.
  3. Supports shall be of the trapeze design to provide maximum stability.
    - a. Each support shall attach to structure via its own hangers.
      - 1) All hanger supports shall be constructed of a rigid material such as all-thread.
      - 2) All hangers and supports shall be installed perpendicular and plumb to the tray. No angle supports shall be permitted unless augmented perpendicularly.
      - 3) Vibration and sway (seismic) damping required.
      - 4) Provide support across width of tray underneath, not via basket side wires.
      - 5) Building walls do not qualify as a support and shall not be used as a support.
  4. Supports shall be of sufficient strength to support at least 200% of the expected load
  5. Wall mounted angle brackets shall not be used as a load bearing support for cable tray.
- B. Complete system access
1. Cable tray shall have a dedicated free clearance zone surrounding it.
    - a. 12" clear space shall be provided on the side where natural feed will occur.
    - b. 6" clear space shall be provided on the side opposite the feed access.
    - c. 8" clear space above the top of tray minimum – recommended 12".
    - d. 3" clear space below the tray.
  2. Exception: other services may pass through the free clearance zone provided it is perpendicular to the tray direction and providing they do not exceed 6' in width or interfere with the access to pull wire in the tray.



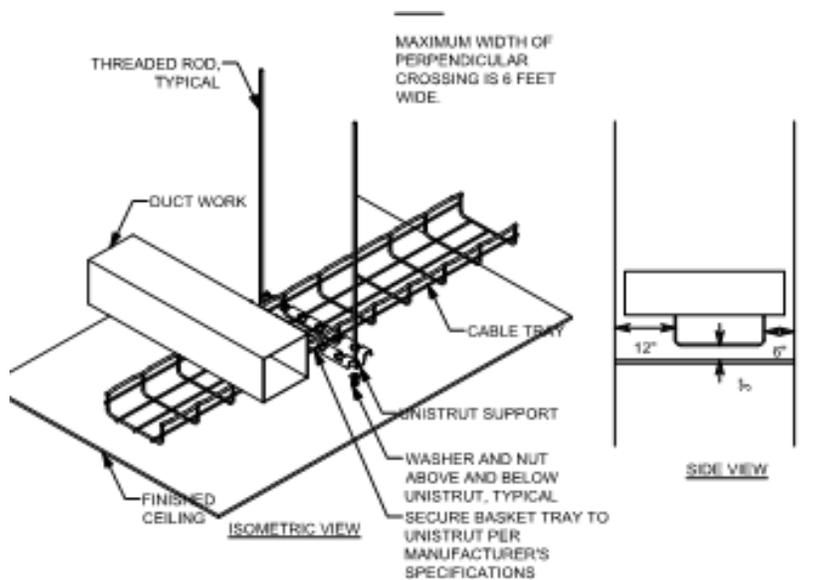
### 3.2 ROUTING OF BASKET TRAY

- A. Exact cable tray location shall be coordinated with other trades to ensure proper clearances and access. Prior to installation, final cable tray routing must be approved by the Owner's Data Center Operations/Infrastructure cabling team.
- B. Cable tray shall be installed in straight lines, either parallel or perpendicular to building lines
- C. Cable tray shall follow corridor paths

1. Routing above rooms and other partitions shall be avoided
- D. Cable tray and flush penetrations shall be utilized over hard-lid areas as specified.
- E. Access panels shall be provided where needed to provide access to the cable tray on both sides of the wall in hard lid areas within 3' or less of the basket tray.

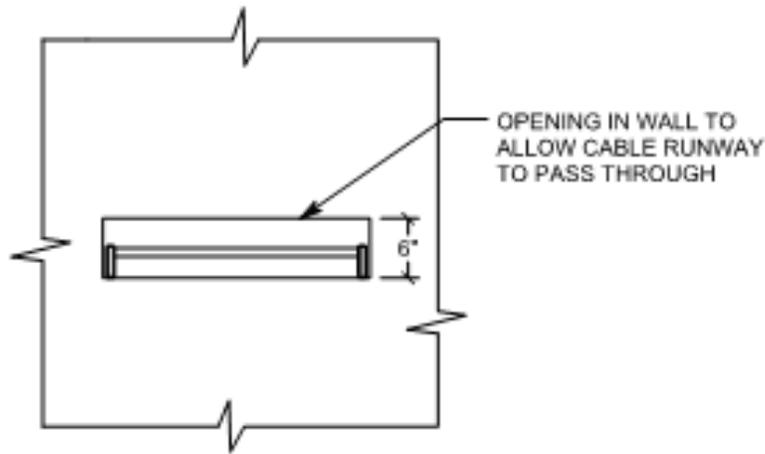
### 3.3 TRAY INTEGRITY

- A. Tray shall be installed as a complete, continuous system with no open spaces, cut outs, or missing segments. Bonding between sections shall be accomplished by the manufacturer's approved clamp or designated method.
- B. Tray shall be free from obstructions, other systems, trash or debris. Access to the tray shall be provided as outlined.
- C. There shall not to be any other trades infrastructure or equipment attached to or supported by the basket tray or basket tray support system.
- D. Tray must not be notched or cut-out to accommodate other trades. Repairs will not be accepted. Section replacement will be required at no cost to owner.
- E. As much tray material as possible shall be left uncut at turns, junctions, elevation changes, width changes, etc. Overlap shall be clamped to maximize strength and prevent pinch points.



**TYPICAL CABLE TRAY WITH PERPENDICULAR CROSSING**

PART 4 - #



## CABLE RUNWAY THROUGH WALL DETAIL

PART 5 - #

### 5.1 WALL OR OTHER PENETRATIONS (SUBMITTAL REQUIRED)

- A. Fire and smoke rated assemblies
  - 1. Penetrations shall comply with all fire and smoke prevention methods per codes and as outlined elsewhere in this document, including Section 270528 and Division 7.
- B. Approved penetration methods
  - 1. Preferred barrier penetration method shall be to run the tray continuous through the barrier, with closure provided by Firestop pillows.
    - a. Framing shall be boxed around openings to permit proper pillow insertion. Coordinate with framing contractor.
  - 2. Sleeves or conduits
    - a. EZ-Path or alternate penetrations must provide 150% of the designed cross-sectional area of the basket.
    - b. Conduit permitted only with written pre-bid permission or engineering notation on the drawings.
    - c. Each penetration sleeve or conduit shall be bonded on both sides of the penetrated barrier using UL and AHJ approved methods.
  - 3. All penetrations shall be positioned in-line with the cable tray to facilitate ease of pulling conductors and provide a straight-line path.
    - a. The bottom of the penetration device shall be flush with the bottom of the cable tray
    - b. Side-to-side penetrations must be completely within the cable tray space or directly above whenever possible.
  - 4. Approved penetration devices shall be a minimum size of 4"
    - a. Total penetration space at each location shall be sized for 20% growth and be equal to or greater than the cross-sectional area of the basket tray.
    - b. Approved devices where smaller penetrations are permitted shall be a minimum size of 1".
  - 5. Approved devices shall be approved by the local facility manager:
    - a. Fire rated STI EZ-Path
    - b. Hilti self-sealing device

- c. Tray with enclosed wall and properly sized and installed pillows
- d. Conduit sleeves
  - 1) Conduit sleeves should only be used as a last resort upon approval from owner's Data Center Operations Infrastructure Cabling representative.

## 5.2 UTILIZATION

- A. Capacity
  - 1. Trays and penetration devices shall be properly sized
    - a. Provide a maximum calculated fill ratio of 40% to an inside depth not to exceed 3 inches (75 mm)
    - b. Provide capacity to allow for at least 20% future growth
- B. Systems served
  - 1. Cable trays, J-hooks, and penetrations shall be dedicated to a single system. Mixing of other systems with voice and data shall not be permitted in tray or J-hook paths.
  - 2. Exception: Different systems may share cable tray providing the following conditions are met:
    - a. Less than 40% overall fill is maintained, plus 20% additional space for growth
    - b. There is a minimum 3" separation between systems
    - c. There is a grounded physical divider between systems
- C. Restricted content in trays
  - 1. The wire basket tray shall only contain cables for the voice and data communications systems.
    - a. If there is sufficient space in the tray, and with approval from both the data network sub-contractor and the Data Center Operations, certain other IP services may share tray space. (i.e. camera, telemetry, similar).
    - b. Service loops must not reduce tray capacity.
    - c. Nurse call cabling shall be run in the J-Hook path. All nurse call installations must provide their own path or utilize the triple J-Hook system.
- D. Triple J-Hook path assignments
  - 1. The Lower tier of the triple J-Hook path is designated for Card Access and building automation and controls
  - 2. The Middle tier of the triple J-Hook path may alternately be utilized for Nurse Call, or other EMI producing systems.
  - 3. The Top tier of the triple J-Hook path is designated for satellite, DAS, or similar systems.
  - 4. When a triple J-hook pathway is not installed or available each system provider shall install their own j-hook pathway and wall penetrations.
  - 5. Service loop and slack shall not interfere with other pathways.

END OF SECTION

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## SECTION 270543/46

### UNDERGROUND DUCTS, UTILITY POLES, AND RACEWAYS FOR INTER- BUILDING/CAMPUS CABLE ROUTING

#### PART 1 - PRODUCTS

##### 1.1 INTER-BUILDING/CAMPUS CABLE ROUTING

- A. The backbone subsystem shall include cable installed between buildings via approved underground, tunnel, direct -buried, aerial or any combination of these from the Campus Distributor/Main Cross-connect (CD/MC/TEC) to Building Distributor/Intermediate Cross-connect (BD/IC/TDR) in a multi-building campus.
  - 1. 4" Conduit is required
  - 2. (3) 1 1/4" inner ducts shall be installed in all 4" conduits going building to building.
  - 3. Armored Fiber is required.
  - 4. Microduct/microfiber is optional.
- B. Backbone pathways shall be installed or selected such that the minimum bend radius and pulling tension of backbone cables is kept within cable manufacturer specifications both during and after installation.
- C. In an underground system, adequate underground conduit space shall be available and accessible at each building. The conduits shall not exceed a fill ratio of 40%.
  - 1. All underground systems shall be designed to prevent water runoff from entering the building. All underground systems must be cleared of any moisture prior to installation of any cable type. These systems must be sealed at both ends when not in use and after cable installation to prevent moisture and rodent infiltration.

#### PART 2 - EXECUTION

##### 2.1 INSTALLATION

- A. The backbone cables shall be installed in a hierarchical star topology, emanating from the Campus Distributor/Main Cross-connect to each satellite building, Building Distributor/Intermediate Cross-connect or Floor Distributor/Horizontal Cross-connect located in a telecommunication room. All Inter-building/Campus cables shall be installed to the applicable codes and regulations.
- B. Where redundant paths are required, they shall be separated by a minimum of 24".
  - 1. Separate innerducts are required for each leg of the redundant path.
  - 2. Separate physical routing for each path shall be utilized where possible.
- C. Optical fiber shall be run for all Inter-building/Campus backbone segments, and as a recommendation, at least one balanced twisted-pair cable should be run for each Inter-building backbone segment.
  - 1. Fibers will be Fusion Spliced in the telecommunications rooms using LC Pigtails in wall mounted interconnect centers or rack mounted panels equipped with sufficient ports, slack storage space and splice trays if required to terminate and secure all fibers.
- D. ST connectors are no longer recommended in the TIA 568-C.3 standard but may be used in legacy installations.
- E. Over-voltage Circuit Protection shall be utilized for cabling which enters or exits a building shall comply with applicable codes and regulations.
- F. OSP (outside plant) cables shall transition to an ISP (inside plant) within 50 feet of changing environment, per national and local codes and regulations.

END OF SECTION

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## SECTION 270553

### IDENTIFICATION FOR LOW-VOLTAGE CABLES AND LABELING

#### PART 1 - GENERAL

##### 1.1 NOT USED

#### PART 2 - PRODUCTS

##### 2.1 LABELING

- A. Structured cabling shall be labeled in accordance with ANSI/TIA 606-B standards.
- B. A unique identifier shall be marked on each faceplate to identify it as connecting hardware.
- C. Each port in the faceplate shall be labeled with its identifier.
- D. A unique identifier shall be marked on each piece of connecting hardware to identify it as connecting hardware.
- E. Each port on the connecting hardware shall be labeled with its identifier.
- F. Cable Labeling
  - 1. Label System
    - a. Labels Identification (Labeling) System:
      - 1) Brady
      - 2) Dymo
      - 3) Hellerman-Tyton
      - 4) Panduit
      - 5) Acceptable alternate
        - a) Approval from Data Center Operations Infrastructure Cabling team member required prior to bid
  - 2. Cable Labels
    - a. Self-adhesive vinyl or vinyl-cloth wraparound tape markers, machine printed with alphanumeric cable designations. Plastic, self-adhesive labels are not acceptable.
    - b. Each end of the Horizontal cables shall be labeled with a mechanically generated label within 300mm (12 in) of the end of the cable jacket with the link identifier which shall be a unique configuration determined by owner. This also applies to the Backbone Cables.
  - 3. Flat-surface labels
    - a. Self-adhesive vinyl or vinyl-cloth labels, machine printed with alphanumeric cable designations
  - 4. Contractor shall:
    - a. Provide transparent plastic label holders, and 4 pair marked colored labels.
    - b. Install colored labels according to the type of field as per ANSI/TIA 606-B.1 color code designations.
- G. PALLETTE
  - 1. Use the owners color-code guidelines for voice, data, cross-connect, riser, and backbone fields. Otherwise, use the ANSI/TIA 606-B designation strip color-code guidelines for voice, data, cross-connect, riser, and backbone fields. Color designations for F/UTP cable:
    - a. Intermountain Healthcare Standard Wiring Palettes for Horizontal Cabling
    - b. Use 

1)	Data & IP Phones	Color
2)	Analog Phone	Blue
3)	Security Card Readers	Blue
4)	IP Security Cameras	Grey/Yellow
		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.

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## SECTION 271100

### EQUIPMENT ROOM FITTINGS

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Requirements of the following Division 26 sections apply to this section
  - 1. Basic electrical requirements
  - 2. Basic electrical materials and methods
  - 3. Grounding, earthing, and bonding
- B. Standards
  - 1. Minimum equipment room specifications shall comply with the 2010 AIA Guidelines for Design and Construction of Healthcare Facilities.
  - 2. Minimum recommended room sizes are requirements, not suggestions.
  - 3. Enterprise IS Architecture (EISA) maintains several documents around standards. The primary standards list is the EISA Standards 2010 – Master List. Occasionally, there is a need to breakout specific standards for an area.

##### 1.2 SUMMARY

- A. This Section specifically details the facilities design and operations standards to be utilized for Intermountain Health Care's Data Rooms (TEC) and data closets (TDR).

##### 1.3 COMMON REQUIREMENTS

- A. Rack layout and mounting
  - 1. Standard room layouts are located on the plans.
- B. Rack and wall mounting locations
  - 1. Rack and wall space use is pre-designated at the design stage. Before mounting any equipment on a wall or in a rack, the location must be verified by the Div 27 sub-contractor and the Data Center Operations.

##### 1.4 DEFINITIONS

- A. **Data Center** – Major computer/technology/network facilities providing a significant percentage of the data and application services for the enterprise.
- B. **Data Rooms – ((TEC) Technology Equipment Center)** – Purpose built buildings or rooms that provide communications point-of-presence along with some data and applications services for a local facility or region.
- C. **TSER (Telecommunications Service Entrance Room)** – Houses the point at which data and voice circuits and services enter the facility and outdoor cabling interfaces with the building infrastructure. Typically, the TSER will be located in the TEC.
- D. **Data Closets – ((TDR) Technology Distribution Room)** – Specific location within a facility that provides communication services for a specific area (floor, wing, office area) of that facility only. A secure, flexible, and easily managed location for the structured cabling systems, network electronics, clinical systems, nurse call systems, and other technology and communications equipment.

#### PART 2 - TECHNOLOGY ROOM SPECIFIC REQUIREMENTS

##### 2.1 TECHNOLOGY EQUIPMENT CENTER (TEC)

- A. Each Hospital will have a dedicated TEC which will serve as the main communications point-of-presence along with data and application services for the local facility or region. Houses the core networking equipment, application servers and data storage devices that serve the buildings on the campus. The Telecommunications Service Entrance Room (TSER) will be in the same room.

## 2.2 TEC IN HOSPITALS

- A. Physical Construction
  1. The TEC should be in an area easily accessed for delivery of equipment and high traffic without disturbing patient care.
  2. The size of the TEC will be based on the number of cabinets required to support the campus, plus 30% growth.
  3. Walls will be constructed from the floor to the deck and be completely sealed from surrounding spaces.
  4. A minimum 50% of open wall space will have ¾" fire rated plywood covering the walls.
  5. Fire rated plywood shall be painted with fire resistant paint, leaving the fire rating stamp un-painted.
  6. The TEC should not have a ceiling other than the deck.
  7. Static Dissipative Tile is required in the TEC.
  8. The door to the TEC shall be 8' tall and 4' wide to accommodate the cabinet height.
  9. The walls of the TEC should not have any windows installed.
- B. Layout
  1. Cabinets will be in a cold isle configuration.
  2. Containment will be installed, including removable ceiling panels and isle doors.
- C. Electrical
  1. The electrical distribution system will follow an A (BLUE) – B (RED) design.
  2. Each system A (BLUE) and B (RED) will be backed up by a dedicated UPS.
  3. Outlet type is L21-30
  4. All power is to be run in conduit.
  5. Lighting will be installed above each isle.
- D. Mechanical
  1. The mechanical system will be a precision cooling solution installed in an in row, N+1 configuration designed to maintain 72 degrees F at mid cabinet.
  2. The mechanical system will be redundant and concurrently maintainable including on the electrical supply.
  3. The system shall meet engineering specifications for the room at 110 degrees outside air at 4500 feet above sea level.
  4. Chilled water, DX (Air Cooled) and Glycol (30% polyethylene glycol to water) are all acceptable cooling strategies.
- E. Security
  1. Doors will be fitted with an auditable card reader.
- F. Fire System
  1. A pre-action dry pipe fire system will be installed
- G. Monitoring
  1. Eaton Forseeer system will be used to monitor all critical systems.
  2. Forseeer cables will be run to all UPSs, cooling units and TDRs.
  3. One Cat 6a F/UTP cable to each UPS.

## 2.3 TEC in Clinics and Office Buildings

- A. Clinics and Offices will have a room which will serve as a TEC and TDR. This room will be sized to accommodate the multifunction of the space.

## 2.4 TEC/TDR in Clinics



- A. Physical Construction
  - 1. TDRs should be in a central location off the main corridor away from patient areas.
  - 2. TDRs should be stacked from floor to floor.
  - 3. TDR size will be at least 12' x 14'.
  - 4. Walls will be constructed from the floor to the deck and be completely sealed from surrounding spaces.
  - 5. A minimum 50% of open wall space will have 3/4" fire rated plywood covering the walls.
  - 6. Fire rated plywood shall be painted with fire resistant paint, leaving the fire rating stamp un-painted.
  - 7. The TDR should not have a ceiling other than the deck.
  - 8. Flooring can be Static Dissipative Tile or Epoxy Paint.
  - 9. 3' wide door is required.
  - 10. When permissible, doors shall swing out of the room to provide maximum available space and rapid egress.
- B. Layout
  - 1. Racks in a single row with the front being the cold isle.
  - 2. The front of the racks should face the door.
- C. Electrical
  - 1. The electrical distribution system will follow an A (BLUE)-B (RED) design.
  - 2. System A(BLUE) will be backed up by a dedicated UPS.
  - 3. System B(RED) will be from a dedicated utility circuit.
  - 4. Outlet type is L6-30 and L5-20.
  - 5. All power is to be run in conduit.
  - 6. Lighting will be installed above each isle.
- D. Mechanical
  - 1. TDRs will have redundant cooling
    - a. Primary cooling is from the facility cooling system via a dedicated source.
    - b. Secondary cooling is from a standalone split or ceiling mount source.
    - c. The secondary system will be fed from the facility generator equipment electrical source if available.
    - d. The Mechanical system will be designed to maintain 72 degrees F at mid rack.
    - e. The coordination scheme between primary and secondary cooling systems can be accomplished by setting the primary system to 72 degrees F and the secondary system to 75 degrees F.
- E. Security
  - 1. Doors will be fitted with an auditable card reader.
- F. Fire System
  - 1. TDRs will utilize the facility fire detection and suppression systems.
  - 2. Sprinkler heads should have a 200-degree fuse.
  - 3. Sprinklers should be protected from accidental activation.
- G. Monitoring
  - 1. TDRs will be monitored using Eaton/Foreseer.
  - 2. Run 3 foreseer cables to each TDR.
  - 3. One Cat6a F/UTP cable to each UPS.

## 2.5 TEC/TDR in Offices

- A. Physical Construction
  - 1. TDRs should be in a central location off a main corridor.
  - 2. TDRs should be stacked from floor to floor.
  - 3. TDR size will be at least 12' x 14'.
  - 4. Walls will be constructed from the floor to the deck and be completely sealed from surrounding spaces.
  - 5. A minimum 50% of open wall space will have 3/4" fire rated plywood covering the walls.

6. Fire rated plywood shall be painted with fire resistant paint, leaving the fire rating stamp un-painted.
  7. The TDR should not have a ceiling other than the deck.
  8. Flooring can be Static Dissipative Tile or Epoxy Paint.
  9. 3' wide door is required.
  10. When permissible, doors shall swing out of the room to provide maximum available space and rapid egress.
- B. Layout
1. Racks in a single row with the front being the cold isle.
  2. The front of the racks should face the door.
- C. Electrical
1. The electrical distribution system will follow an A (BLUE)-B (RED) design.
  2. System A(BLUE) will be backed up by a dedicated UPS.
  3. System B(RED) will be from a dedicated utility circuit.
  4. Outlet type is L6-30 and L5-20.
  5. All power is to be run in conduit.
  6. Lighting will be installed above each row.
- D. Mechanical
1. TDRs will have redundant cooling system designed to maintain 72 degrees F at mid rack.
    - a. Primary cooling is from the facility cooling system via a dedicated source.
    - b. Secondary cooling is from a standalone split or ceiling mount source.
      - 1) The secondary system will be fed from the facility generator equipment electrical source if available.
    - c. The coordination scheme between primary and secondary cooling systems can be accomplished by setting the primary system to 72 degrees F and the secondary system to 75 degrees F.
  2. Doors will be fitted with an auditable card reader.
- E. Fire System
1. TDRs will utilize the facility fire detection and suppression systems.
  2. Sprinkler heads should have a 200-degree fuse.
  3. Sprinklers should be protected from accidental activation.
- F. Monitoring
1. TDRs will be monitored using Eaton/Foreseer.
  2. Run 3 foreseer cables to each TDR.
  3. One Cat 6a F/UTP cable to each UPS.

## 2.6 TECHNOLOGY DISTRIBUTION ROOM (TDR)

- A. There shall be a minimum of one TDR on each floor of the facility. TDR's shall be provided throughout the facility as necessary to meet the 292' (90-meter) maximum cables distance. The TDR is located on each floor within a facility to house equipment and cabling, providing communication and technology services for a specific area of that facility. Based on the different needs of different facilities, the TDR's will be broken down into three categories. Hospital, Clinic and Office spaces.

## 2.7 TDR IN HOSPITALS

- A. Physical Construction
1. TDRs should be in a central location off a main corridor and away from patient areas.
  2. TDRs should be stacked from floor to floor.
  3. TDR size will be at least 14' x 16'.
  4. Walls will be constructed from the floor to the deck and be completely sealed from surrounding spaces.
  5. A minimum 50% of open wall space will have 3/4" fire rated plywood covering the walls.

6. Fire rated plywood shall be painted with fire resistant paint, leaving the fire rating stamp un-painted.
  7. The TDR should not have a ceiling other than the deck.
  8. Flooring can be Static Dissipative Tile or Epoxy Paint.
  9. 3' wide door is required.
  10. When permissible, doors shall swing out of the room to provide maximum available space and rapid egress.
- B. Layout
1. Racks will be in a cold isle configuration.
  2. Two rows with the cold isle in the middle.
- C. Electrical
1. The electrical distribution system will follow an A (BLUE)-B (RED) design.
  2. Each system A(BLUE) and B(RED) will be backed up by a dedicated UPS.
  3. Outlet type is L6-30 and L5-20.
  4. All power is to be run in conduit.
  5. Lighting will be installed above each row.
- D. Mechanical
1. TDRs will have redundant cooling designed to maintain 72 degrees F at mid rack.
    - a. Primary cooling is from the facility cooling system via a dedicated source.
    - b. Secondary cooling is from a standalone split or ceiling mount source.
    - c. The secondary system will be fed from the facility generator equipment electrical source if available.
    - d. The coordination scheme between primary and secondary cooling systems can be accomplished by setting the primary system to 72 degrees F and the secondary system to 75 degrees F.
- E. Security
1. Doors will be fitted with an auditable card reader.
- F. Fire System
1. TDRs will utilize the facility fire detection and suppression systems.
  2. Sprinkler heads should have a 200-degree fuse.
  3. Sprinklers should be protected from accidental activation.
- G. Monitoring
1. TDRs will be monitored using Eaton/Foreseer.
  2. Run 3 foreseeer cables to each TDR.
  3. One Cat 6a F/UTP cable to each UPS.

## 2.8 TDR in Clinics

- A. Physical Construction
1. TDRs should be in a central location off a main corridor and away from patient areas.
  2. TDRs should be stacked from floor to floor.
  3. TDR size will be at least 10' x 12'.
  4. Walls will be constructed from the floor to the deck and be completely sealed from surrounding spaces.
  5. A minimum 50% of open wall space will have ¾" fire rated plywood covering the walls.
  6. Fire rated plywood shall be painted with fire resistant paint, leaving the fire rating stamp un-painted.
  7. The TDR should not have a ceiling other than the deck.
  8. Flooring can be Static Dissipative Tile or Epoxy Paint.
  9. 3' wide door is required.
  10. When permissible, doors shall swing out of the room to provide maximum available space and rapid egress.
- B. Layout
1. Racks in a single row with the front being the cold isle.
  2. The front of the racks should face the door.

- C. Electrical
  - 1. The electrical distribution system will follow an A (BLUE)-B (RED) design.
  - 2. System A(BLUE) will be backed up by a dedicated UPS.
  - 3. System B(RED) will be from a dedicated utility circuit.
  - 4. Outlet type is L6-30 and L5-20.
  - 5. All power is to be run in conduit.
  - 6. Lighting will be installed above each isle.
- D. Mechanical
  - 1. TDRs will have redundant cooling designed to maintain 72 degrees F at mid rack
    - a. Primary cooling is from the facility cooling system via a dedicated source.
    - b. Secondary cooling is from a standalone split or ceiling mount source.
    - c. The secondary system will be fed from the facility generator equipment electrical source if available.
    - d. The coordination scheme between primary and secondary cooling systems can be accomplished by setting the primary system to 72 degrees F and the secondary system to 75 degrees F.
- E. Security
  - 1. Doors will be fitted with an auditable card reader.
- F. Fire System
  - 1. TDRs will utilize the facility fire detection and suppression systems.
  - 2. Sprinkler heads should have a 200-degree fuse.
  - 3. Sprinklers should be protected from accidental activation.
- G. Monitoring
  - 1. TDRs will be monitored using Eaton/Foreseer.
  - 2. Run 3 foreseeer cables to each TDR.
  - 3. One Cat 6a F/UTP cable to each UPS.

## 2.9 TDR in Offices

- A. Physical Construction
  - 1. TDRs should be in a central location off a main corridor.
  - 2. TDRs should be stacked from floor to floor.
  - 3. TDR size will be at least 10' x 12'.
  - 4. Walls will be constructed from the floor to the deck and be completely sealed from surrounding spaces.
  - 5. A minimum 50% of open wall space will have ¾" fire rated plywood covering the walls.
  - 6. Fire rated plywood shall be painted with fire resistant paint, leaving the fire rating stamp un-painted.
  - 7. The TDR should not have a ceiling other than the deck.
  - 8. Flooring can be Static Dissipative Tile or Epoxy Paint.
  - 9. 3' wide door is required.
  - 10. When permissible, doors shall swing out of the room to provide maximum available space and rapid egress.
- B. Layout
  - 1. Racks in a single row with the front being the cold isle.
  - 2. The front of the racks should face the door.
- C. Electrical
  - 1. The electrical distribution system will follow an A (BLUE)-B (RED) design.
  - 2. System A(BLUE) will be backed up by a dedicated UPS.
  - 3. System B(RED) will be from a dedicated utility circuit.
  - 4. Outlet type is L6-30 and L5-20.
  - 5. All power is to be run in conduit.
  - 6. Lighting will be installed above each isle.
- D. Mechanical
  - 1. TDRs will have redundant cooling designed to maintain 72 degrees F at mid rack.
    - a. Primary cooling is from the facility cooling system via a dedicated source.

- b. Secondary cooling is from a standalone split or ceiling mount source.
  - c. The secondary system will be fed from the facility generator equipment electrical source if available.
  - d. The coordination scheme between primary and secondary cooling systems can be accomplished by setting the primary system to 72 degrees F and the secondary system to 75 degrees F.
- E. Security
- 1. Doors will be fitted with an auditable card reader.
- F. Fire System
- 1. TDRs will utilize the facility fire detection and suppression systems.
  - 2. Sprinkler heads should have a 200-degree fuse.
  - 3. Sprinklers should be protected from accidental activation.
- G. Monitoring
- 1. TDRs will be monitored using Eaton/Foreseer.
  - 2. Run 3 foreseer cables to each TDR.
  - 3. One Cat 6a F/UTP cable to each UPS.

### PART 3 - EXECUTION

#### 3.1 COMMON REQUIRED CHARACTERISTICS FOR TDR, TEC, & TSER

- A. SECURITY - COMMON
- 1. Any visitor, vendor, or contractor requiring access to a Technology Room, who does not have appropriate approvals or clearances, must be escorted by a properly credentialed tech from the appropriate system.
  - 2. The main technology equipment shall be secured in a dedicated, locked Technology Room.
  - 3. Unused access jacks should be disconnected from the patch panels, and unused switch ports disabled.
  - 4. Technology Rooms shall be dedicated to the data and telecommunications functions.
  - 5. Access to the Technology Room shall be restricted to authorized service personnel and shall not be shared with building services that may interfere with the main networking interfaces, the networking equipment, the application servers, data storage devices, and telecommunications equipment systems.
  - 6. Technology Rooms shall not be used for building maintenance services, custodial services, or be used for general storage.
  - 7. Security cameras may be installed in each Technology Room upon owner's preference.
    - a. At entrances
    - b. At the end of each row of equipment racks
    - c. In electrical and mechanical rooms serving the Technology Room
    - d. Approved camera manufacturers: Axis and Bosch
  - 8. Access to a Technology Room shall be restricted and controlled by an auditable access control system. The access control system shall comply with the requirements of this document.
  - 9. All secure data areas must be secured by an auditable badge reader system.
    - a. Refer to plans or quotes for detailed information
    - b. Approved supplier: Intermountain Lock and Security Supply / 3106 S Main St / Salt Lake City, UT 84115 / 801-486-0079
    - c. Owner of security locks and badge readers: Intermountain Healthcare Data Center
    - d. For programing on the Medeco XT Electronic Keys contact: Intermountain Healthcare Data Center
- B. PHYSICAL ENVIRONMENT
- 1. The Technology Room shall be in a dry area not subject to flooding and should be as close as possible to the electrical service room in order to reduce the length of the bonding conductor to electrical grounding system.

2. The Technology Room shall be in an accessible, non-sterile area.
3. Access to the Technology Room shall be directly off a corridor and not through another space.
4. The Technology Room shall be located to avoid large ducts, beams, and other building elements that may interfere with proper cable routing and may limit future access.
5. Mechanical and electrical equipment or fixtures not directly and exclusively related to the support of the Technology Room shall not be installed in, pass through, or enter the Technology Room.
6. Technology rooms shall not be located on exterior walls.
7. Technology rooms shall not have windows or other exterior openings.

### 3.2 TECHNOLOGY DISTRIBUTION ROOM (TDR) / DATA CLOSET

#### A. ELECTRICAL ENVIRONMENT

1. Separation from sources of EMI shall be in accordance with ANSI/TIA/EIA-569-C and local codes.
2. Communication grounding/earthing and bonding shall be in accordance with applicable codes and regulations. It is recommended that the requirements of IEC/TR3 61000-5-2 - Ed. 1.0, ANSI-J-STD-607-C, or both be observed throughout the entire cabling system.
  - a. All racks, equipment frames, furniture, flooring, ductwork within the IT space shall be bonded to the Central Ground bar provided and installed by Division 26.
    - 1) No AC electrical equipment bonding will be done at the Central Ground Bar. AC electrical grounding and bonding will be done according to the NEC.
3. Some TDRs will require redundant power and data feeds. See plans and drawings.
4. Lighting in the TDRs should be a minimum of 500 lx (50-foot candles) at the lowest point of termination.
  - a. Light switch should be easily accessible when entering the room.
  - b. Lighting will be fed from the generator system or have fixtures with battery backup.
5. A minimum of two dedicated duplex or two dedicated simplex electrical outlets, each on a separate 120V 20A circuit, should be provided for equipment power. Additional convenience duplex outlets should be placed at 1.8 m (6 ft) intervals around the perimeter walls.
  - a. Only twist lock receptacles will be used for rack power points. Type L-6-30R for 208 volt and type Nema L-5-20R for 120 volt
6. All power is to originate from the facilities generator backup system with one system (A-B) originating from the critical system.
7. All circuits serving the TDR and the equipment within it shall be dedicated to serving the TDR.
8. TDRs shall be connected by a backbone of insulated, #6 (minimum) to 3/0 AWG stranded copper cable between all technology rooms. This cable shall be provided and installed by Division 26.

#### B. MECHANICAL ENVIRONMENT

1. Reliable cooling shall be provided.
  - a. Based on criticality tiering structure individual rooms may require redundant, concurrently maintainable cooling systems.
  - b. Tier structure level shall be determined from the design guide.
2. Heat load shall be calculated at 4KW per equipment rack
3. Temperature and humidity in the TDR shall be controlled to an operating range of 64 to 75 degrees F (18 to 24 degrees C) with 30 to 55 percent relative humidity.

#### C. EQUIPMENT

1. Each TDR shall be connected to the TEC (Technology Equipment Center) to provide a building-wide network and communications system.
2. All racks, cabinets, sections of cable tray, and metal components of the technology system that do not carry electrical current shall be grounded.

### 3.3 TECHNOLOGY EQUIPMENT CENTER (TEC) / DATA ROOM

#### A. ELECTRICAL ENVIRONMENT

1. The TDR and TEC electrical environments shall match with the following exceptions:
2. All circuits serving the TEC and the equipment within it shall be dedicated to serving the TEC.

#### B. MECHANICAL ENVIRONMENT

1. TEC and TSER have the same mechanical environment.
2. Reliable cooling shall be provided.
3. Heat load shall be calculated at 4KW per equipment rack
4. Temperature and humidity in the TEC shall be controlled to an operating range of 64 to 75 degrees F (18 to 24 degrees C) with 30 to 55 percent relative humidity.

#### C. EQUIPMENT

1. Each TEC shall be connected to the TSER (Telecommunications Service Entrance Room) to provide an enterprise-wide network and communications system.
2. All racks, cabinets, sections of cable tray, and metal components of the technology system that do not carry electrical current shall be grounded.

### 3.4 TELECOMMUNICATION SERVICE ENTRANCE ROOM (TSER) / D-MARC

#### A. PURPOSE

1. The TSER (Telecommunications Service Entrance Room) equipment subsystem shall consist of shared (common) electronic communications equipment in the TEC or the TSER required to interface this equipment and distribution hardware to the transmission media of enterprise Wide Area Network (WAN) infrastructure.
2. The TSER shall be equipped to contain telecommunications equipment, cable terminations, and associated cross-connects.
  - a. Note that the AIA/State guidelines specify that the minimum size for a TSER is 12' by 14'.
  - b. Doors shall swing out of the room to provide maximum available space and rapid egress.
    - 1) Exception: where prohibited by fire or safety code.
3. The TSER shall be dedicated to the telecommunications function.

#### B. MECHANICAL ENVIRONMENT

1. Reliable cooling and heating shall be provided.
2. Temperature and humidity in the TSER shall be controlled to an operating range of 64 to 75 degrees F (18 to 24 degrees C) with 30 to 55 percent relative humidity.

#### C. EQUIPMENT

1. The TSER (Telecommunications Service Entrance Room) shall be connected to the specified WAN equipment to provide connectivity to the enterprise-wide network and communications system.
2. All racks, cabinets, sections of cable tray, and metal components of the technology system that do not carry electrical current shall be grounded.

END OF SECTION

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## SECTION 271116

### CABINETS, RACKS, FRAMES, AND ENCLOSURES

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Cabinets and racks specifications are in TIA569-C and in the ET pages of the plans.

#### PART 2 - PRODUCTS

##### 2.1 APPROVED PRODUCT

###### A. OPEN RACKS

1. For rack-mounted installations in a telecommunications room the installer shall use a 19 inch by 3-inch-deep equipment rack.
  - a. Equipment Rack 19" X 8', 52 RU, Black – Chatsworth 55053-715
  - b. Equipment Rack 19" X 7', 45 RU, Black – Chatsworth 55053-703
  - c. Exception: Where other size cabinets are specified by design team at owner's direction

###### B. WIRE MANAGERS

1. Part Numbers
  - a. Vertical Wire Manager, Double Sided, Black 10" wide x 8' tall – Chatsworth 40096-715
  - b. Vertical Wire Manager, Double Sided, Black 10" wide x 7' tall – Chatsworth 40096-703
  - c. Horizontal Wire Manager, 4U – Panduit PEHF4
2. Typical Standard Layout
  - a. Layout is 10" vertical manager, then 19" rack, then 10" vertical manager, then 19" rack, then 10" vertical manager.
  - b. Where more than 2 racks are called for, maintain the pattern of 10" vertical wire management on the ends, and 10" vertical management between racks.

###### C. CABINETS

1. Standard Cabinet
  - a. 2-Sided Cabinet – Vertiv E4562121120001S
  - b. 1-Sided Cabinet – Vertiv E4562122120001S
2. Wall Mount Cabinet
  - a. Vertical Wall Mount Cabinet – Legrand VWMSD-4RU-42-B
  - b. Vertical Wall Mount Cabinet – Legrand VWMSD-8RU-42-B
  - c. Fixed Mounting Rail Kit – Legrand VWM-RR-4RU
  - d. Fixed Mounting Rail Kit – Legrand VWM-RR-8RU
  - e. Pivoting Mounting Rail Kit – Legrand VWM-PIV-4RU
  - f. Fan Kits with 115 VAC fans – Legrand VWMFK-115
  - g. Top Brush Grommet Kit – Legrand VWMBGK
  - h. Circular Knockout Grommet Kit – Legrand VWMGR-30

END OF SECTION

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## SECTION 271119

### TERMINATION BLOCKS AND PATCH PANELS

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Requirements of the following Division 26 sections apply to this section
  - 1. Basic electrical requirements
  - 2. Basic electrical materials and methods
  - 3. Grounding, Earthing, and Bonding

#### PART 2 - PRODUCTS

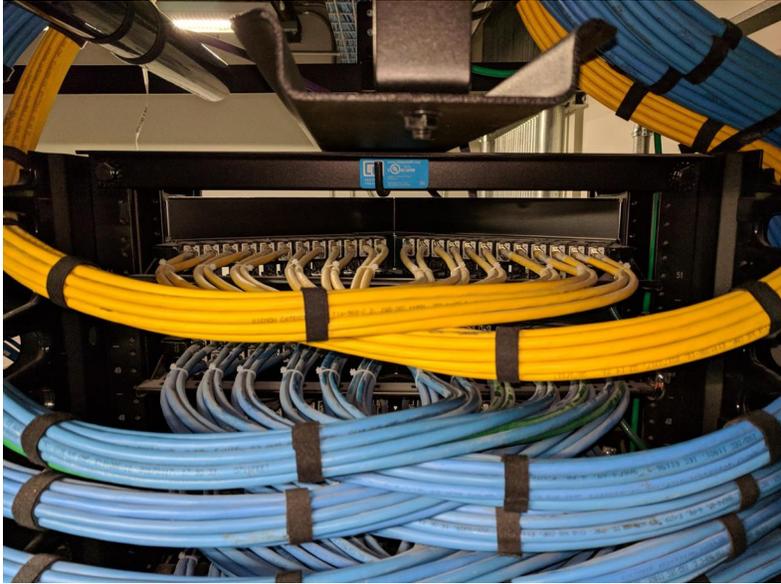
##### 2.1 APPROVED PRODUCT

- A. PATCH PANELS – COPPER
  - 1. 48 Port CAT 6A Shielded, 1RU Angled Patch Panel with Outlets – Siemon Z6AS-PA-48A
  - 2. 48 Port CAT 6A Shielded, 1RU Flat Patch Panel with Outlets – Siemon Z6AS-PNL-U48K
  - 3. 24 Port CAT 6A Shielded, 1RU Flat Patch Panel with Outlets – Siemon Z6AS-PNL-U24K
  - 4. 48 Port CAT 5e, 2RU Angled Patch Panel, 110 Style – Siemon HD5-48A
  - 5. 48 Port CAT 5e, 2RU Flat Patch Panel, 110 Style – Siemon HD5-48
  - 6. 24 Port CAT 5e, 1RU Angled Patch Panel, 110 Style – Siemon HD5-24A
  - 7. 24 Port CAT 5e, 1RU Flat Patch Panel, 110 Style – Siemon HD5-24
  - 8. 19" Angled Blank Filler Panel, 1U, Black – Siemon PNL-BLNKA-1
    - a. Provide blank fillers where appropriate.
  - 9. 19" Flat Blank Filler Panel, 1U, Black – Siemon PNL-BLNK-1
    - a. Provide blank fillers where appropriate.
- B. PATCH PANELS – FIBER
  - 1. Rack Mount Fiber Enclosure – Siemon RIC3-48E-01
  - 2. Wall Mount Fiber Enclosure – Siemon SWIC3G-AA-01
  - 3. Blank Adapter Plate, Black – Siemon RIC-F-BLANK-01
  - 4. 12F-LCUPC-SM-Loaded-Splice Cassette - Siemon – RSC12-LCUSMA-B1
- C. CABINET PATCH PANEL – FIBER
  - 1. Lightstack Surface Mount Module Enclosure – Siemon – LSE-01
  - 2. Lightstack Surface Mount Splice Enclosure – Siemon – LSS-01
  - 3. LightStack LC Adapter Plate – Siemon LS-LS12-01C-AQ

#### PART 3 - EXECUTION

##### 3.1 INSTALLATION

- A. For angled patch panels, the terminations shall cross in the back to the opposite path of the patch panel to maximize available cable bend radius.
- B. See illustration below in this section:



END OF SECTION

## SECTION 271300

### BACKBONE CABLING

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawing and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.
- B. Section 27 05 28 – Pathways for Communications Systems.

##### 1.2 DEFINITIONS

- A. INTRA-BUILDING CABLING
  - 1. Cable that runs between telecommunications rooms (TRs) inside a building. Can be vertical or horizontal in physical orientation. It consists of the backbone transmission media between these locations and the associated connecting hardware terminating this media.
- B. INTER-BUILDING / CAMPUS CABLING
  - 1. Cable that runs between buildings in a campus environment. It is normally a first-level backbone cable beginning at the main cross-connect in the equipment room of the hub building and extending to the intermediate cross-connect in the equipment room of a satellite building. Campus Backbones require optical fiber cable to be installed to support high speed data applications.
  - 2. Customer owned outside plant (OSP) cabling.

#### PART 2 - PRODUCTS

##### 2.1 PERMITTED BACKBONE MEDIA

- A. Cables allowed for use in the backbone include:
  - 1. CAT 6A F/UTP Riser, Blue, Data – Siemon 9A6R4-A5-06-R1A
  - 2. CAT 6A F/UTP Plenum, Blue, Data – Siemon 9A6P4-A5-06-R1A
  - 3. 50 Pair Category 3 Riser Cable Gray – General Cable 2133161 or equal
  - 4. Fiber Optic Cable, Single-mode, 24 Strand, Armored Indoor/Outdoor Cable, Black – Siemon 9BG8P024L-E201A
  - 5. Fiber Optic Cable, Single-mode, 24 Strand, Armored, Riser Cable, Yellow – Siemon 9BC8P024L-205A
  - 6. Fiber Optic cable, Multi-mode, OM4, 12 Strand, Armored, Riser Cable, Aqua – Siemon 9BC5P012G-T512A (Data Centers must be OM4 or better)
- B. The cable shall support voice, data and imaging applications. The bending radius and pulling strength requirements of all backbone cables shall be observed during handling and installation.
- C. Multi-pair twisted pair cable is intended to support analog voice applications and shall be tested for continuity only.
- D. In addition to meeting the applicable performance specifications, all copper and optical fiber cable shall be appropriate for the environment in which it is installed.

##### 2.2 MEDIA PRODUCTS

- A. COPPER

1. The total channel length between the Campus Distributor/Main Cross-connect and to any floor Distributor/Horizontal Cross-connect shall not exceed the following length limits for copper cabling:
  - a. 2,000 m (6,560 ft) for balanced twisted pair for PBX/Class A (100 kHz) applications.
  - b. 200 m (656 ft) for balanced twisted pair for Class B ( $\leq$  1 MHz) applications.
  - c. 100 m (328 ft) for balanced twisted-pair categories 6, 6A & 7 (per Backbone segment when providing a two-level Backbone).
- B. MULTIMODE OPTICAL FIBER
  1. See Siemon website for supportable fiber distances
    - a. Laser qualified 50/125 $\mu$ m multimode fiber optical fiber cables shall be in compliance with the following standards ISO/IEC 11801:2002 OM3, ANSI/TIA-568-C.3, ANSI/TIA-568-C.1 and Telcordia GR-409-CORE as well as the guaranteed application distances, attenuation, bandwidth, and group index of refraction requirements.
    - b. Specifications:
      - 1) Shall support 10GBASE-SX for all horizontal workstations, risers and short length backbone (<300 m) locations.
      - 2) Constructed for overfilled launch (OFL) and restricted mode launch (RML) bandwidth to ensure compatibility with both LED and laser light sources.
      - 3) Have an Aqua Outer Jacket and be available in cable ratings including OFNR and OFNP.
- C. SINGLE MODE OPTICAL FIBER
  1. See Siemon website for supportable fiber distances
  2. Single-mode optical fiber cable shall be used for 1st and 2nd Level Backbone applications only.
  3. All fiber is to fusion spliced terminations.

## PART 3 - EXECUTION

### 3.1 TOPOLOGY

- A. The Backbone cabling shall use a conventional hierarchal star topology.
  1. There shall be no more than two (2) levels of cross-connects between the campus distributor/main cross –connect (CD/MC) and any given floor distributor/horizontal cross-connect (FD/HC).
  2. From the FD/HC no more than one cross-connect shall be passed through to reach the CD/MC.
- B. Splicing of UTP, F/UTP and S/FTP copper cables is not permitted.

### 3.2 TYPICAL TDR BACKBONE

- A. A typical TDR backbone for a hospital campus shall consist of:
  1. Redundant (2 ea.) 24 strand single-mode fiber each routed in a separate path.
  2. One 50 pair copper feed line.

END OF SECTION

**SECTION 271500  
HORIZONTAL CABLING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.
- B. Section 27 05 28 - Pathways for Communications Systems

**1.2 SUMMARY**

- A. This section includes requirements and guidelines for the installation of F/UTP, ScTP, and Fiber horizontal cabling.
  - 1. Horizontal cable and its connecting hardware provide the means of transporting signal between the telecommunications outlet/connector and the horizontal cross-connect located in the communications termination room. This cabling and its connecting hardware are called "permanent link," a term that is used in the testing protocols.

**PART 2 - EXECUTION**

**2.1 HORIZONTAL CABLE**

- A. Quantity
  - 1. Two horizontal cables shall be routed to each work area. Cable connected to information outlets shall be CAT6A F/UTP, 4-pair, 100Ω balanced twisted-pair.
    - a. A work area is approximately 100 sq. ft. and includes the components that extend from the telecommunications outlet/connectors to the station equipment.
    - b. Two (2) standard cables shall be run to each wireless access point location per current best practice.
    - c. One (1) standard horizontal cable may be run to the following locations:
      - 1) Each building control system enclosure as directed by the building controls vendor.
      - 2) Each IP Video Surveillance Camera at each of the designated locations.
      - 3) Each wall phone.
      - 4) Each wall monitor/display.
  - 2. For voice or data applications, 4-pair balanced twisted-pair or fiber optic cables shall be run using a star topology from the telecommunications room serving that floor to every individual information outlet. The customer prior to installation of the cabling shall approve all cable routes.
  - 3. Installation interfaces shall be T568B wiring standards.
- B. Maximum Length
  - 1. All horizontal cables, regardless of media type, shall not exceed 90 m (295 ft.) from the telecommunications outlets in the work area to the Floor Distributor/Horizontal Cross connect (FD/HC) located in the Telecommunication Room.
  - 2. The combined length of jumpers, patch cords inclusive of equipment cables in the Floor Distributor/Horizontal Cross-connect shall not exceed 5m (16 ft.).
  - 3. The maximum length of Work Area equipment cables shall be 5m (16 ft.) if a

MuTOA (Multiple User Telecommunication Outlet) environment exists, then the

- maximum equipment cable shall not exceed 22m (72 ft.) (Lake Park Facility)
5. Terminate all conductors; no cable shall contain un-terminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
- C. Minimum Length
1. It is recommended that a minimum horizontal cable distance of 15m (49 ft.) shall be maintained between the telecommunications room and the work area. This will provide adequate Insertion Loss/Attenuation for applications over 1 Gig.
  2. For installations with consolidation points, a minimum horizontal cable distance of 15m (49 ft.) shall be maintained between the telecommunications room and consolidation point, and 5m (16 ft.) between the consolidation point and the work area. This will provide adequate Insertion Loss/Attenuation for applications over 1 Gig.
- D. Splice Free
1. Each run of balanced twisted-pair cable between Floor Distributor/Horizontal Cross-connect in the telecommunication room and the information outlet at the Work Area shall not contain splices.
  2. Bridged taps and splices shall not be installed in the horizontal cabling
- E. Protection
1. Horizontal distribution cables shall not be run in under slab raceways that are damp or wet locations unless suitably rated for the environment.
    - a. Under slab conduits that are outside of the building are considered wet locations.
- F. Slack -Service Loop – Routing
1. In the work area, a minimum of 1m (3 ft) should be left for balanced twisted-pair cables and fiber cables.
  2. In telecommunications rooms a minimum of 3m (10 ft) of slack should be left for all cable types. This slack must be neatly managed on trays or other support types

## 2.2 SEPARATION

- A. Separation from EMI sources
1. Installation shall comply with BICSI TDMM and TIA/EIA-569-B for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
  2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and EMI Source shall be as follows:
    - a. EMI Source Rating Less Than 2 kVA: A minimum clearance of 5 inches.
    - b. EMI Source Rating between 2 and 5 kVA: A minimum clearance of 12 inches.
    - c. EMI Source Rating More Than 5 kVA: A minimum clearance of 24 inches.
  3. Separation between communications cables in grounded metallic raceways and unshielded power lines or EMI Source shall be as follows:
    - a. EMI Source Rating Less Than 2 kVA: A minimum clearance of 2-1/2 inches.
    - b. EMI Source Rating between 2 and 5 kVA: A minimum clearance of 6 inches.
    - c. EMI Source Rating More Than 5 kVA: A minimum clearance of 12 inches.
  4. Separation between communications cables in grounded metallic raceways and power lines and EMI Source located in grounded metallic conduits or enclosures shall be as follows:
    - a. EMI Source Rating Less Than 2 kVA: A minimum clearance of 2 inches.
    - b. EMI Source Rating between 2 and 5 kVA: A minimum clearance of 3 inches.
    - c. EMI Source Rating More Than 5 kVA: A minimum clearance of 6 inches.



5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or 1 HP and Larger: A minimum clearance of 48 inches.
  6. Separation between Communications Cables and Fluorescent Fixtures: A minimum clearance of 5 inches
- B. Other Clearances
1. Horizontal pathways used for telecommunications cabling shall be dedicated for telecommunications use and not shared by other building services.
  2. In a false ceiling environment, a minimum of 75 mm (3 in) shall be observed between the cable supports and the false ceiling.

## 2.3 PATHWAY

- A. Cable Tie Wraps
1. Cable Tie Wraps are not permitted as a pathway device or support.
  2. Tie Wraps shall only be used to provide strain relief at termination points.
  3. Tie wraps shall not be over tightened to the point of deforming or crimping the cable sheath.
- B. Constraints
1. Horizontal cables shall be installed in "dry" locations that provide protection from moisture levels above the intended operating range of inside plant (ISP) cables.
    - a. If cabling is intentionally or unintentionally exposed to water or otherwise coated with or exposed to direct contact with solvents, paints, adhesives, sealants or other third-party materials, Siemon will not warranty the cabling product or if after the warranty has been issued, it would become void. Therefore, any cabling that has been exposed as listed above, must be removed and replaced.
  2. Horizontal pathways shall be installed or selected such that the minimum bend radius of horizontal cables is kept within manufacturer specifications both during and after installation.
  3. A minimum of a 1" diameter conduit is recommended for new construction. Existing conduits will require the reduction of the number of cables placed in the conduit to meet the required fill ratio.
    - a. The Contractor shall observe the bending radius and pulling strength requirements of the 4-pair balanced twisted-pair and fiber optic cable during handling and installation.
      - 1) 4-Pair UTP, F/UTP, S/FTP bend radius = 4 times outside diameter of cable under no-load conditions. 8 times the outside diameter under load (pulling 110 N/25 lbf.) conditions.
      - 2) Multi-pair or Hybrid cable bend radius = 10 times the outside diameter under all conditions.
      - 3) 2-Fiber and 4 Fiber cables bend radius = 25mm (1 in.) under no-load conditions. 50mm (2 in.) under load (pulling 222 N 50 lbf)
  4. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
  5. Cable that passes through non-Intermountain Healthcare spaces must be installed in conduit.
  6. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.
  7. Do not install bruised, kinked, scored, deformed, abraded cable or otherwise damaged cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
  8. During Cold-Weather Installation, bring cable to room temperature before de-reeling. Heat lamps shall not be used for heating.
- C. Capacity

1. The number of horizontal cables placed in a cable support or pathway shall be limited to the number of cables that will not alter the geometric shape of the cables.
2. Maximum pathway (cable tray/basket tray/wireway) capacity shall not exceed a calculated fill ratio of 50% to a maximum of 75 mm (3 in) inside depth.
3. Maximum conduit pathway capacity shall not exceed a 40% fill. However, perimeter and furniture fill are limited to 60% fill for move and changes. A 40% fill ratio is the maximum fill for CAT6A F/UTP cables.
4. All unused cables shall be removed
  - a. Or labeled at both ends designating future purpose and locations of each end.

END OF SECTION

## SECTION 271513

### COPPER CABLE

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 PALLETTE

- A. Color palette shall be in accordance with Section 27 05 53

##### 1.3 SUMMARY

- A. This Section covers approved F/UTP cable types
- B. Systems shall be CAT6A F/UTP unless a written deviation has been approved.
- C. CAT6A UTP and CAT6A F/UTP shall not be mixed on the same campus.
- D. This cable shall be used for both voice and data applications and shall be plenum rated where required by code

#### PART 2 - PRODUCT

##### 2.1 APPROVED PRODUCT

- A. TYPE 6A F/UTP (foil over unshielded twisted pair) - Siemon
  - 1. CAT 6A F/UTP Riser, (CMR) – Siemon 9A6R4-A5-(XX)-R1A
  - 2. CAT 6A F/UTP Plenum, (CMP) – Siemon 9A6P4-A5-(XX)-R1A
    - a. (XX) = Color – 06, Blue – 05, Yellow – 09, Orange

END OF SECTION

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## SECTION 271543

### FACEPLATES AND CONNECTORS

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 DEFINITION

- A. Work-Area Cabling
  - 1. The work area is comprised of work area outlet/connectors, faceplates, outlet boxes and equipment cords. It acts as the interface to the horizontal cabling from the horizontal cross-connect (HC) to telephone, network equipment, wireless access points (WAP) and OIP devices.

#### PART 2 - PRODUCT

##### 2.1 OUTLETS

- A. Category 6A Jack – Siemon Z6A-S(XX)
  - 1. Use (XX) to specify color.
  - 2. Universal design allows the same outlet to be mounted in a flat or angled orientation.
- B. Category 6A Z-Plug WO Latch Protector – Siemon ZP1-6AS-(00)S
- C. Voice Outlet, Single Gang Faceplate, White W/Wall Hung Phone W/6A Insert – Siemon MX-WP-Z6AS-SS

##### 2.2 FACEPLATES/BOXES

- A. 10G Single Gang Faceplate, White, 4 Position – Siemon 10GMX-FP-04-02
- B. MAX Single Gang Faceplate, White – Siemon MX-FP-S-(XX)-02
  - 1. USE (XX) to specify the number of ports.
- C. MAX Single Gang Faceplate, Stainless Steel, 4 Position, with Label Holder – Siemon MX-FP-S-04-SS-L
  - 1. To be used in the Operation Rooms
- D. Surface Mount Box, White, 2 Position – Siemon MX-SMZ2-02
- E. Furniture Faceplate, Black – Siemon MX-UMA-01
- F. Conference Room Table Inserts 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 271619

### PATCH CABLES

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. This section is issued as a guide for patch cable installations in the Data Center, wiring closets (TDR) and user areas where patch cables are required for connectivity to IP and TDM phones, and IP data connectivity needs for Intermountain Healthcare. All patch cables will support voice, data, and imaging applications within the Intermountain Healthcare Enterprise.

#### PART 2 - PRODUCTS

##### 2.1 APPROVED PRODUCT

- A. Patch Cable, CAT 6A Shielded - Siemon SP6A-S (XX)-(XX)
  - 1. Use 1<sup>st</sup> (xx) to specify length. Use 2<sup>nd</sup> (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

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**SECTION 275113**  
**OVERHEAD PAGING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. The Primary Division 27 subcontractor shall be accountable to closely coordinate the Overhead Paging system with the General Contractor.
  - 1. Division 27 is accountable for including the cabling, equipment, and installation thereof in their work; based upon the project drawings.
- B. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- C. Requirements of the following Division 26 Sections apply to this Section:
  - 1. Basic Electrical Requirements.
  - 2. Basic Electrical Materials and Methods.

**1.2 SUMMARY**

- A. This Section includes the installation of an overhead paging system that shall be accessible through the telephone system. It includes requirements for paging system components including, but not limited to, the following:
  - 1. Speaker systems.
  - 2. Wiring
- B. This section requires that rough-in materials for this section be provided by the Division 26 installer for installation under Division 26. Rough-in materials include but are not limited to conduit, junction boxes, alternative raceway, and device enclosures. Cable for this section is to be provided by the Division 27 installer.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following (for each type of product) as listed in the drawings and these specifications:
  - 1. Atlas Sound
  - 2. Bogen
  - 3. Quam

**2.2 SYSTEM REQUIREMENTS**

- A. General: Provide complete and fully functional overhead paging systems using materials and equipment of types, sizes, ratings, and performances as indicated. Use materials and equipment that comply with referenced standards and manufacturers' standard design and construction in accordance with published product information. Coordinate the features of materials and equipment so they form an integrated system with components and interconnections matched for optimum performance of specified functions.

**2.3 EQUIPMENT AND MATERIALS**

- A. General: Provide all solid-state components fully rated for continuous duty at the ratings indicated or specified. Select equipment for normal operation on input power supplied at 105-130 V, 60 Hz.

- B. Loudspeakers shall be an 8" dual cone type with a 10-ounce, ceramic magnet. Power handling rating shall be 5 watts continuous with a sensitivity of 94 dB at 1 meter/1 watt and frequency response of +/- 5 dB from 80 to 15,000 Hz. The speaker shall have an impedance of 8 ohms and be equipped with a 70-volt matching transformer with power taps from 0.5 to 4 watts. Recessed ceiling mounted speaker assemblies shall mount on an Atlas Sound T720-8-A or similar baffle on a T95-8 series or similar enclosure.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine conditions, with the Installer present, for compliance with requirements and other conditions affecting the performance of the Overhead Paging System work.
- B. Do not proceed until unsatisfactory conditions have been corrected.
- C. Verify compliance of the following items before beginning sound equipment installation.
  - 1. No cables spliced except at standard barrier terminal blocks inside equipment cabinet.
  - 2. Cables marked at each end with permanent wire labels such as Brady or equal.
  - 3. Isolated ground run back to main electrical panel from paging equipment cabinet.
  - 4. Specified conduit, cables, speaker enclosures and equipment cabinets are properly installed.

#### **3.2 INSTALLATION**

- A. General: Install system in accordance with NFPA 70 and other applicable codes. Install equipment in accordance with manufacturer's written instructions.
- B. Speakers:
  - 1. Confirm polarity of speaker before installation and wire to maintain uniform polarity.
  - 2. Mount transformers with screws securely to speaker brackets or enclosures.
  - 3. Neatly mount speaker grilles, panels, connector plates, etc., tight, plumb, and square unless indicated otherwise on drawings.
  - 4. Provide brackets, screws, adapters, springs, rack mounting kits, etc., recommended by manufacturer for correct assembly and installation of speaker assemblies and electronics components.
  - 5. Identification:
    - a. Legibly identify user operated system controls and system input/output jacks using engraved, permanently attached laminated plastic plates or imprinted Lexon labels. Label equipment and controls within equipment cabinet using similar labels or "Kroy" type labels.
- C. Repairs: Wherever walls, ceilings, floors, or other building finishes are cut for installation, the contractor shall be responsible to repair, restore, and refinish to original appearance.

#### **3.3 FIELD QUALITY CONTROL**

- A. Manufacturer's Field Services: Provide services of a factory authorized service representative to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the system.
- B. Pre-testing: Upon completing installation of the system, align, adjust, and balance the system and perform a complete pretest. Determine the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed. Replace malfunctioning or damaged items with new, and retest until materials satisfactory performance and conditions are achieved.

#### **3.4 COMMISSIONING**

- A. Occupancy Adjustments: When requested by the Architect or the Sound/Acoustical Consultant within one year of date of substantial completion, provide on-site assistance in adjusting sound levels, resetting matching transformer taps, and adjusting controls to suit actual occupied conditions. Provide two trips for this purpose.

**3.5 CLEANING AND PROTECTION**

- A. Prior to final acceptance, clean system components and protect from damage and deterioration.

END OF SECTION

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**SECTION 275223**  
**NURSE CALL SYSTEM**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. This Section includes system hardware and software that shall consist of nurse/patient communication systems comprised of nurse consoles, control stations, dome lights, entertainment cords, call cords, pull cord stations, emergency push button stations, code blue stations and wiring. The Rauland V system shall be installed in the surgical center and the Rauland 4000 system shall be installed for the radiology and PT areas.
- B. All necessary equipment required to meet the intent of these specifications, whether or not enumerated within these specifications, shall be supplied and installed to provide a complete and operating nurse/patient communications network in the indicated areas.
- C. This section requires that rough-in materials for this section be provided by the Division 26 installer for installation under Division 26. Rough-in materials include but are not limited to conduit, junction boxes, alternative raceway, and device enclosures. Cable for this section is to be provided by the installer for this section.

**1.3 SUBMITTALS**

- A. Any supplying contractor proposing a system or equipment which does not meet the basic functional specifications as stated herein must provide full statement of exceptions 10 days prior to the time of bid. This option shall be exercised at the discretion of the owner/specifying authority.
- B. Prior to commencement of work, the supplying contractor shall submit six (6) complete submittal sets which shall include the following:
  - 1. Cabling Diagrams: Single-line block diagrams showing cabling interconnection of all components for this specific equipment. Include cable type for each interconnection.
  - 2. Wiring Diagrams: Power, signal, and control wiring.
  - 3. Station Installation Details: For built-in equipment; dimensioned and to scale.
  - 4. Equipment Cabinet Drawings: Dimensioned and to scale.
- C. Coordination Drawings: Detail system components that fit, match, and line up with provisions made in equipment specified in other Sections or in separate contracts:
  - 1. Patient head-wall units or wall elevations.
  - 2. Nurse Call Master consoles.

- D. **Manufacturer Certificates:** Signed by manufacturers certifying that nurse call equipment complies with requirements.
- E. **Field Tests Reports and Observations:** Include record of final adjustments certified by Installer.
- F. **Operation and Maintenance Data:** For nurse call equipment to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 "Closeout Procedures " and "Operation and Maintenance Data," include the following:
  - 1. Operating instructions.
  - 2. Troubleshooting guide.
  - 3. Wiring diagrams and terminal identification.
  - 4. Equipment parts list.
  - 5. Product data for types and sizes of wires and cables used.
- G. **Warranty Statement:** Special warranty requirements as specified in this Section.

#### **1.4 QUALITY ASSURANCE**

- A. **Installer Qualifications:** Manufacturer's authorized representative who is trained and approved for installation of units required for this Project. The Installer shall be able to fully support the listed service and warranty requirements as specified herein.
- B. **Manufacturer Qualifications:** A firm experienced in manufacturing equipment similar to that indicated for this Project and that maintains technical support services capable of providing user with training, parts, and emergency maintenance and repair with a 24-hour-maximum response time.
- C. **Source Limitations:** Obtain nurse call equipment components through one source from a single manufacturer.
- D. **Electrical Components, Devices, and Accessories:** Listed and labeled according to UL 1069 as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

#### **1.5 COORDINATION**

- A. **Coordinate patient control units with items controlled that are not part of nurse call equipment.**
  - 1. TV: Channel selection and volume.
- B. **Coordinate wiring paths and maintenance access at locations listed below. Coordinate trim features and finishes at these locations to present a unified design appearance.**
  - 1. Patient head-wall installations.
  - 2. Patient consoles.
  - 3. Nurse station.

#### **1.6 WARRANTY**

- A. **The installing contractor shall provide a warranty on the system which shall include all necessary labor and equipment to maintain the system(s) in full operation for a period of one year from the date of acceptance.**

- B. Manufacturer shall provide, free of charge, product firmware/software upgrades throughout the warranty period for any product feature enhancements.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Rauland-Borg Corporation.

### **2.2 SYSTEM REQUIREMENTS**

- A. Coordinate the features of materials and equipment to form an integrated system. Match components and interconnections for optimum performance of specified functions. System shall be microprocessor based, but independent of the facility's local area network, with a segmented platform configuration providing that system or equipment failures are locally mitigated without global system shutdowns or resets.
- B. Expansion Capability: Equipment ratings, housing volume, spare keys, switches, relays, annunciator modules, terminals, and cable conductor quantities adequate to increase the number of stations in the future by 20 percent above those indicated without adding internal or external components or main trunk cable conductors.
- C. Resistance to Electrostatic Discharge: System, components, and cabling, and the selection, arrangement, and connection of materials and circuits, shall be protected against damage or diminished performance when subjected to electrostatic discharges of up to 25,000 V in an environment with a relative humidity of 20 percent or less.
- D. Equipment: Solid state, modular.
- E. Wall-Mounted Component Connection Method: Components connect to system wiring in back boxes with factory-wired plug connectors.

### **2.3 FUNCTIONAL PERFORMANCE**

- A. Station Selection: Master station is capable of selectively communicating with other stations or groups of stations on its system by operating selector switches.
- B. Master Station Privacy: Capable of conversing with individual stations in complete privacy.
- C. Hands Free: Called station is capable of conversing hands free.
- D. Annunciation: At the master station, a tone announces an incoming call and a visual indication is displayed on the console and identifies the calling station and indicates the priority of the call. LED/LCD lighted displays or touchscreens identify stations selected for outgoing calls.

- E. System Reset at Master Station: When a normal incoming call is canceled, associated lights and audible tones are extinguished, and the system is reset when the station switch is returned to the normal position after responding to a call.
- F. Patient Station Call: Activates the call-placed lamp at patient station, zone, and corridor dome lights. It sounds a tone and lights the call lights at staff/duty stations and actuates annunciation at the master station. When the calling station is selected at the master station, the patient can converse with the master station without moving and without raising or directing the voice. During voice communications, entertainment audio at the calling station is automatically muted.
- G. Pull-Cord Call Station and Emergency-Call Station Call: Activates call-placed lamp and corridor dome light, and flashes zone light. Master station tone pulses with visual display for that room flashes. When master station acknowledges the call, the tone stops but the display and lights continue to function until the call is canceled at the point of origin.
- H. Code Blue Station Call: Activates the call-placed lamp at the station and actuates annunciation at the master station. When the called station is selected at the master station, the tone stops but the display and lights continue to function until the call is canceled at the point of origin.
  - 1. Code Blue: Unique sound and light pattern, indicating the highest priority emergency.
- I. Handset Operation: Lifting handset on master station disconnects speaker microphone and transfers conversation to the handset.
- J. Station Privacy: No patient, staff, or duty station can be remotely monitored without the lighting of a warning lamp at the monitored station.
- K. Patient Station Cord Set: When a patient station cord-set plug is removed from the jack in the station faceplate, a patient station call is initiated as described above. When the master station call button for the station is pressed, the tone stops but lights continue to flash until the call is canceled at the point of origin or the plug is reinserted or replaced with a dummy plug.
- L. Patient Station/Pillow Speaker: Controls entertainment volume and channel selection. Speaker is used for both nurse communication and entertainment sound. Entertainment sound is automatically muted when station is communicating with master station. "Nurse" call button on the unit initiates a patient station call.

## 2.4 EQUIPMENT DESCRIPTIONS

- A. Master Station: Speaker-microphone unit with operating controls.
  - 1. LED/LCD displays with "button" controls or touchscreen technology to designate location and priority of calling stations and called stations.
    - a. Pulse rate of incoming-call lights denotes priority of calls awaiting response.
  - 2. Station Selection Controls: Touchscreen controls or console "button" controls select stations for two-way voice communications.
  - 3. Signal Tones: Announce incoming calls.
  - 4. Volume Control: Regulates incoming-call volume.
  - 5. Privacy Handset with Hook Switch: Of the type that does not require push-to-talk switch, attached to each station, unless otherwise indicated.
- B. Central Equipment Cabinet: Lockable metal. Houses amplifiers, tone generators, power supplies, controls, terminal strips, and other components.
  - 1. Amplifier: With fidelity and overall gain necessary to achieve the sound transmission and reproduction characteristics specified, considering interoperability with the installed speakers/microphones and wiring.



- a. Power Output: Not less than 3 W at a total harmonic distortion not exceeding 5 percent.
  - b. Hum and Noise: 60 dB below full output with normal input open.
  - c. Volume Control: Concealed within the amplifier unit to control the volume of sound reproduced at all stations.
  - d. Protection: Circuit to prevent damage to the amplifier in case shorted or open output.
2. System Power Supply: For low-voltage operation of the call system.
    - a. Equipment Rating: Suitable for continuous operation between 32 and 120 deg F (0 and 49 deg C), from a primary line voltage between 105- to 125-V ac, 60 Hz.
    - b. Output: Regulated low voltages with protection against overloads. Line-to-load regulation shall not exceed 2-1/2 percent with ripple and noise remaining below the 10 mV, RMS level.
    - c. Overload Protection: Electronic fold-back circuit set to limit the volt-ampere output to less than 100 VA during overloaded or shorted output. Restore power output automatically on removal of overload without resetting circuit breakers or replacing fuses.
  3. Power-on indicator lamp.
  4. Surge Protective Device: Comply with Division 26 Section "Transient Voltage Suppression" for auxiliary panel suppressors, with LED indicator lights for power and protection status.
  5. Battery Backup Unit: Sealed nickel-cadmium, wet-cell battery supplies power through an automatic switch when normal power fails, for a period of not less than six minutes at rated output.
    - a. Automatic retransfer to normal power, after a 15-minute time delay.
    - b. Two-rate battery charger with an automatic trickle rate and a recharge rate.
- C. Speaker/Microphones:
1. Type: Permanent-magnet, dynamic or ceramic, protected against dust and humidity.
  2. Sound Reproduction: Sound level of 90 dB plus or minus 3 dB at a distance of 48 inches on the axis without overdriving or distorting any frequencies between 300 and 3000 Hz when installed in an enclosure or in the pillow speaker.
  3. Power Handling Capacity: Not susceptible to damage from overdriving within the range of power available from the amplifier.
  4. Impedance Matching: Coordinated and matched to the input and output circuits of the amplifier, both for single connection and for group monitoring, to provide the sound reproduction specified. Subsystems or components shall not be combined, which could cause unacceptable distortion such as feedback between pillow speakers and unmuted room speaker/microphone combinations. This protection shall extend throughout the entire range of operation (volume control) of all components.
- D. Single-Patient Station: Each bedside control station shall be capable of the following functions:
1. At least 6 programmable call levels (including associated sub-stations).
  2. Sound Reproduction: Sound level of 90 dB plus or minus 3 dB at a distance of 48 inches on the axis without overdriving or distorting any frequencies between 300 and 3000 Hz when installed in an enclosure or in the pillow speaker.
  3. Entertainment/pillow speaker intercom.
  4. Entertainment muting shall occur when nurse call audio is established.
  5. Support and supervise up to 5 sub-stations including pull-cord, push-button, code blue, staff register, and fire/auxiliary modules.
  6. Provide interface to local equipment alarm contacts (i.e. ventilator, IV drip, fire detector, etc.) to notify console of local alarm condition in patient room.

- E. Staff and Duty Stations: Audible call-tone signal device, speaker microphone with dynamic cone, monitor lamp, reset switch, routine-call lamp, emergency-call lamp, and call push button; assembled under a single faceplate.

## 2.5 MISCELLANEOUS EQUIPMENT COMPONENT DESCRIPTIONS

- A. Emergency-Call Station: Locking-type push button, labeled "Push to Call Help"; reset trigger to release push button and cancel call; and call-placed lamp; mounted in a single faceplate.
- B. Pull-Cord Call Station (Bath): Water-resistant construction. Includes the following, mounted under a single faceplate:
  - 1. Pull-Down Switch: Lever-locking type, labeled "Pull Down to Call Help."
  - 2. Reset trigger.
  - 3. Call-placed lamp.
- C. Call-Button Cord Set (Clinic 4<sup>th</sup> Floor Recovery): Plug and 72-inch white cord; equipped with momentary-action, call-button switch.
  - 1. Ethylene oxide, sterilizable.
  - 2. Washable cord.
  - 3. Palladium switch contacts in high-impact white housing with cord-set strain relief.
  - 4. Attachment: Stainless-steel bed clamp with permanently attached Mylar strap.
  - 5. Quantity: 3 cord sets for every 10 patient beds.
- D. Indicator Lamps: Light-emitting-diode type with 20-year rated life, unless otherwise indicated.
- E. Station Faceplates: High-impact plastic, color by architect. Molded or machine-engraved labeling identifies indicator lamps and controls.
- F. Corridor Dome Lights and Zone Lights: Four-lamp signal lights (minimum).
  - 1. Lamps: Front replaceable without tools, low voltage with rated life of 7500 hours. Barriers are such that only one color is displayed at a time.
  - 2. Lenses: Heat-resistant, shatterproof, translucent polymer that will not deform, discolor, or craze when exposed to hospital cleaning agents.
  - 3. Filters: Two per unit, amber and red.
- G. Cable: Features include the following, unless otherwise indicated:
  - 1. Conductors: Jacketed single and multiple twisted-pair, copper cables. Sizes and types as recommended by equipment manufacturer. All cable shall be plenum rated.
- H. Grounding Components: As specified in Division 26 Section "Grounding."

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Wiring Method: Install wiring in raceway except within consoles, desks, and counters; and except in accessible ceiling spaces, where cable wiring method may be used. Use UL-listed plenum cable in environmental air spaces including plenum ceilings. Conceal cable and raceway wiring except in unfinished spaces.
- B. Install cables without damaging conductors, shield, or jacket.

- C. Do not bend cables, in handling or in installing, to smaller radii than minimums 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 and not more than 6 inches from cabinets, boxes, or fittings.
- F. Wiring within Enclosures: Provide adequate length of conductors. Bundle, lace, and train conductors to terminal points with no excess. Provide and use lacing bars in cabinets.
- 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 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: Retain color-coding of conductors and apply wire and cable marking tape to designate wires and cables so all media are identified in coordination with system wiring diagrams. Label stations, controls, and indications using approved consistent nomenclature.
  - 1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
  - 2. Prepare cable administration drawings to show building floor plans with cable administration point labeling. Identify labeling convention and show labels for terminal hardware and positions, cables, stations and devices and equipment grounding conductors.

### **3.2 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 Division 26 Section "Grounding."

### 3.3 FIELD QUALITY CONTROL

- A. **Manufacturer's Field Service:** Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. **Test Procedure:** Comply with the following:
  - 1. **Schedule tests** a minimum of seven days in advance of performance of tests.
  - 2. **Report:** Submit a written record of test results.
  - 3. **Operational Test:** Perform an operational system test, and demonstrate proper operations, adjustment, and sensitivity of each station. Perform tests that include originating station-to-station and all-call messages and pages at each nurse call station. Verify proper routing, volume levels, and freedom from noise and distortion. Test each available message path from each station on the system. Meet the following criteria:
    - a. **Speaker Output:** 90 dB plus or minus 3 dB, 300 to 3000 Hz.
    - b. **Gain from patient's bedside station to nurse station,** with distortion less than 65 dB (plus or minus 3 dB, 300 to 3000 Hz).
    - c. **Signal-to-Noise Ratio:** Hum and noise level at least 45 dB below full output.
  - 4. **Test Procedure:**
    - a. **Frequency Response:** Determine frequency response of two transmission paths by transmitting and recording audio tones.
    - b. **Signal-to-Noise Ratio:** Measure the ratio of signal to noise of the complete system at normal gain settings, using the following procedure: Disconnect a speaker microphone and replace it in the circuit with a signal generator using a 1000-Hz signal. Measure the ratio of signal to noise and repeat the test for four speaker microphones.
    - c. **Distortion Test:** Measure distortion at normal gain settings and rated power. Feed signals at frequencies of 300, 400, 1000, and 3000 Hz into each nurse call equipment amplifier, and measure the distortion in the amplifier output.
- C. **Retesting:** Rectify deficiencies indicated by tests and completely retest work affected by such deficiencies at Contractor's expense. Verify by the system test that the total system meets these Specifications and complies with applicable standards. Report results in writing.
- D. **Inspection:** Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.

### 3.4 ADJUSTING

- A. **Occupancy Adjustments:** When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sound levels and controls to suit actual occupied conditions. Provide up to three visits to Project during other-than-normal operating hours for this purpose.

### 3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel and caregiver staff to adjust, operate, and maintain nurse call equipment. Refer to Division 1 Section "Closeout Procedures" and "Demonstration and Training."

### **3.6 TRAINING**

- A. Both manufacturer/factory supported and local installer training shall be provided to all nursing staff. Floor nurses/staff shall receive training appropriate to their needs, and likewise, unit secretaries (or any person whose specific responsibilities include answering patient calls and dispatching staff) shall receive operational training appropriate to their needs and charge nurses (or any person whose specific responsibilities include scheduling staff to patient assignments) shall receive operational training appropriate to their needs.
- B. The training shall be comprehensive enough to allow the local in-house technical staff the ability to maintain and service the system themselves, including the making of internal programming alterations and to the extent of programming their own "canned" text messages. Include in the contract any factory training sessions required, trips, expenses, etc. at local or factory locations to provide this level of training.

**END OF SECTION**

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## SECTION 275319

### INTERNAL CELLULAR, PAGING AND ANTENNA SYSTEMS

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Requirements of the following Division 26 Sections apply to this Section:
  - 1. Basic Electrical Requirements.
  - 2. Basic Electrical Materials and Methods.

##### 1.2 SUMMARY

- A. This Section includes the installation of a complete distributed antenna system (DAS).
- B. This section requires that rough-in materials for this section be provided by the Division 26 installer for installation under Division 26. Rough-in materials include but are not limited to conduit, junction boxes, and device enclosures. Cable for this section is to be provided by the DAS (Distributed Antenna System) installer.

#### PART 2 - PRODUCTS

##### 2.1 MANUFACTURERS

- A. Approved Vendor & Installer
  - 1. Hunt Electric
  - 2. Anchorcom LLC
  - 3. Cache Valley Electric

##### 2.2 SYSTEM REQUIREMENTS

- A. General: Provide complete and fully functional DAS system using materials and equipment of types, sizes, ratings, and performances as indicated. Use materials and equipment that comply with referenced standards and manufacturers' standard design and construction in accordance with published product information. Coordinate the features of materials and equipment so they form an integrated system with components and interconnections matched for optimum performance of specified functions.

#### PART 3 - EXECUTION

##### 3.1 INSTALLATION

- A. General: Install system in accordance with NFPA 70 and other applicable codes. Install equipment in accordance with manufacturer's written instructions, and UL, ETL, CSA and other applicable listings.
- B. Install equipment located in TDRs in the assigned rack.
- C. The location of wall mounted equipment will be coordinated with the Data Center Operations.

- D. Specific power requirements will be provided at the beginning of the project.

### **3.2 FIELD QUALITY CONTROL**

- A. Pre-testing: Upon completing installation of the system, align, adjust, and balance the system and perform a complete pretest. Determine the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed. Replace malfunctioning or damaged items with new, and retest until materials satisfactory performance and conditions are achieved.
- B. Provide a heat map of the facility before and after installation is required.

### **3.3 COMMISSIONING**

- A. Occupancy Adjustments: When requested by the Architect or the Electrical Consultant within one year of date of substantial completion, provide on-site assistance in adjusting levels to suit actual occupied conditions. Provide two trips for this purpose.

### **3.4 CLEANING AND PROTECTION**

- A. Prior to final acceptance, clean system components and protect from damage and deterioration.

END OF SECTION



## SECTION 276001

### APPENDIX 01 – DEVIATION REQUEST PROCESS

#### PART 1 - GENERAL

##### 1.1 DEFINITIONS

- A. Cable Plant Deviation
  1. A business need to not fully comply with the requirements of the “Division 27 – Communications and Structured Cabling Specification document”
- B. Cable Plant Deviation Request form.
  1. The document is available from the Facilities Planning team, the Data Center Ops team, or the Infrastructure Cabling team.
  2. Usage:
    - a. The deviation request form shall be used if there is a business need to not comply with the requirements of the “Division 27 – Communications and Structured Cabling Specification document”
    - b. The deviation request form should also be used to propose a change to that document. Always verify that you are using the current version of the Standard before requesting a modification.

#### PART 2 - PROCESS

##### 2.1 STANDARDS MODIFICATION

- A. Check the box and explain why the standard should be modified.

##### 2.2 ALTERNATE PRODUCT

- A. The deviation form must be completed, submitted through channels, and approved prior to any deviation from the specifications. This includes issuing change orders.

##### 2.3 AUTHORIZED SIGNATURES

- A. Both the Standards Holder and the DCO Manager signatures are required for a deviation to be valid.

##### 2.4 DEVIATION REVIEW PROCESS STEPS

- A. First be sure that there is an actual need. Then be certain that your manager, supervisor, or project manager agrees with the requested deviation. Be sure to state this or obtain their signature on the deviation form. By doing so you are confirming that your supervisor or project manager has approved.
- B. The requestor will then complete sections 1, 2, and 3 of the deviation form.
  1. The requestor should then digitally sign in the designated location at the end of Section 3. Do not write in the sections below 3.
- C. Forward the saved copy of this form to the Standards Holder via email.
  1. Email to: [melissa.lopez2@imail.org](mailto:melissa.lopez2@imail.org)
- D. The Standards Holder will then review and evaluate the request. The requestor should be prepared to provide plans, specifications, and competitive bids if requested. Any email threads or meeting discussions regarding the issue will be taken into consideration.
- E. The Standards Holder will then cast an Approve or Deny vote and forward the request to the DCO Manager for a decision.

- F. When the decision has been made by the Operations Manager, the Standards Holder will then notify the requestor by returning the completed and signed form via email.
- G. An approved deviation will have the final disposition button 'Approved' and be signed by at least 2 people. One will be from the Standards Holder, and the other the DCO Manager. Other signatures may be required for specific features and areas such as Safety, Security, Print, Medical group, etc.

## PART 3 - EXECUTION

### 3.1 POST DECISION EXECUTION

- A. DENIED
  - 1. If the requester is not satisfied with the decision, they may file an appeal with the Data Center Operations manager (shawn.folkman@imail.org), who will then escalate the issue to the appropriate business leaders as needed. The decision from the appeal is final.
- B. APPROVED
  - 1. If a deviation is approved for contracted material, labor, or method; the facilities project manager will arrange for fulfillment or contract adjustment as needed via appropriate contract channels such as change orders.

END OF SECTION

## SECTION 276002

### APPENDIX 02 – DOCUMENT REFRESH PROCESS

#### PART 1 - GENERAL

##### 1.1 NOT USED

#### PART 2 - PRODUCTS

##### 2.1 APPROVED PRODUCT

- A. The purpose of this section is to help ensure a current standards document.
- B. The product delivered will be a current revision or version of the Cable Plant Standards Document.
- C. All changes must be approved by Enterprise Infrastructure Cabling team.

#### PART 3 - EXECUTION

##### 3.1 REVIEWS AND UPDATES

###### A. Minor updates

- 1. Changes that do not significantly affect scope of work, or contract pricing will be made, and the Rev number will be updated. (i.e. updated part numbers, etc.)
- 2. Significant changes will be added to the Change Log for review and approval from the DCO/Infrastructure Cabling Team.
  - a. When approved, they will be submitted for approval; and then implemented in the new Version.

###### B. Major updates

- 1. The DCO/Infrastructure Cabling Team will review the entire document at least once every three years.
- 2. This review will coincide with the release of new versions of NFPA70 (National Electrical Code) (2017, 2020, etc. - to be completed by the end of each designated year).
- 3. The review will cover standards adjustments that may be deemed necessary and ensure compliance with applicable codes and standards.
- 4. Upon completion of the reviews and updates, the standards document will be submitted for approval.

END OF SECTION

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**SECTION 276003**

**APPENDIX 03 – DATA CENTER, TEC, TDR PART NUMBERS**

<b>ITEM</b>	<b>MANUFACTURER</b>	<b>PART NO.</b>	<b>DESCRIPTION</b>
Blanking Panel	Upsite Hotlok	10031	Blanking Panel 1U
Blanking Panel	Upsite Hotlok	10033	Blanking Panel 2U
UPS	Eaton	9PX1500R	Eaton Powerware 9PX-1500V
UPS Network Card	Eaton	NETWORK-M	Card for 9PX-1500VA
PDU	Eaton	ePBZ79	Horizontal Mount ePDU 208vac
PDU	Eaton	ePBZ82	Horizontal Mount ePDU 120vac
PDU	Server Technology	C1S24VS-YCFA13C9	Vertical 30A PDU (Blue) for TEC
PDU	Server Technology	C1L24VS-YCFA13C9	Vertical 30A PDU (Red) for TEC
PDU	Server Technology	C2SG36TE-YCMFAM66/C	Vertical 30A PDU (Blue) for Data Centers
PDU	Server Technology	C2LG36TE-YCMFAM66/C	Vertical 30A PDU (Red) for Data Centers
PDU	Server Technology	C2SG36TE-DQME2M66/ZB	Vertical 60A PDU (Blue) for Data Centers
PDU	Server Technology	C2LG36TE-DQME2M66/ZR	Vertical 60A PDU (Red) for Data Centers
UPS	Eaton	K41512000000000	Eaton 9155-15kVA UPS
Modbus Card	Eaton	103005425-5591	Eaton Modbus Card X-Slot
Reverse Transfer UPS System	Eaton	9GPV15C0009E00R2	Eaton 93PM-150kW Reverse Transfer UPS System
CRAC Cooling Unit	Liebert	DE363G	
Vertical Wall Mount Cabinets	Legrand	VWMSD-4RU-42-B	42" 12" 4RU Fixed
Vertical Wall Mount Cabinets	Legrand	VWMSD-8RU-42-B	42" 18" 8RU Fixed
Rail Accessories	Legrand	VWM-RR-4RU	Fixed Mounting Rail Kit, 4RU
Rail Accessories	Legrand	VWM-RR-8RU	Fixed Mounting Rail Kit, 8RU
Rail Accessories	Legrand	VWM-PIV-4RU	Pivoting Mounting Rail Kit, 4RU
Fan Kit	Legrand	VWMFK-115	VWM Fan Kit w/115 VAC Fans (includes 2 fans and mounting hardware) (2 kits needed for 8RU cabinet)
VWM Top Brush Grommet Kit	Legrand	VWMBGK	VWM Top Brush Grommet Kit
Circular Knockout Grommet Kit	Legrand	VWMGR-30	Circular Knockout Grommet Kit
Vertical Wall-Mount Cabinets	Hubbell	IR221APG	Refrigerated cabinet 24"
Vertical Wall-Mount Cabinets	Hubbell	IR321APG	Refrigerated cabinet 36"
Vertical Wall-Mount Cabinets	Hubbell	IR421APG	Refrigerated cabinet 48"
Air Conditioners	Hubbell	IRAC1	Air conditioner for Hubbell refrigerated cabinets
Cylinder	Medeco	100500 G	1 ¼" Mortise Cylinder
Cylinder	Medeco	100400H G	Rim Cylinder, Horizontal Tailpiece
Cylinder	Medeco	EA-100108	Small Format Interchangeable Core (SFIC) Cylinder
Cylinder	Medeco	20200S1 G	Cylinder Package for Schlage
Cam Lock	Medeco	EN-150002-219	7/8" Cam Lock Assembly, Key Retaining

Cam Lock	Medeco	EN-150003-219	1 1/8" Cam Lock Assembly, Key Retaining
Cylinder for Legrand cabinet front door	Medeco	232301S 800 G	Modular Profile Cylinder – 30mm Half Profile - Assembled
Electronic Key	Medeco	94-0271	Medeco Slim Line Key (G2) & Charger Bundle
Programming Station for Small Locations	Medeco	EA-100109	Medeco XT Desktop USB Programming Station (not preferred)
Programming Station for Large Locations	Medeco	EA-100158	Medeco XT Wall USB Programming Station (preferred)
Wall Mount for Wall Programmer	Medeco	94-0294	Medeco XT Remote Wall Programmer Wall Mount Kit
Padlock for use with Electronic Cylinder	Master	6842D045KZ	Padlock
Red C20 C19 Dual Lock 12 gauge 6'	Stay Online	5914	Red C20 C19 Dual Lock 12 gauge 6'
Blue C20 C19 Dual Lock 12 gauge 6'	Stay Online	6766	Blue C20 C19 Dual Lock 12 gauge 6'
Red C14 Locking C15 Notched 14 gauge 6'	Stay Online	9144	Red C14 Locking C15 Notched 14 gauge 6'
Blue C14 Locking C15 Notched 14 gauge 6'	Stay Online	9138	Blue C14 Locking C15 Notched 14 gauge 6'
Red C14 C13 Dual Lock 18 gauge 6'	Stay Online	5656	Red C14 C13 Dual Lock 18 gauge 6'
Blue C14 C13 Dual Lock 18 gauge 6'	Stay Online	6694	Blue C14 C13 Dual Lock 18 gauge 6'

## SECTION 276004

### APPENDIX 04 – REFERENCE STANDARDS

#### PART 1 - GENERAL

##### 1.1 REFERENCE STANDARDS

- A. Codes and Standards (Most recent editions with addenda/TSB, etc.) All materials, installation and workmanship shall meet or exceed the applicable requirements and standards addressed within the references listed below:
1. ANSI/TIA-568.0-D and addenda “Generic Telecommunications Cabling for Customer Premises
  2. ANSI/TIA-568.1-D and addenda “Commercial Building Telecommunications Cabling Standard
  3. ANSI/TIA-568.2-D and addenda “Balanced Twisted-Pair Telecommunications Cabling and Components
  4. ANSI/TIA-568.3-D and addenda “Optical Fiber Cabling Components Standard”
  5. ANSI/TIA-568.4-D and addenda “Broadband Coaxial Cabling and Components Standard”
  6. ANSI/TIA-569-D and addenda “Telecommunications Pathways and Spaces”
  7. ANSI/TIA-606-C and addenda “Administration Standard for Commercial Telecommunications Infrastructure”
  8. ANSI/TIA-607-D and addenda “Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises”
  9. ANSI/TIA-758-B “Customer-Owned Outside Plant Telecommunication Infrastructure Standard”
  10. IEEE 802.3at PoE Plus and Next Gen PoE CFI March 2013 and IEEE P802.3ba latest draft revision and amendments.
  11. “Media Access Control Parameters, Physical Layers and Management Parameters for 40 Gbp/s and 100 Gbp/s Operation”.
  12. ANSI/TIA-526-7-A “Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant”
  13. ANSI/TIA/EIA-526-14-C “Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant”
  14. ANSI/TIA-942-B “Telecommunications Infrastructure Standard for Data Centers”
  15. ANSI/TIA – 1179-A “Healthcare Facility Telecommunications Infrastructure Standard”
  16. IEC/TR3 61000-5-2 - Ed. 1.0 and amendments “Electromagnetic compatibility (EMC) - Part 5: Installation and mitigation guidelines - Section 2: Earthing and cabling”
  17. ISO/IEC 11801-1 (2017) and amendments “Information technology - Generic cabling for customer premises – PART 1: General Requirements”
  18. EN 50173-1 and amendments “Information Technology - Generic cabling systems – PART 1 General Requirements”
  19. AIA Guidelines for Design and Construction of Hospital and Healthcare Facilities
  20. Construction Specification Institute Master Format
  21. BICSI: Comply with the most current editions of the following BICSI manuals:
    - a. BICSI - Telecommunications Distribution Methods Manual
    - b. BICSI – Installation Transport Systems Information Manual
    - c. BICSI – Network Design Reference Design Manual
    - d. BICSI – Outside Plant Design Reference Manual
    - e. BICSI – Wireless Design Reference Manual
    - f. BICSI -Electronic Safety and Security Design Reference Manual
    - g. Infocomm/BICSI – AV Design Reference Manual

22. Underwriters Laboratories (UL) Cable Certification and Follow-Up Program.
23. National Electrical Manufacturers Association (NEMA)
24. American Society for Testing Materials (ASTM)
25. National Electrical Code (NEC) NFPA70 2020
26. National Electrical Safety Code (NESC) 2017
27. Institute of Electrical and Electronic Engineers (IEEE)
28. UL Testing Bulletin
29. Building Industry Consulting Services International (BICSI) Information Transport Systems Methods Manual (ITSMM)
30. Local, county, state and federal regulations and codes in effect as of date of installation.
31. Equipment of foreign manufacture must meet U.S. codes and standards. It shall be indicated in the proposal the components that may be of foreign manufacture, if any, and the country of origin.

END OF SECTION



## SECTION 276005

### APPENDIX 05 – DEFINITIONS AND ABBREVIATIONS

#### PART 1 - GENERAL

##### 1.1 RELATED TERMS

- A. Codes and Standards (Most recent editions with addenda/TSB, etc.) All materials, installation and workmanship shall meet or exceed the applicable requirements and standards addressed within the references listed below:
1. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.
  2. BICSI: Building Industry Consulting Service International.
  3. CBC: Coupled Bonding Conductor
  4. CFCI: Customer Furnished Customer Installed
  5. Cable Run - A single cable to a single location
  6. Cable Drop - Two cables to a single location
  7. Cable Tri Drop - Three cables to a single location
  8. CT Coupler A type of wall connector made by the Siemon Company
  9. DCO: Data Center Operations
  10. Div.1: Division 1 General and Performance Requirements
  11. Div. 23: Division 23 Heating, Ventilating, and Air Conditioning
  12. Div. 22: Division 22 Plumbing
  13. Div. 26: Division 26 Electrical
  14. Div. 27: Division 27 Communications and Audio Visual
  15. Div. 28: Division 28 Electronic Safety and Security
  16. E.E.: Electrical Engineer
  17. EMI: Electromagnetic Interference
  18. F/UTP: Foil over Unshielded Twisted Pair. Individual pairs are unshielded.
  19. GC: General Contractor
  20. GE: Ground Equalizer
  21. Horizontal Cabling: The cable and connecting hardware utilized to transport communications signals
  22. ICT: Infrastructure Cabling Team
  23. LAN: Local Area Network
  24. N/A: Not Applicable
  25. NIC: Not in Contract
  26. OFCI: Owner Furnished Contractor Installed
  27. OFOI: Owner Furnished Owner Installed
  28. OTDR: Optical Time Domain Reflectometer
  29. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.
  30. RCDD: Registered Communications Distribution Designer
  31. RFI: Radio Frequency Interference
  32. TBA or TBD: To Be Determined
  33. TDR: Technology Distribution Room
  34. TEC: Technology Equipment Center
  35. TGB: Telecommunications Ground Bus Bar
  36. TMBC: Telecommunications Main Bonding Conductor
  37. TMGB: Telecommunications Main Grounding Bus Bar
  38. TSER: Telecommunications Service Entrance Room
  39. UTP: Unshielded Twisted Pair
  40. Work Area: approx. 100 sq. ft. equipped for workstation equipment

- 41. DCO = Data Center Operations – [Boe.Sausedo@imail.org](mailto:Boe.Sausedo@imail.org)
- 42. ICT = Information and Communications Technology – [Melissa.Lopez2@imail.org](mailto:Melissa.Lopez2@imail.org)

END OF SECTION

## SECTION 276006

### APPENDIX 06 – MATERIAL SUPPLIERS

#### PART 1 - GENERAL

##### 1.1 RELATED TERMS

- A. Siemon Authorized Suppliers are listed below. To help prevent counterfeiting and support warranties, known, factory authorized distributors are recommended.
1. Approved Suppliers of Siemon cable, patch panels, jacks, and parts:

#### **Anixter**

Randi Whittaker  
Inside Sales Main Phone: (801) 973-2121  
3775 W. California Ave. Ste 400 Fax: (801) 973-4472  
Salt Lake City, UT 84104 US Email: [randi.whittaker@anixter.com](mailto:randi.whittaker@anixter.com)

Karl Bartlam  
End User/Outside Sales Main Phone: (801) 973-2121  
3775 W. California Ave. Ste 400 Fax: (801) 973-4472  
Salt Lake City, UT 84104 US Email: [karl.bartlam@anixter.com](mailto:karl.bartlam@anixter.com)

#### **Graybar Electric**

Elizabeth Vaughn  
Inside Sales Main Phone: (801) 656-3016  
2841 South 900 West Fax: (801) 973-4314  
Salt Lake City, UT 84119 US Email: [Elizabeth.Vaughn@graybar.com](mailto:Elizabeth.Vaughn@graybar.com)

Erika Morrison  
Contractor Outside Sales Main Phone: (801) 656-3014  
2841 South 900 West Fax: (801) 973-4314  
Salt Lake City, UT 84119 US Email: [Erika.Morrison@graybar.com](mailto:Erika.Morrison@graybar.com)

#### **WESCO / CSC**

Brian Walters  
Inside Sales Main Phone: (801) 975-0600  
3210 South 900 West Fax: (801) 907-4450  
Salt Lake City, UT 84119 US Email: [Bwalters@gocsc.com](mailto:Bwalters@gocsc.com)

Adam Tueller  
Contractor Outside Sales Main Phone: (801) 975-0600  
3210 South 900 West Direct: (801) 618-6665  
Salt Lake City, UT 84119 US Email: [Atueller@wesco.com](mailto:Atueller@wesco.com)

- B. The Siemon Company is represented locally by: [Marc.Lovestrand@Siemon.com](mailto:Marc.Lovestrand@Siemon.com)

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## SECTION 276007

### APPENDIX 07 – SIEMON CERTIFIED INSTALLATION FIRMS

#### PART 1 - GENERAL

##### 1.1 RELATED TERMS

- A. NOTE: Cable installers have rigorous requirements to be certified for Siemon cables and products. Validation of certification is required prior to accepting a bid.
- B. The firms selected to bid must be pre-approved by the local facility IT manager. Installation firms desiring to do work for Intermountain Healthcare must be selected from the official CI list below.
- C. Current Siemon Approved/Certified Cable Installers for Siemon Network Cable. This list is up to date as of 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](mailto:Jason.King@iescomm.com) / [www.iescomm.com](http://www.iescomm.com)
    - b. Boyd Evans – Project Manager // Phone 801 975 8191 / Fax 385 242 7366 / Mobile 801 381 1518 // [Boyd.Evans@iescomm.com](mailto:Boyd.Evans@iescomm.com) / [www.iescomm.com](http://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](mailto:Travis.Grant@cve.com) / [www.cve.com](http://www.cve.com)
    - b. Brad Readicker – Acct. Manager // Phone 801 908 2686 / Fax 801 908 7401 // [Brad.Readicker@cve.com](mailto:Brad.Readicker@cve.com) / [www.cve.com](http://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](mailto:Jesse@datatechprofessionals.com) / [www.datatechprofessionals.com](http://www.datatechprofessionals.com)
  6. **Hunt Electric, Inc.:** 1863 W. Alexander St., Salt Lake City, UT 84119
    - a. Darrin Guevara – Division Manager // Phone 801 975 8844 // [Darrin@huntelelectric.com](mailto:Darrin@huntelelectric.com) / [www.huntelelectric.com](http://www.huntelelectric.com)
  7. **NCNS Communications:** 419 West Universal Circle, Sandy, UT 84070
    - a. Jayson Nosack – Owner // Phone 801 361 4572 // [Jnosack@ncns-co.com](mailto:Jnosack@ncns-co.com) / [www.ncns-co.com](http://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](mailto: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](mailto:Bob.reese@bombardelec.com) / [www.bombardelectric.com](http://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](mailto:cshadbolt@rosendin.com)
    - b. Adrian Youngblood – Sr. Estimator // Phone 702 258 1455 // [ayoungblood@rosendin.com](mailto:ayoungblood@rosendin.com)
    - c. Breck Hardesty – Sr. Project Mgr. // Phone 702 258 1428 // [bhardesty@rosendin.com](mailto:bhardesty@rosendin.com) / [www.rosendin.com](http://www.rosendin.com)
  11. **Mojave Electric:** 3755 W. Hacienda Ave., Las Vegas, NV 89118 / Phone 702 798 2970

12. **The Morse Group:** 3874 Silvestri Lane, Las Vegas, NV 89120  
Phone 702 257 4400

END OF SECTION

**SECTION 276008**

**APPENDIX 08 – LEAD WALL PENETRATIONS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Sections 13090 & 134900

**1.2 RELATED TERMS**

**Procedure Name:** New Port and Electrical Box Installation Lead Lined Walls

**Document Detail Information: (This section must be completed in full.)**

<b>Implements Policy:</b>	Click here to enter policy title		
<b>Content Owner</b>	Craig Allen, Safety Security Environment Health Director, Central Office Jeremy Hawk Medical Physicist Radiation Safety Coordinator	<b>Content Consultant(s):</b>	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
<b>Date of Final Draft:</b>	12/29/2015	<b>Who Reviewed Content?</b>	<Name, Title, Dept> <Name, Title, Dept> <Name, Title, Dept> <Committee Name>
<b>Keywords (must have at least 3):</b>	Searchable Keywords (e.g., PHI, EMTALA, Coding)		

**1.3 PURPOSE**

- A. Maintain radiation safety controls in lead lined walls during installation of new power and data outlets in existing lead lined walls.

**1.4 SCOPE**

- A. Intermountain Hospitals, Intermountain Clinics Medical Group

**1.5 DEFINITIONS**

- A. Lead lined Walls – Structured element designed to provide a barrier to block radiation penetration beyond the designated space.
- B. Maintenance Manager – The person responsible for plant maintenance operations or his/her delegate.
- C. Radiation Safety Coordinator – The person responsible for Radiation Safety or his/her

Delegate. Medical Physicist.

- D. Worker – The person responsible for completing work with the lead lined wall. This includes Intermountain Employees as well as any outside supplier or contractor.

## 1.6 PROVISIONS

- A. The Radiation Safety Program is following Utah regulation R313-15-101, R313-28 and U.S. Nuclear Regulatory Commission Regulation 1- CFR Part 20-1101.

## 1.7 PROCEDURE

- A. Prior to any work within a lead lined wall, the Worker reports to the Radiation Safety Coordinator, Maintenance Manager and completed a review of planned work “ACWP” Identification of specific description related to the lead lined wall planned work.
  - 1. Intermountain workers, outside suppliers or contractors hired to work in any Intermountain facility must contact the Maintenance Manager and Radiation Safety Coordinator prior to beginning work to discuss the project and ensure that the planned work will not interfere with facility operations, maintenance, or other projects.
  - 2. Failure to scheduled and complete the planning meeting described above may results in the delay or rescheduling of work. Outside suppliers or contractors are responsible for any costs incurred because of their failure to schedule and complete this meeting.
- B. The Radiation Safety Coordinator, Maintenance Manager and the worker conduct a pre-work inspection of the areas in which work is to be performed. This inspection identified the following:
  - 1. Areas of special concern or sensitivity, including those noted or described on the facility Life Safety records and drawings, and Radiation Safety records and drawings.
  - 2. Appropriate areas or structures to use for support of any work, as applicable.
  - 3. Existing deficiencies in Barriers.
  - 4. The as act assemblies impacted by the work.
  - 5. The type of shielding material acceptable in the area.
    - a. Lead lined boxes
    - b. Lead lined wall “inside wall” installation, and OR
    - c. Lead shielding for wall installation of “outside wall” maintaining radiation safety barriers.
  - 6. The exact condition of the areas upon completion of work.
- C. Upon completion of the work and before closing the wall, the worker, Radiation Safety Coordinator and Maintenance Manager conduct a post-work inspection of the area in which the work was performed, this inspection verifies the following:
  - 1. No Tools, Supplies or debris are left within the walls.
  - 2. Lead lining is installed to maintain radiation safety protection according to regulatory requirements.
  - 3. All work affecting Radiation Safety Lead Barriers has been properly sealed.
  - 4. The overall condition of the area meets the expectation outline in the per-work inspection.
- E. The Maintenance Manager and Radiation Safety Coordinator signs and logs the completed “ACWP”

## 1.8 EXCEPTIONS

- A. None.



1.9 PRIMARY SOURCES

- A. List the regulatory references upon which the procedure is based (cite the code, the title, and the statute).

1.10 SECONDARY MATERIALS

- A. Radiation Safety Policy
- B. Above Ceiling Work Permit
- C. Lead lined wall requirements as defined by Radiation Safety Building Requirements



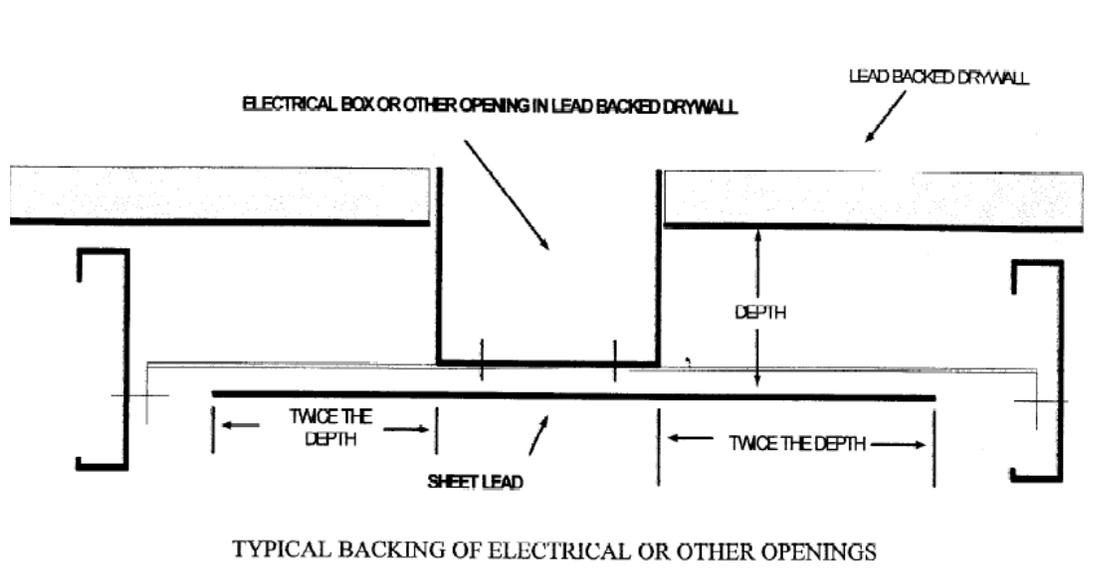
Option 1: worker to install new power utility wall box and add Lead Lining to wall behind box  
If worker can access posterior wall entry



Option 2: worker to install new power utility wall box – box is lead Lined by manufacturer



Option 3: worker to install new power utility wall box - no additional lead lining required if installation does not disrupt the existing shielding



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## **DIVISION 28 - ELECTRONIC SAFETY AND SECURITY**

Section 28 1300	Access Control
Section 28 2300	Video Surveillance
Section 28 3100	Fire Alarm

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## 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 the installation of An extension to the existing PC based and managed access control and security system (Lenel) and specifies sensors, signal equipment, and system controls.
- 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.
- C. Provide system installed by installer designated by Owner.

##### 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 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. Comply with NFPA 70, "National Electrical Code."
- B. 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.
- C. Comply with UL Standard 609, 1023, and 1076.
- D. FM Compliance: Provide FM approved card access system and components.
- E. Single Source Responsibility: Obtain system components from a single source (the prime system manufacturer) that assumes responsibility for system components and for their compatibility.

## 1.9 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 key access control system to interface and 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 087100 Door Hardware Schedule for hardware set information.**

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Continental

## **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 (ACS): 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 (ACS) shall accept a power input voltage of 120 VAC, 60Hz. Maximum power draw shall be no more than 300W. The ACS 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 ACS shall have the capability of charging standard gel-cell batteries, and shall be capable of operating on direct battery backup. The ACS 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 multiclass proximity readers.
  - 1. Proximity Readers: The system shall be provided with uni directional proximity card readers. The standard multiClass 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.

## **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.
  - 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. Wiring Method:
  - 1. Concealed in walls or above inaccessible ceilings: Install all cabling in raceways, ¾ 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.
- C. 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.
- D. 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.
- E. Splices, Taps, and Terminations: Make splices, taps, and terminations on numbered terminal strips in junction, pull and outlet boxes, terminal cabinets, and equipment enclosures.
- F. Tighten connections to comply with tightening torques specified in UL Standard 486A.
- G. 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.
- H. 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.

### **3.4 GROUNDING**

- A. Comply with Section 280526 "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: Where multiple push buttons are housed within a single switch enclosure, they shall be stacked vertically with each push-button switch labeled with 1/4-inch- (6.4-mm-) high text and symbols as required. 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.

### **3.6 IDENTIFICATION**

- A. In addition to requirements in this article, comply with applicable requirements in Section 260553 "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**

**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. User selected installer: Convergent.

**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. 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 NECA 1.
- C. Comply with NFPA 70.
- D. Electronic data exchange between video surveillance system with an access-control system shall comply with SIA TVAC.
  - 1.

## 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 6 compliant UTP. (By Section 271500)
- B. Video Surveillance Cable Connectors: Category 6 compliant. (By Section 271500)
- C. Camera Power: POE enabled network switches. (By Owner)

## **PART 3 - EXECUTION**

### **3.1 VIDEO SURVEILLANCE SYSTEM INSTALLATION**

- A. Install cameras at heights noted in drawings.
- B. 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.
- C. 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



## SECTION 283100

### FIRE ALARM

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. This Section includes fire alarm systems with manual stations, detectors, signal equipment, controls, and devices.
- B. Related Sections include the following:
  - 1.
  - 2. Division 8 Section "Hardware" for door closers/holders/smoke detectors, electric door locks, and release devices that interface with fire alarm systems.

##### 1.3 DEFINITIONS

- A. FACP: Fire alarm control panel.
- B. LED: Light-emitting diode.
- C. Definitions in NFPA 72 apply to fire alarm terms used in this Section.

##### 1.4 SYSTEM DESCRIPTION

- A. General: Noncoded, addressable-analog system with manual and automatic alarm initiation; automatic sensitivity control of certain smoke detectors; and multiplexed signal transmission dedicated to fire alarm service only.

##### 1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
  - 1. Wiring Diagrams: Detail wiring and differentiate between manufacturer-installed and field-installed wiring. Include diagrams for equipment and for system with all terminals and interconnections identified.
  - 2. Battery: Sizing calculations.
  - 3. Floor Plans: Indicate final outlet locations and routings of raceway connections.
  - 4. Device Address List: Coordinate with final system programming.
  - 5. System Operation Description: Detailed description for this Project, including method of operation and supervision of each type of circuit and sequence of operations for manually and automatically initiated system inputs and outputs. Manufacturer's standard descriptions for generic systems are not acceptable.
- C. Operating Instructions: For mounting at the FACP.
- D. Product Certificates: Signed by manufacturers of system components certifying that products furnished comply with requirements.

- E. Installer Certificates: Signed by manufacturer certifying that installers comply with requirements.
- F. Field Test Reports: Indicate and interpret test results for compliance with performance requirements. Comply with NFPA 72.
- G. Maintenance Data: For fire alarm systems to include in maintenance manuals specified in Division 1. Comply with NFPA 72.
- H. Submissions to Authorities Having Jurisdiction: In addition to distribution requirements for Submittals specified in Division 1 Section "Submittals," make an identical submission to authorities having jurisdiction. Include copies of annotated Contract Drawings as needed to depict component locations to facilitate review. Resubmit if required to make clarifications or revisions to obtain approval. On receipt of comments from authorities having jurisdiction, submit them to Architect for review.
- I. Certificate of Completion: Comply with NFPA 72.

## **1.6 QUALITY ASSURANCE**

- A. Installer Qualifications: An experienced installer who is an authorized representative of the FACP manufacturer for both installation and maintenance of units required for this Project.
- B. Manufacturer Qualifications: A firm experienced in manufacturing systems similar to those indicated for this Project and with a record of successful in-service performance.
- C. Source Limitations: Obtain fire alarm system components through one source from a single manufacturer.
- D. Compliance with Local Requirements: Comply with applicable building code, local ordinances and regulations, and requirements of authorities having jurisdiction.
- E. Comply with NFPA 72.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Notifier

### **2.2 FUNCTIONAL DESCRIPTION OF SYSTEM**

- A. Control of System: By the existing FACP.
- B. System Supervision: Automatically detect and report open circuits, shorts, and grounds of wiring for initiating device, signaling line, and notification-appliance circuits.
- C. Priority of Signals: Automatic alarm response functions resulting from an alarm signal from one zone or device are not altered by subsequent alarm, supervisory, or trouble signals. An alarm signal is the highest priority. Supervisory and trouble signals have second- and third-level priority. Higher-priority signals take precedence over signals of lower priority, even when the lower-priority condition occurs first. Annunciate and display all alarm, supervisory, and trouble signals regardless of priority or order received.
- D. Noninterference: A signal on one zone shall not prevent the receipt of signals from other zones.

- E. System Reset: All zones are manually resettable from the FACP after initiating devices are restored to normal.
- F. Transmission to Remote Alarm Receiving Station: Automatically route alarm, supervisory, and trouble signals to a remote alarm station by means of a digital alarm communicator transmitter and telephone lines.
- G. System Alarm Capability during Circuit Fault Conditions: System wiring and circuit arrangement prevent alarm capability reduction when a single ground or open circuit occurs in an initiating device circuit, signal line circuit, or notification-appliance circuit.
- H. Loss of primary power at the FACP initiates a trouble signal at the FACP and the annunciator. An emergency power light is illuminated at both locations when the system is operating on the secondary power supply.
- I. Basic Alarm Performance Requirements: Unless otherwise indicated, operation of initiating device initiates the sequence of operation as indicated in the fire alarm matrix.
- J. Alarm Silencing, System Reset and Indication: Controlled by switches in the FACP and the remote annunciator.
  - 1.
  - 2. Silencing-switch operation halts alarm operation of notification appliances and activates an "alarm silence" light. Display of identity of the alarm zone or device is retained.
  - 3. Subsequent alarm signals from other devices or zones reactivate notification appliances until silencing switch is operated again.
  - 4. When alarm-initiating devices return to normal and system reset switch is operated, notification appliances operate again until alarm silence switch is reset.
- K. Low-air-pressure switch operation on a dry-pipe or preaction sprinkler system initiates the following:
  - 1. A supervisory, audible, and visible "sprinkler trouble" signal indication at the FACP and the annunciator.
  - 2. Flashing of the device location-indicating light for the device that has operated.
  - 3. Recording of the event by the system printer.
  - 4. Transmission of trouble signal to remote central station.
- L. Remote Detector Sensitivity Adjustment: Manipulation of controls at the FACP causes the selection of specific addressable smoke detectors for adjustment, display of their current status and sensitivity settings, and control of changes in those settings. Same controls can be used to program repetitive, scheduled, automated changes in sensitivity of specific detectors. Sensitivity adjustments and sensitivity-adjustment schedule changes are recorded in system memory and are printed out by the system printer.
- M. Removal of an alarm-initiating device or a notification appliance initiates the following:
  - 1. A "trouble" signal indication at the FACP and the annunciator for the device or zone involved.
  - 2. Recording of the event by the system printer.
  - 3. Transmission of trouble signal to remote alarm receiving station.

### 2.3 SMOKE DETECTORS

- A. General: Include the following features:
  - 1. Operating Voltage: 24-V dc, nominal.
  - 2. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.

3. Plug-in Arrangement: Detector and associated electronic components are mounted in a module that connects in a tamper-resistant manner to a fixed base with a twist-locking plug connection. Terminals in the fixed base accept building wiring.
  4. Integral Visual-Indicating Light: LED type. Indicates detector has operated.
  5. Sensitivity: Can be tested and adjusted in-place after installation.
  6. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
  7. Remote Controllability: Unless otherwise indicated, detectors are analog-addressable type, individually monitored at the FACP for calibration, sensitivity, and alarm condition, and individually adjustable for sensitivity from the FACP.
- B. Photoelectric Smoke Detectors: Include the following features:
1. Sensor: LED or infrared light source with matching silicon-cell receiver.
  2. Detector Sensitivity: Between 2.5 and 3.5 percent/foot (0.008 and 0.011 percent/mm) smoke obscuration when tested according to UL 268A.
- C. Duct Smoke Detector: Photoelectric type.
1. Sampling Tube: Design and dimensions as recommended by the manufacturer for the specific duct size, air velocity, and installation conditions where applied.

## 2.4 OTHER DETECTORS

- A. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F (57 deg C) or rate of rise of temperature that exceeds 15 deg F (8.3 deg C) per minute, unless otherwise indicated.
1. Mounting: Plug-in base, interchangeable with smoke detector bases.
  2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
- B. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190 deg F (88 deg C).
1. Mounting: Plug-in base, interchangeable with smoke detector bases.
  2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.

## 2.5 NOTIFICATION APPLIANCES

- A. Description: Equip for mounting as indicated and have screw terminals for system connections.
1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly.
- B. Selectable-Tone Horns: Electronic-vibrating type, field selectable tone (temporal pattern, chime, high/low/silent), 24 VDC, Horns produce a sound-pressure level of 90dBA, measured 10 feet (3m) from the horn. Built-in provisions for reducing the output to 87dBA and 84dBA.
- C. Visible Alarm Devices: Xenon strobe lights listed under UL 1971 with clear polycarbonate lens. Mount lens on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.
1. Rated Light Output: as shown on drawings, field selectable outputs of 15CD, 30CD, 75CD, and 110CD.
  2. Sleeping Room Rated Light Output: 177CD.
  3. Synchronization.
  4. Strobe Leads: Factory connected to screw terminals.

## 2.6 CENTRAL FACP (Existing)

## 2.7 REMOTE ANNUNCIATOR (Existing)

## 2.8 ADDRESSABLE INTERFACE DEVICE

- A. Description: Microelectronic monitor module listed for use in providing a multiplex system address for listed fire and sprinkler alarm-initiating devices with normally open contacts.
- B. Integral Relay: Capable of providing a direct signal to the elevator controller to initiate elevator recall or to a circuit-breaker shunt trip for power shutdown.

## 2.9 DIGITAL ALARM COMMUNICATOR TRANSMITTER

- A. Listed and labeled under UL 864 and NFPA 72.
- B. Functional Performance: Unit receives an alarm, supervisory, or trouble signal from the FACP panel, and automatically captures one or two telephone lines and dials a preset number for a remote central station. When contact is made with the central station(s), the signal is transmitted. The unit supervises up to two telephone lines. Where supervising two lines, if service on either line is interrupted for longer than 45 seconds, the unit initiates a local trouble signal and transmits a signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. When telephone service is restored, unit automatically reports that event to the central station. If service is lost on both telephone lines, the local trouble signal is initiated.
- C. Secondary Power: Integral rechargeable battery and automatic charger. Battery capacity is adequate to comply with NFPA 72 requirements.
- D. Self Test: Conducted automatically every 24 hours with report transmitted to central station.

## 2.10 WIRE

- A. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.
  - 1. Low-Voltage Circuits: No. 16 AWG, minimum.
  - 2. Line-Voltage Circuits: No. 12 AWG, minimum.
- B. Power-Limited Circuits: NFPA 70, Types FPL, FPLR, or FPLP, as recommended by manufacturer.

# PART 3 - EXECUTION

## 3.1 EQUIPMENT INSTALLATION

- A. Connect the FACP with a disconnect switch with lockable handle or cover.
- B. Ceiling-Mounted Smoke Detectors: Not less than **4 inches (100 mm)** from a side wall to the near edge. For exposed solid-joist construction, mount detectors on the bottom of joists. On smooth ceilings, install not more than **30 feet (9 m)** apart in any direction.
- C. Wall-Mounted Smoke Detectors: At least **4 inches (100 mm)**, but not more than **12 inches (300 mm)**, below the ceiling.
- D. Smoke Detectors near Air Registers: Install no closer than **60 inches (1520 mm)**.
- E. Duct Smoke Detectors: Comply with manufacturer's written instructions.
  - 1. Verify that each unit is listed for the complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
  - 2. Install sampling tubes so they extend the full width of the duct.

- F. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.
- G. Audible Alarm-Indicating Devices: Install not less than **6 inches (150 mm)** below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Combine audible and visible alarms at the same location into a single unit.
- H. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least **6 inches (150 mm)** below the ceiling.
  - 1. Synchronization: synchronize any two strobes located such that they are visible from the same location.

### **3.2 WIRING INSTALLATION**

- A. Wiring Method: Install wiring in metal raceway according to Division 26 Section "Raceways and Boxes." Conceal raceway except in unfinished spaces and as indicated.
- B. 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.
- C. Cable Taps: Use numbered terminal strips in junction, pull and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.
- D. 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.
- E. 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.
- F. 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 IDENTIFICATION**

- A. Identify system components, wiring, cabling, and terminals according to Division 16 Section "Electrical Identification."
  - 1. Paint all fire alarm system junction boxes, device boxes, and pull boxes with red paint.
- B. Install instructions frame in a location visible from the FACP.
- C. Prepare laminated drawings showing each device and identifying the device address or zone
- D. Paint power-supply disconnect switch red and label "FIRE ALARM."

### **3.4 GROUNDING**

- A. Signal Ground Terminal: Locate at main equipment rack or cabinet. Isolate from power system and equipment grounding.
- B. Install grounding electrodes of type, size, location, and quantity as indicated. Comply with installation requirements in Division 16 Section "Grounding."
- C. Ground equipment and conductor and cable shields. For audio circuits, minimize, to the greatest extent possible, ground loops, common-mode returns, noise pickup, cross talk, and other impairments. Provide 5-ohm ground at main equipment location. Measure, record, and report ground resistance.

### 3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and connections and to supervise pretesting, testing, and adjustment of the system. Report results in writing.
- B. Pretesting: After installation, align, adjust, and balance the system and perform complete pretesting. Determine, through pretesting, the compliance of the system with requirements of Drawings and Specifications. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new ones, and retest until satisfactory performance and conditions are achieved. Prepare forms for systematic recording of acceptance test results.
- C. Report of Pretesting: After pretesting is complete, provide a letter certifying the installation is complete and fully operable, including the names and titles of witnesses to preliminary tests.
- D. Final Test Notice: Provide a minimum of 10 days' notice in writing when the system is ready for final acceptance testing.
- E. Minimum System Tests: Test the system according to procedures outlined in NFPA 72. Minimum required tests are as follows:
  - 1. Verify the absence of unwanted voltages between circuit conductors and ground.
  - 2. Test all conductors for short circuits using an insulation-testing device.
  - 3. With each circuit pair, short circuit at the far end of the circuit and measure the circuit resistance with an ohmmeter. Record the circuit resistance of each circuit on record drawings.
  - 4. Verify that the control unit is in the normal condition as detailed in the manufacturer's operation and maintenance manual.
  - 5. Test initiating and indicating circuits for proper signal transmission under open circuit and ground fault conditions. One connection each should be opened at not less than 10 percent of initiating and indicating devices. Observe proper signal transmission according to class of wiring used.
  - 6. Test each initiating and indicating device for alarm operation and proper response at the control unit.
    - a. Test smoke detectors with actual products of combustion.
    - b. Test each heat detector with hair dryer or other means approved by the manufacturer.
    - c. Test fan shut down, sprinkler flow and tamper switches, door closers, magnetic door holders, and elevator return.
  - 7. Test the system for all specified functions according to the approved operation and maintenance manual. Systematically initiate specified functional performance items at each station, including making all possible alarm and monitoring initiations and using all communications options. For each item, observe related performance at all devices required to be affected by the item under all system sequences. Observe indicating lights, displays, signal tones, and annunciator indications.
  - 8. Test Both Primary and Secondary Power: Verify by test that the secondary power system is capable of operating the system for the period and in the manner specified.

- a. Disconnect fire alarm from primary power source 24 hours prior to test, or longer as specified. Test all indicating devices to determine whether audio and visual devices comply with testing requirements for a 15 minute test.
- F. Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets Specifications and complies with applicable standards.
- G. Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log. Submit log on the satisfactory completion of tests.
- H. Tag all equipment, stations, and other components at which tests have been satisfactorily completed.

### **3.6 CLEANING AND ADJUSTING**

- A. Cleaning: Remove paint splatters and other spots, dirt, and debris. Touch up scratches and marred finish to match original finish. Clean unit internally using methods and materials recommended by manufacturer.

### **3.7 ON-SITE ASSISTANCE**

- A. Occupancy Adjustments: When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels, controls, and sensitivities to suit actual occupied conditions. Provide up to three requested visits to Project site for this purpose.

END OF SECTION



## **DIVISION 31 - EARTHWORK**

Section 31 0700	General Site Construction Requirements
Section 31 1100	Site Clearing
Section 31 1200	Earthmoving
Section 31 5000	Excavation

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## SECTION 31 0700

### GENERAL SITE CONSTRUCTION REQUIREMENTS

#### PART 1 - GENERAL

##### 1.1 SUMMARY

###### A. Includes but Not Limited to

1. General procedures and requirements for Site Work.

#### PART 2 – PRODUCTS: Not Used

#### PART 3 - EXECUTION

##### 3.1 PREPARATION

###### A. Site Verification of Conditions

1. 48 hours minimum prior to performing any work on site, contact Dig Line to arrange for utility location services.
2. Perform minor, investigative excavations to verify location of various existing underground facilities at sufficient locations to assure that no conflict with the proposed work exists and sufficient clearance is available to avoid damage to existing facilities.
3. Perform investigative excavating 5 days minimum in advance of performing any excavation or underground work.
4. Upon discovery of conflicts or problems with existing facilities, notify Architect by phone or fax within 24 hours. Follow telephone or fax notification with letter and diagrams indicating conflict or problem and sufficient measurements and details to evaluate problem.
5. Notify Owner of utilities a minimum of 48 hours prior to an work taking place.
6. Any work required within public Right-of-Ways will require encroachment permit from entity with jurisdiction.

##### 3.2 PREPARATION

###### A. Protection

1. Spillage:
  - a. Avoid spillage by covering and securing loads when hauling on or adjacent to public streets or highways.
  - b. Remove spillage and sweep, wash, or otherwise clean project, streets, and highways.

2. Dust Control:
    - a. Take precautions necessary to prevent dust nuisance, both on-site and adjacent to public and private properties.
    - b. Correct or repair damage caused by dust.
  3. Erosion Control:
    - a. Take precautions necessary to prevent erosion and transportation of soil downstream, to adjacent properties, and into on-site or off-site drainage systems.
    - b. Develop, install, and maintain an erosion control plan if required by law.
    - c. Repair and correct damage caused by erosion.
  4. Existing Plants and Features: Do not damage tops, trunks, and roots of existing trees and shrubs on site which are intended to remain. Do not use heavy equipment within branch spread. Interfering branches may be removed only with permission of Architect. Do not damage other plants and features which are to remain.
  5. Protect site from fire caused by welding, cutting, smoking, or other sources of ignition.
- B. If specified precautions are not taken or corrections and repairs made promptly, Owner may take such steps as may be deemed necessary and deduct costs of such from monies due to Contractor. Such action or lack of action on Owner's part does not relieve Contractor from responsibility for proper protection of the Work.

### **3.3 REPAIR / RESTORATION**

- A. Adjust existing covers, boxes, and vaults to grade.
- B. Replace broken or damaged covers, boxes, and vaults.
- C. Independently confirm size, location, and number of covers, boxes, and vaults which require adjustment.

### **3.4 FIELD QUALITY CONTROL**

- A. Notify Architect 48 hours prior to performing excavation or fill work.
- B. If work has been interrupted by weather, scheduling, or other reason, notify Architect 24 hours minimum prior to intended resumption of grading or compacting.
- C. Owner reserves right to require additional testing to re-affirm suitability of completed work including compacted soils which have been exposed to adverse weather conditions.

**END OF SECTION 31 0700**

## SECTION 31 1000

### SITE CLEARING

#### 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. Removing existing trees, shrubs, groundcovers, plants, and grass as indicated on demolition plan.
  2. Clearing and grubbing.
  3. Stripping and stockpiling topsoil.
  4. Removing asphalt and concrete walks, curb and gutter and paving
  5. Removing above and below grade site improvements.
  6. Disconnecting, capping or sealing, abandoning site utilities in place, and removing site utilities.
  7. Temporary erosion and sedimentation control measures.
- B. Related Sections include the following:
  1. Division 01 Section "Temporary Facilities and Controls" for temporary utilities, temporary construction and support facilities, temporary security, protection facilities, and temporary erosion and sedimentation control procedures.
  2. Division 02 Section "Selective Site Demolition" for demolition of buildings, structures, and site improvements.
  3. Division 31 Section "Earth Moving" for soil materials, excavating, backfilling, and site grading.

##### 1.3 DEFINITIONS

- A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other non-soil materials.
- B. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

#### 1.4 MATERIAL OWNERSHIP

- A. Except for stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site. Stripped topsoil shall only be removed from the property upon approval from the Owner.

#### 1.5 SUBMITTALS

- A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.
- B. Record drawings, according to Division 01 Section "Project Record Documents," identifying and accurately locating capped utilities and other subsurface structural, electrical, and mechanical conditions.

#### 1.6 QUALITY ASSURANCE

- A. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

#### 1.7 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
  - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
  - 2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.
  - 1. Do not proceed with work on adjoining property until directed by Architect.
- C. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.
- D. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.
- E. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

## **PART 2 - PRODUCTS**

### **2.1 SOIL MATERIALS**

- A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 31 Section "Earth Moving."
  - 1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Locate and clearly flag trees and vegetation to remain or to be relocated.
- C. Protect existing site improvements to remain from damage during construction.
  - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

### **3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL**

- A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction, sediment and erosion control Drawings, a sediment and erosion control plan, specific to the site, that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.
- B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

### **3.3 UTILITIES**

- A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.
  - 1. Verify that utilities have been disconnected and capped before proceeding with site clearing.
- B. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.
  - 1. Arrange with utility companies to shut off indicated utilities.

2. Owner will arrange to shut off indicated utilities when requested by Contractor.
- C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
  1. Notify Architect not less than two days in advance of proposed utility interruptions.
  2. Do not proceed with utility interruptions without Architect's written permission.
- D. Excavate for and remove underground utilities indicated to be removed.
- E. Removal of underground utilities is included in Division 21, Division 22, Division 26, Division 27, and Division 28 Sections covering site utilities.

### **3.4 CLEARING AND GRUBBING**

- A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction.
  1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
  2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
  3. Grind stumps and remove roots, obstructions, and debris extending to a depth of 18 inches below exposed subgrade.
  4. Use only hand methods for grubbing within tree protection zone.
  5. Remove tree branches and dispose of off-site.
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
  1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches and compact each layer to a density equal to adjacent original ground.

### **3.5 TOPSOIL STRIPPING**

- A. Remove top 1-2" of soil including all weeds, grass, brush and other vegetation and haul this material off-site before stripping topsoil. Actual depth of soil removal from site may vary depending on the amount of roots and plant material in the top 1-6" of soil. The base bid shall be to strip up to 3" of soil, etc. from the site and dispose of it off-site. If additional material is deemed necessary for removal from the site, a change order will be issued. Consult with Landscape Architect on-site prior to stripping soil so that a visual inspection can be done. Contractor shall provide a topsoil test of existing soils prior to stripping. See appendix 'A' for topsoil report.
- B. Strip only from 3" depth to 12" depth (the first 1-2" being disposed off of-site) of topsoil in a manner to prevent intermingling with underlying subsoil or other waste materials. This depth of topsoil stripping may need to be modified based on the results of the topsoil test noted above and also based on observations at the meeting to be held on-site as discussed above. The contractor shall calculate how much soil is needed for the lawn areas and planter areas and then only needs to strip that much soil (less the amendments).



1. Remove subsoil and non-soil materials from topsoil by screening all topsoil from trash, debris, weeds, roots, and other waste materials greater than ½ inch in any dimension.
  2. Amount of topsoil that needs to be stockpiled shall be determined by the following:
    - a. Strip all soils under buildings, structures, hardscaped/paved areas per civil, architectural, mechanical and structural drawings.
    - b. Strip enough topsoil based on quantity needed to install 4" depth of amended soil in lawn areas and 12" depth of amended soil in planter areas.
    - c. Topsoil depths in lawn and planter areas may be deeper than noted if at no additional cost to the Owner.
- C. Stockpile stripped topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.
1. Limit height of topsoil stockpiles to 6 feet.
  2. Do not stockpile topsoil within tree protection zones.
  3. Minimize overworking of topsoil so that physical properties of topsoil are retained. Topsoil should be stripped and piled in a location that will not interfere with construction. Topsoil shall not be moved from location to location. Topsoil shall not be driven over with any equipment. Overworking of topsoil may invalidate the reuse of it for landscaping purposes. If topsoil is unusable due to overworking it, moving it, driving over it unnecessarily, etc, contractor shall at his own expense import topsoil to replace damaged topsoil as required. Contractor shall also bear the expense of disposal of any unusable stripped topsoil. Landscape contractor shall provide a second soils test for stockpiled topsoil prior to reuse in landscaped areas. Adjustments may need to be made to amendments depending on results of topsoil test.
  4. Dispose of excess topsoil as specified for waste material disposal as directed by the Owner. Owner retains all rights to stripped topsoil. Owner shall approve any removal of stripped topsoil from site however the contractor shall bear the cost to remove such soil as approved by the Owner.
  5. Stockpile surplus topsoil to allow for landscaping per plans. Depths of topsoil in lawn areas can be deeper than what is specified if excess soils are available for the extra depths, however, the Civil engineer must approve this and determine that all grading and drainage requirements can still be met by having deeper topsoil depths in lawn areas. Consult with Owner and Civil Engineer on-site prior to site work to discuss this and determine appropriate course of action to be taken.

### 3.6 SITE IMPROVEMENTS

- A. Remove existing above-grade and below-grade improvements as indicated and as necessary to facilitate new construction. Refer to project plans for improvements to be abandoned in place.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
  1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.
  2. Paint cut ends of steel reinforcement in concrete to remain to prevent corrosion.

### **3.7 DISPOSAL**

- A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.
  - 1. Separate recyclable materials produced during site clearing from other non-recyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.

**END OF SECTION 31 1000**

## SECTION 31 2000

### EARTH MOVING

#### 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. Refer to the Geotechnical Report titled "Geotechnical Investigation Proposed Alta View Hospital Campus Reconfiguration Project, 9660 South 1300 East, Sandy, Utah" prepared by AGECE Applied GeoTech, dated September 4, 2015, Project No. 1150624 for additional grading and earthwork requirements.

##### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Preparing sub-grades for slabs on grade, walks, pavements, lawns and grasses, and exterior plants.
  - 2. Excavating and backfilling for buildings and structures.
  - 3. Drainage course for slabs-on-grade.
  - 4. Subbase course for concrete walks and pavements.
  - 5. Subbase and base course for asphalt paving patches.
  - 6. Subsurface drainage backfill for walls and trenches.
  - 7. Excavating and backfilling for utility trenches.
  - 8. Excavating and backfilling trenches for buried mechanical and electrical utilities and pits for buried utility structures.
- B. Related Sections include the following:
  - 1. Division 01 Section "Temporary Facilities and Controls" for temporary controls, utilities, and support facilities.
  - 2. Division 03 Section "Cast-in-Place Concrete" for granular course if placed over vapor retarder and beneath the slab-on-grade.
  - 3. Divisions 21, 22, 23, 26, 27, and 28 Sections for installing underground mechanical and electrical utilities and buried mechanical and electrical structures.
  - 4. Division 31 Section "Site Clearing" for temporary erosion and sedimentation control measures, site stripping, grubbing, stripping and stockpiling topsoil, and removal of above-grade and below-grade improvements and utilities.
  - 5. Division 32 Section "Finish Grading and Soil Preparation" and "Sodding" for finish grading, including preparing and placing topsoil and planting soil for lawns.
  - 6. Division 32 Section "Plants" for planting bed establishment and tree and shrub pit excavation and planting.

##### 1.3 DEFINITIONS

- A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
  2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Base Course: Course placed between the subbase course and hot-mix asphalt paving.
- C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- E. Drainage Course: Course supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
- F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices and changes in the work.
  2. Bulk Excavation: Excavation more than 10-feet in width and more than 30-feet in length.
  3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.
- G. Fill: Soil materials used to raise existing grades.
- H. Rock: Rock material in beds, ledges, un-stratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cubic yard for bulk excavation or 3/4 cubic yard for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:
1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,090-lbf and stick-crowd force of not less than 18,650-lbf; measured according to SAE J-1179.
  2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 210-hp flywheel power and developing a minimum of 48,510-lbf breakout force with a general-purpose bare bucket; measured according to SAE J-732.
- I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- J. Subbase Course: Course placed between the subgrade and base course for hot-mix asphalt pavement, or course placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
- K. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- L. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

## 1.4 SUBMITTALS

- A. Product Data: For the following:
  - 1. Each type of plastic warning tape.
  - 2. Geotextile.
  - 3. Controlled low-strength material, including design mixture.
- B. Samples: 12-by-12-inch Sample of sub-drainage and other geotextiles used.
- C. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
  - 1. Classification according to ASTM D 2487 of each on-site and borrow soil material proposed for fill and backfill.
  - 2. Laboratory compaction curve according to ASTM D698 or ASTM D1557 for each on-site and borrow soil material proposed for fill and backfill.
- D. Blasting Plan: For record purposes and for approval of authorities having jurisdiction.
- E. Seismic Survey Report: For record purposes; from seismic survey agency.
- F. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by earthwork operations. Submit before earthwork begins.

## 1.5 QUALITY ASSURANCE

- A. Blasting: Comply with applicable requirements in NFPA 495, "Explosive Materials Code," and prepare a blasting plan reporting the following:
  - 1. Types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
  - 2. Seismographic monitoring during blasting operations.
- B. Seismic Survey Agency: An independent testing agency, acceptable to authorities having jurisdiction, experienced in seismic surveys and blasting procedures to perform the following services:
  - 1. Report types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
  - 2. Seismographic monitoring during blasting operations.
- C. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.
- D. Pre-excavation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

## 1.6 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated.
  - 1. Notify Architect not less than two days in advance of proposed utility interruptions.
  - 2. Do not proceed with utility interruptions without Architect's written permission.
  - 3. Contact utility-locator service for area where Project is located before excavating.
- B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

## PART 2 - PRODUCTS

### 2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: ASTM D 2487 Soil Classification Groups GW, GP, GM, SW, SP, and SM or AASHTO M 145 Soil Classification Groups A-1, A-2-4, A-2-5, and A-3, or a combination of these groups; free of rock or gravel larger than 3-inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter. Native rock crushed to meet the above requirements and free from significant porosity may also be used as satisfactory soils.
- C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487 or A-2-6, A-2-7, A-4, A-5, A-6, and A-7 according to AASHTO M 145, or a combination of these groups.
  - 1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.
- F. Engineered / Structural Fill: Naturally or artificially graded mixture of non-expansive granular soil - natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with 4-inch maximum particle size, at least 90 percent passing a 1-1/2-inch sieve, maximum 30 percent passing 3/4-inch sieve, not more than 35 percent passing a No. 200 sieve, a maximum Liquid Limit of less than 30.
- G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 3/4-inch sieve and not more than 8 percent passing a No. 200 sieve.

- H. Drainage Course: Narrowly graded mixture of washed or crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.
- I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.
- J. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.
- K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

## 2.2 GEOTEXTILES

- A. Subsurface Drainage Geotextile: Non-woven needle-punched geotextile, manufactured in the USA for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
  - 1. Survivability: Class 2; AASHTO M 288.
  - 2. Grab Tensile Strength: 157 lbf; ASTM D 4632.
  - 3. Sewn Seam Strength: 142 lbf; ASTM D 4632.
  - 4. Tear Strength: 56 lbf; ASTM D 4533.
  - 5. Puncture Strength: 56 lbf; ASTM D 4833.
  - 6. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
  - 7. Permittivity: 0.2 per second, minimum; ASTM D 4491.
  - 8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.
- B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made in the USA from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
  - 1. Survivability: Class 2; AASHTO M 288.
  - 2. Grab Tensile Strength: 247 lbf; ASTM D 4632.
  - 3. Sewn Seam Strength: 222 lbf; ASTM D 4632.
  - 4. Tear Strength: 90 lbf; ASTM D 4533.
  - 5. Puncture Strength: 90 lbf; ASTM D 4833.
  - 6. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
  - 7. Permittivity: 0.02 per second, minimum; ASTM D 4491.
  - 8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

## 2.3 CONTROLLED LOW-STRENGTH MATERIAL

- A. Controlled Low-Strength Material: Low-density, self-compacting, flowable concrete material as follows:
  - 1. Portland Cement: ASTM C 150, Type II.
  - 2. Fly Ash: ASTM C 618, Class C or F.
  - 3. Normal-Weight Aggregate: ASTM C 33, 3/4-inch to 3/8-inch nominal maximum aggregate size.
  - 4. Foaming Agent: ASTM C 869.
  - 5. Water: ASTM C 94/C 94M.
  - 6. Air-Entraining Admixture: ASTM C 260.

- B. Produce low-density, controlled low-strength material made in the USA with the following physical properties:

1. As-Cast Unit Weight: 30 to 36 lb/cu. ft. at point of placement, when tested according to ASTM C 138/C 138M.
2. Compressive Strength: 80 psi , when tested according to ASTM C 495.

## **2.4 ACCESSORIES**

- A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured in the USA for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored as follows:
- B. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured in the USA for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows when required by utility purveyor:
  1. Red: Electric.
  2. Yellow: Gas, oil, steam, and dangerous materials.
  3. Orange: Telephone and other communications.
  4. Blue: Water systems.
  5. Green: Sewer systems.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Division 31 Section "Site Clearing."
- C. Protect and maintain erosion and sedimentation controls, which are specified in Division 31 Section "Site Clearing," during earthwork operations.
- D. Provide protective insulating materials to protect subgrades and foundation soils against freezing temperatures or frost.

### **3.2 DEWATERING**

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.



1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

### 3.3 EXPLOSIVES

- A. Explosives: Obtain written permission from authorities having jurisdiction and from architect and owner before bringing explosives to Project site or using explosives on Project site.
1. Perform blasting without damaging adjacent structures, property, or site improvements.
  2. Perform blasting without weakening the bearing capacity of rock subgrade and with the least-practicable disturbance to rock to remain.

### 3.4 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
  2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
    - a. 24 inches outside of concrete forms other than at footings.
    - b. 12 inches outside of concrete forms at footings.
    - c. 6 inches outside of minimum required dimensions of concrete cast against grade.
    - d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
    - e. 6 inches beneath bottom of concrete slabs on grade.
    - f. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

### 3.5 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
  2. Pile Foundations: Stop excavations 6 to 12 inches above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
  3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

### **3.6 EXCAVATION FOR WALKS AND PAVEMENTS**

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

### **3.7 EXCAVATION FOR UTILITY TRENCHES**

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
  - 1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.
  - 1. Clearance: 12 inches each side of pipe or conduit.
- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
  - 1. For pipes and conduit less than 6 inches in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
  - 2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
  - 3. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

### **3.8 SUBGRADE INSPECTION**

- A. Notify Architect when excavations have reached required subgrade.
- B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll subgrade below the building slabs and pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
  - 1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
  - 2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons or vehicle with similar unit axel weight.
  - 3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices and changes in the Work.

- E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

### **3.9 UNAUTHORIZED EXCAVATION**

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Architect.
  - 1. Fill unauthorized excavations under other construction or utility pipe as directed by Architect.

### **3.10 STORAGE OF SOIL MATERIALS**

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  - 1. Stockpile soil materials away from edge of excavations.

### **3.11 BACKFILL**

- A. Place and compact backfill in excavations promptly, but not before completing the following:
  - 1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
  - 2. Surveying locations of underground utilities for Record Documents.
  - 3. Testing and inspecting underground utilities.
  - 4. Removing concrete formwork.
  - 5. Removing trash and debris.
  - 6. Removing temporary shoring and bracing, and sheeting.
  - 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- B. Place backfill on subgrades free of mud, frost, snow, or ice.

### **3.12 UTILITY TRENCH BACKFILL**

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Division 03 Section "Cast-in-Place Concrete."
- D. Provide 4-inch- thick, concrete-base slab support for piping or conduit less than 12 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase.

- E. Place and compact initial backfill of subbase material or satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the utility pipe or conduit.
  - 1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- F. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches over the utility pipe or conduit.
- G. Backfill voids with satisfactory soil while installing and removing shoring and bracing.
- H. Place and compact final backfill of satisfactory soil to final subgrade elevation.
- I. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation.
- J. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

### **3.13 SOIL FILL**

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
  - 1. Under grass and planted areas, use satisfactory soil material.
  - 2. Under walks and pavements, use satisfactory soil material.
  - 3. Under steps and ramps, use engineered fill.
  - 4. Under building slabs, use engineered fill.
  - 5. Under footings and foundations, use engineered fill.
- C. Place soil fill on subgrades free of mud, frost, snow, or ice.

### **3.14 SOIL MOISTURE CONTROL**

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
  - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
  - 2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

### **3.15 COMPACTION OF SOIL BACKFILLS AND FILLS**

- A. Place backfill and fill soil materials in layers not more than 12-inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for

material compacted by hand-operated tampers. Reduce loose depths as needed to achieve required compactions.

- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698 or ASTM D 1557:
  - 1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
  - 2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent.
  - 3. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.
  - 4. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent if in landscaping areas or 95 percent if under structures, pavements, or walks.
  - 5. Under structure, buildings slabs, steps, pavements and walkways placed on five or more feet of fill scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 98 percent.

### **3.16 GRADING**

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
  - 1. Provide a smooth transition between adjacent existing grades and new grades.
  - 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
  - 1. Lawn or Unpaved Areas: Plus or minus 1 inch.
  - 2. Walks: Plus or minus 1 inch
  - 3. Pavements: Plus or minus 1/2 inch
- C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

### **3.17 SUBSURFACE DRAINAGE**

- A. Subdrainage Pipe: Specified in Division 33 Section "Subdrainage."
- B. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches of filter material, placed in compacted layers 6 inches thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches.
  - 1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698 with a minimum of two passes of a plate-type vibratory compactor.

- C. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final subgrade, in compacted layers 6 inches thick. Overlay drainage backfill with 1 layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches.
  - 1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698 with a minimum of two passes of a plate-type vibratory compactor].
  - 2. Place and compact impervious fill over drainage backfill in 6-inch- thick compacted layers to final subgrade.

### **3.18 SUBBASE AND BASE COURSES**

- A. Place subbase and base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase and base course under pavements and walks as follows:
  - 1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends where called for on details and on plans.
  - 2. Place base course material over subbase course under hot-mix asphalt pavement.
  - 3. Shape subbase and base course to required crown elevations and cross-slope grades.
  - 4. Place subbase and base course 6 inches or less in compacted thickness in a single layer.
  - 5. Place subbase and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
  - 6. Compact subbase and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698 or ASTM D 1557.
- C. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 698 or ASTM D 1557 where called for on project plans.

### **3.19 DRAINAGE COURSE**

- A. Place drainage course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
  - 1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
  - 2. Place drainage course 6 inches or less in compacted thickness in a single layer.
  - 3. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
  - 4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

### **3.20 FIELD QUALITY CONTROL**

- A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.
- D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
  - 1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than 3 tests.
  - 2. Foundation Wall Backfill: At each compacted backfill layer, at least 1 test for each 100 feet or less of wall length, but no fewer than 2 tests.
  - 3. Trench Backfill: At each compacted initial and final backfill layer, at least 1 test for each 150 feet or less of trench length, but no fewer than 2 tests.
- E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

### **3.21 PROTECTION**

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
  - 1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
  - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

### **3.22 DISPOSAL OF SURPLUS AND WASTE MATERIALS**

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

- B. Disposal: Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Architect.
  - 1. Remove waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

**END OF SECTION 31 2000**



## SECTION 31 5000

### EXCAVATION SUPPORT AND PROTECTION

#### 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 temporary excavation support and protection systems.
- B. Related Sections:
  - 1. Division 01 Section "Construction Progress Documentation" for recording preexisting conditions and excavation support and protection system progress.
  - 2. Division 01 Section "Temporary Facilities and Controls" for temporary utilities and support facilities.

##### 1.3 PERFORMANCE REQUIREMENTS

- A. Design, furnish, install, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting soil and hydrostatic pressure and superimposed and construction loads.
  - 1. Delegated Design: Design excavation support and protection system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
  - 2. Prevent surface water from entering excavations by grading, dikes, or other means.
  - 3. Install excavation support and protection systems without damaging existing buildings, structures, and site improvements adjacent to excavation.
  - 4. Monitor vibrations, settlements, and movements.

##### 1.4 SUBMITTALS

- A. Shop Drawings: For excavation support and protection system.
- B. Delegated-Design Submittal: For excavation support and protection system indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Coordinate first paragraph below with qualification requirements in Division 01 Section "Quality Requirements." Qualification Data: For qualified professional engineer.

D. Other Informational Submittals:

1. Photographs or Videotape: Show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by the absence of, the installation of, or the performance of excavation support and protection systems. Submit before Work begins.
2. Record Drawings: Identifying and locating capped utilities and other subsurface structural, electrical, or mechanical conditions.
  - a. Note locations and capping depth of wells and well points.

**1.5 QUALITY ASSURANCE**

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to excavation support and protection system including, but not limited to, the following:
  - a. Geotechnical report.
  - b. Existing utilities and subsurface conditions.
  - c. Proposed excavations.
  - d. Proposed equipment.
  - e. Monitoring of excavation support and protection system.
  - f. Working area location and stability.
  - g. Coordination with waterproofing.
  - h. Abandonment or removal of excavation support and protection system.

**1.6 PROJECT CONDITIONS**

A. Interruption of Existing Utilities: Do not interrupt any utility serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of utility.
2. Do not proceed with interruption of utility without Architect's, Construction Manager's, and Owner's written permission.

B. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from the data.

1. Make additional test borings and conduct other exploratory operations necessary for excavation support and protection.
2. The geotechnical report is referenced elsewhere in the Project Manual.

C. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

1. During installation of excavation support and protection systems, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations and positions for comparison with original elevations and positions. Promptly notify Architect if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. General: Provide materials that are either new or in serviceable condition and made in the USA.

### **2.2 PREPARATION**

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.
  1. Shore, support, and protect utilities encountered.
- B. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
  1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- C. Locate excavation support and protection systems clear of permanent construction so that forming and finishing of concrete surfaces are not impeded.
- D. Monitor excavation support and protection systems daily during excavation progress and for as long as excavation remains open. Promptly correct bulges, breakage, or other evidence of movement to ensure that excavation support and protection systems remain stable.
- E. Promptly repair damages to adjacent facilities caused by installing excavation support and protection systems.
- F. Install wood lagging within flanges of soldier piles as excavation proceeds. Trim excavation as required to install lagging. Fill voids behind lagging with soil, and compact.
- G. Install wales horizontally at locations indicated on Drawings and secure to soldier piles.

### **2.3 BRACING**

- A. Bracing: Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move brace, install new bracing before removing original brace.

1. Do not place bracing where it will be cast into or included in permanent concrete work unless otherwise approved by Architect.
2. Install internal bracing, if required, to prevent spreading or distortion of braced frames.
3. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

## 2.4 REMOVAL AND REPAIRS

- A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and bear soil and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils or damaging structures, pavements, facilities, and utilities.
  1. Remove excavation support and protection systems to a minimum depth of **48 inches** below overlaying construction and abandon remainder.
  2. Fill voids immediately with approved backfill compacted to density specified in Division 31 Section "Earth Moving."
  3. Repair or replace, as approved by Architect, adjacent work damaged or displaced by removing excavation support and protection systems.
- B. Leave excavation support and protection systems permanently in place.

**END OF SECTION 31 5000**

## **DIVISION 32 – EXTERIOR IMPROVEMENTS**

Section 32 1216	Asphalt Paving
Section 32 1313	Concrete Paving
Section 32 1373	Concrete Paving Joint Sealants

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## SECTION 32 1216

### ASPHALT PAVING

#### 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. Cold milling of existing hot-mix asphalt pavement.
2. Hot-mix asphalt patching.
3. Asphalt surface treatments.
4. Pavement-marking paint.
5. Traffic-calming devices.

- B. Related Sections:

1. Division 02 Section "Selective Site Demolition" for demolition, removal, and recycling of existing asphalt pavements, and for geotextiles that are not embedded within courses of asphalt paving.
2. Division 31 Section "Earth Moving" for aggregate subbase and base courses and for aggregate pavement shoulders.
3. Division 32 Sections for other paving installed as part of crosswalks in asphalt pavement areas.
4. Division 32 Section "Concrete Paving Joint Sealants" for joint sealants and fillers at paving terminations.

##### 1.3 UNIT PRICES

- A. Work of this Section is affected by unit prices and as defined in Division 1.

##### 1.4 DEFINITION

- A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.

##### 1.5 SUBMITTALS

- A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.

1. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.

2. Job-Mix Designs: For each job mix proposed for the Work.
- B. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.
- C. Samples: For each paving fabric, 12 by 12 inches minimum if used.
- D. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:
  1. Each paving fabric, 12 by 12 inches minimum.
  2. Each type and color of preformed traffic-calming device.
  3. Each pattern and color of imprinted asphalt and precut marking material.
- E. Qualification Data: For qualified manufacturer and Installer.
- F. Material Certificates: For each paving material, from manufacturer.
- G. Material Test Reports: For each paving material.

## 1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Provide copy of manufacturer's experience for verification of qualifications.
- B. Installer Qualifications: Imprinted-asphalt manufacturer's authorized installer who is trained and approved for installation of imprinted asphalt required for this Project.
- C. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated.
- D. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of city and DOT for asphalt paving work.
  1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.
- E. Preinstallation Conference: Conduct conference at Project site
  1. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:
    - a. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
    - b. Review condition of subgrade and preparatory work.
    - c. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.
    - d. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.



## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.
- B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

## 1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:
  - 1. Tack Coat: Minimum surface temperature of 60 deg F.
  - 2. Slurry Coat: Comply with weather limitations in ASTM D 3910.
  - 3. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
  - 4. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.
- B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials 55 deg F for water-based materials, and not exceeding 95 deg F.

## PART 2 - PRODUCTS

### 2.1 AGGREGATES

- A. General: Use materials and gradations that have performed satisfactorily in previous installations.
- B. Coarse Aggregate: ASTM D 692, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.
- C. Fine Aggregate: ASTM D 1073 or AASHTO M 29, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.
  - 1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.
- D. Mineral Filler: ASTM D 242 or AASHTO M 17, rock or slag dust, hydraulic cement, or other inert material.

### 2.2 ASPHALT MATERIALS

- A. Asphalt Cement: AC 20 per ASTM D 3381 for viscosity-graded material except use ductility at 39.2 deg. F., >5 for AC 20 and delete the loss on heating requirement on residue from "Thin-Film Oven Test".
- B. Prime Coat: Not required if paving is done within 48 hours of final compaction.

- C. Tack Coat: ASTM D 977 or AASHTO M 140 emulsified asphalt, or ASTM D 2397 or AASHTO M 208 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.
- D. Fog Seal: ASTM D 977 or AASHTO M 140 emulsified asphalt, or ASTM D 2397 or AASHTO M 208 cationic emulsified asphalt, slow setting, factory diluted in water, of suitable grade and consistency for application.
- E. Water: Potable.
- F. Undersealing Asphalt: ASTM D 3141, pumping consistency.

### 2.3 AUXILIARY MATERIALS

- A. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.
- B. Sand: ASTM D 1073 or AASHTO M 29, Grade Nos. 2 or 3.
- C. Paving Geotextile: AASHTO M 288, nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications.
- D. Joint Sealant: ASTM D 6690 or AASHTO M 324, Type I Type II or III Type IV, hot-applied, single-component, polymer-modified bituminous sealant.
- E. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248, Type N, Type F, and Type S; colors complying with FS TT-P-1952.
  - 1. Color: White, Yellow, Blue, and As indicated.
- F. Pavement-Marking Paint: MPI #32 Alkyd Traffic Marking Paint.
  - 1. Color: White, Yellow, Blue, and As indicated.
- G. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, Type II, with drying time of less than 45 minutes.
  - 1. Color: White, Yellow, Blue, and As indicated.
- H. Pavement-Marking Paint: MPI #97 Latex Traffic Marking Paint.
  - 1. Color: White, Yellow, Blue, and As indicated.
- I. Glass Beads: AASHTO M 247, Type 1.
- J. Wheel Stops: Precast, air-entrained concrete, 2500-psi minimum compressive strength, 4-1/2 inches high by 9 inches wide by 72 inches. Provide chamfered corners, drainage slots on underside, and holes for anchoring to substrate.
  - 1. Dowels: Galvanized steel, 3/4-inch diameter, 20-inch minimum length.

## 2.4 MIXES

- A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction; **designed** according to procedures in AI MS-2, "Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types"; and complying with the following requirements:
1. Provide mixes with a history of satisfactory performance in geographical area where Project is located. Provide mix with the following characteristics:
    - a. Number of compaction blows each end of specimen: 50.
    - b. Satiability based on ASTM D5581: 1200 minimum.
    - c. Flow in 0.01-inch units per ASTM D5581: 10-18.
    - d. Voids in mineral aggregate VMA: 15.
    - e. The percentage of bituminous material by weight added to aggregate will be between 4% and 7% of the weight of the bituminous mixture.
  2. Surface Course: 3-inch minimum compacted thickness and as indicated on the drawings with aggregate meeting the following gradation table:

1/2 inch	100
No. 4	60-80
No. 16	28-42
No. 50	11-23
No. 200	3-7
- B. Emulsified-Asphalt Slurry: ASTM D 3910, Type 1.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that subgrade is dry and in suitable condition to begin paving.
- B. Verify that the road base has been properly compacted and is at the correct line, grade, and slope.
- C. Verify that the road base thickness is as indicated on the project plans.
- D. Verify that sufficient depth at curbs, walks, lips and other vertical edges is available to place the required thickness of compacted asphalt.
- E. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
1. Completely proof-roll subgrade in one direction. Limit vehicle speed to 3 mph.
  2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons or other vehicle with similar axel weight.
  3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- F. Proceed with paving only after unsatisfactory conditions have been corrected.
- G. Verify that utilities, traffic loop detectors, and other items requiring a cut and installation beneath the asphalt surface have been completed and that asphalt surface has been repaired flush with adjacent asphalt prior to beginning installation of imprinted asphalt.

### 3.2 PATCHING

- A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.
- B. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseal concrete pieces firmly.
  - 1. Pump hot undersealing asphalt under rocking slab until slab is stabilized or, if necessary, crack slab into pieces and roll to reseal pieces firmly.
  - 2. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.
- C. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.15 gal./sq. yd.
  - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
  - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
- D. Patching: Fill excavated pavements with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.
- E. Patching: Partially fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

### 3.3 REPAIRS

- A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch in existing pavements.
  - 1. Install leveling wedges in compacted lifts not exceeding 3 inches thick.
- B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/4 inch.
  - 1. Clean cracks and joints in existing hot-mix asphalt pavement.
  - 2. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.
  - 3. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.

### 3.4 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

- B. Herbicide Treatment: Not used.
- C. Prime Coat: Do not use if paving takes place not more than 48 hours after final compaction and grading of road bases. If paving must be delayed significantly, re-grade and re-compact road base or apply Prime Coat. Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd. Apply enough material to penetrate and seal but not flood surface. Allow prime coat to cure.
  - 1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
  - 2. Protect primed substrate from damage until ready to receive paving.
- D. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.
  - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
  - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings.
  - 3. Remove and replace items damaged by overspray or clean affected surfaces as directed by architect at no additional cost to owner.

### 3.5 HOT-MIX ASPHALT PLACING

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
  - 1. Place hot-mix asphalt surface course in single lift if design thickness is less than 3-inches. If design thickness is more than 3-inches, place in multiple lifts with a minimum thickness of 1.5-inches and a maximum thickness of 3-inches.
  - 2. Spread mix at minimum temperature of 250 deg F.
  - 3. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
  - 4. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
  - 1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.
- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

### 3.6 JOINTS

- A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat to joints.
2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
3. Offset transverse joints, in successive courses, a minimum of 24 inches.
4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."
5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
6. Compact asphalt at joints to a density within 2 percent of specified course density.

### 3.7 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.
  1. Complete compaction before mix temperature cools to 185 deg F.
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
  1. Average Density: 96 percent of the laboratory Marshal Mix design density according to ASTM D 1559.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- F. Place asphalt so that final compacted asphalt is even with lip of gutter on curbs that drain away from the curb and gutter (open face or depressed curb and gutter). Place asphalt so that final compacted asphalt is 1/4-inch above lip of gutter on curbs that carry water (slope of parking lot is towards the curb). In transition areas, use extra care to make sure that no ponds, bird baths, or depressions are left after paving.
- G. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.
- H. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- I. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

### **3.8 INSTALLATION TOLERANCES**

- A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
  - 1. Surface Course: Plus 1/4 inch, no minus.
- B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
  - 1. Surface Course: 1/8 inch.
  - 2. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.
- C. After paving is complete, pour water on paved areas and identify ponds, bird baths, and depressions. Identify the same at open face and transition sections of curb and gutter. Remove and replace asphalt, curb and gutter, road base, and or sub-base as necessary to fix ponds, bird baths, or depressions at no additional cost to owner.

### **3.9 SURFACE TREATMENTS**

- A. Fog Seals: Apply fog seal at a rate of 0.10 to 0.15 gal./sq. yd. to existing asphalt pavement and allow to cure. With fine sand, lightly dust areas receiving excess fog seal.
- B. Slurry Seals: Apply slurry coat in a uniform thickness according to ASTM D 3910 and allow curing.
  - 1. Roll slurry seal to remove ridges and provide a uniform, smooth surface.

### **3.10 PAVEMENT MARKING**

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.
- B. Allow paving to age for 7 days minimum days before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.
  - 1. Broadcast glass beads uniformly into wet pavement markings at a rate of 6 lb/gal.
- E. Color
  - 1. Yellow: Parking stalls and pedestrian crossings.
  - 2. Blue: Handicap insignia at appropriate stalls.
  - 3. Red: Fire lanes and no parking areas.
  - 4. White: Directional arrows.

### 3.11 WHEEL STOPS

- A. Securely attach wheel stops to pavement with not less than two galvanized-steel dowels embedded at one-quarter to one-third points. Securely install dowels into pavement and bond to wheel stop. Recess head of dowel beneath top of wheel stop.

### 3.12 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.
- C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
- D. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979 or AASHTO T 168.
  - 1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
  - 2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726. Cores will also be measured for compacted thickness. The owner and architect may also direct additional cores to be taken at locations of their choosing to verify final pavement thickness.
    - a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than 3 cores taken.
    - b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.
    - c. Coordinate the time and locations of all holes so that cores may be filled.
- E. The contractor will replace and compact hot-mix asphalt where core tests were taken.
- F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

### 3.13 DISPOSAL

- A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.
  - 1. Do not allow milled materials to accumulate on-site.

**END OF SECTION 32 1216**



**SECTION 32 1313**  
**CONCRETE PAVING**

**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 exterior cement concrete pavement for the following:
  - 1. Walkways.
- B. Related Sections include the following:
  - 1. Division 03 Section "Cast-in-Place Concrete" for general building applications of concrete.
  - 2. Division 31 Section "Earth Moving" for subgrade preparation, grading, and subbase course.
  - 3. Division 32 Section "Concrete Paving Joint Sealants" for joint sealants of joints in concrete pavement and at isolation joints of concrete pavement with adjacent construction.

**1.3 DEFINITIONS**

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

**1.4 SUBMITTALS**

- A. Product Data: For each type of manufactured material and product indicated.
- B. Design Mixtures: For each concrete pavement mixture. Include alternate mixture designs when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
- C. Samples: 10-lb sample of exposed aggregate.
- D. Qualification Data: For manufacturer and testing agency.
- E. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:

1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.
- F. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements:
1. Cementitious materials.
  2. Steel reinforcement and reinforcement accessories.
  3. Fiber reinforcement.
  4. Admixtures.
  5. Curing compounds.
  6. Applied finish materials.
  7. Bonding agent or epoxy adhesive.
  8. Joint fillers.
- G. Field quality-control test reports.
- H. Minutes of preinstallation conference.

## 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.
1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- B. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
- C. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by requirements in the Contract Documents.
- D. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
- E. Mockups: Cast mockups of full-size sections of concrete pavement to demonstrate typical joints, surface finish, texture, color, and standard of workmanship.
1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
  2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
  3. Obtain Architect's approval of mockups before starting construction.
  4. Maintain approved mockups during construction in an undisturbed condition as a standard for judging the completed pavement.
  5. Demolish and remove approved mockups from the site when directed by Architect.

6. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
1. Before submitting design mixtures, review concrete pavement mixture design and examine procedures for ensuring quality of concrete materials and concrete pavement construction practices. Require representatives, including the following, of each entity directly concerned with concrete pavement, to attend conference:
    - a. Contractor's superintendent.
    - b. Independent testing agency responsible for concrete design mixtures.
    - c. Ready-mix concrete producer.
    - d. Concrete pavement subcontractor.

## 1.6 PROJECT CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

## 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. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
  2. Products: Subject to compliance with requirements, provide one of the products specified.
  3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
  4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### 2.2 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
1. Use flexible or curved forms for curves with a radius 100 feet or less.
- B. 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.

## 2.3 STEEL REINFORCEMENT

- A. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.
- B. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.
- C. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.
- D. Steel Bar Mats: ASTM A 184/A 184M; with ASTM A 615/A 615M, Grade 60, deformed bars; assembled with clips.
- E. Plain Steel Wire: ASTM A 82.
- F. Deformed-Steel Wire: ASTM A 496.
- G. Joint Dowel Bars: Plain steel bars, ASTM A 615/A 615M, Grade 60. Cut bars true to length with ends square and free of burrs.
- H. Tie Bars: ASTM A 615/A 615M, Grade 60, deformed.
- I. Hook Bolts: ASTM A 307, Grade A, internally and externally threaded. Design hook-bolt joint assembly to hold coupling against pavement form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.
- J. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete, and as follows:
  - 1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
  - 2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

## 2.4 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout the Project:
  - 1. Portland Cement and as specified in Division 3 except that for exterior concrete, the minimum compressive strength is 4000 psi at 28 days.
- B. Normal-Weight Aggregates: ASTM C 33, coarse aggregate, uniformly graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar pavement applications and service conditions using similar aggregates and cementitious materials.
  - 1. Maximum Coarse-Aggregate Size: 1 inch nominal.
  - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Exposed Aggregate: Selected, hard, and durable; washed; free of materials with deleterious reactivity to cement or that cause staining; from a single source, with gap-graded coarse aggregate as follows:

1. Aggregate Sizes: 3/4 to 1 inch nominal.
  2. Aggregate Source, Shape, and Color and as required by the architect.
- D. Water: ASTM C 94/C 94M.
- E. Air-Entraining Admixture: ASTM C 260.
- F. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
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.

## 2.5 FIBER REINFORCEMENT (Not Used)

- A. Synthetic Fiber: Monofilament or fibrillated polypropylene fibers engineered and designed for use in concrete pavement, complying with ASTM C 1116, Type III, 1/2 to 1-1/2 inches long.
1. Products:
    - a. Monofilament Fibers:
      - 1) Axim Concrete Technologies; Fibrasol IIP.
      - 2) Euclid Chemical Company (The); Fiberstrand 100.
      - 3) FORTA Corporation; Forta Mono.
      - 4) Grace, W. R. & Co.--Conn.; Grace MicroFiber.
      - 5) Metalcrete Industries; Polystrand 1000.
      - 6) SI Concrete Systems; Fibermix Stealth.
    - b. Fibrillated Fibers:
      - 1) Axim Concrete Technologies; Fibrasol F.
      - 2) FORTA Corporation; Forta.
      - 3) Euclid Chemical Company (The); Fiberstrand F.
      - 4) Grace, W. R. & Co.--Conn.; Grace Fibers.
      - 5) SI Concrete Systems; Fibermesh.

## 2.6 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.

D. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.

1. Products:

- a. Axim Concrete Technologies; Cimfilm.
- b. Burke by Edeco; BurkeFilm.
- c. ChemMasters; Spray-Film.
- d. Conspec Marketing & Manufacturing Co., Inc.; Aquafilm.
- e. Dayton Superior Corporation; Sure Film.
- f. Euclid Chemical Company (The); Eucobar.
- g. Kaufman Products, Inc.; Vapor Aid.
- h. Lambert Corporation; Lambco Skin.
- i. L&M Construction Chemicals, Inc.; E-Con.
- j. MBT Protection and Repair, ChemRex Inc.; Confilm.
- k. Meadows, W. R., Inc.; Sealtight Evapre.
- l. Metalcrete Industries; Waterhold.
- m. Nox-Crete Products Group, Kinsman Corporation; Monofilm.
- n. Sika Corporation, Inc.; SikaFilm.
- o. Symons Corporation; Finishing Aid.
- p. Vexcon Chemicals, Inc.; Certi-Vex EnvioAssist.

E. Clear Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

1. Products:

- a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
- b. Burke by Edoko; Aqua Resin Cure.
- c. ChemMasters; Safe-Cure Clear.
- d. Conspec Marketing & Manufacturing Co., Inc.; W.B. Resin Cure.
- e. Dayton Superior Corporation; Day Chem Rez Cure (J-11-W).
- f. Euclid Chemical Company (The); Kurez DR VOX.
- g. Kaufman Products, Inc.; Thinfilm 420.
- h. Lambert Corporation; Aqua Kure-Clear.
- i. L&M Construction Chemicals, Inc.; L&M Cure R.
- j. Meadows, W. R., Inc.; 1100 Clear.
- k. Nox-Crete Products Group, Kinsman Corporation; Resin Cure E.
- l. Symons Corporation; Resi-Chem Clear.
- m. Tamms Industries Inc.; Horncure WB 30.
- n. Unitex; Hydro Cure 309.
- o. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.

F. White Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B.

1. Products:

- a. Anti-Hydro International, Inc.; AH Curing Compound #2 WP WB.
- b. Burke by Edoco; Resin Emulsion White.
- c. ChemMasters; Safe-Cure 2000.
- d. Conspec Marketing & Manufacturing Co., Inc.; W.B. Resin Cure.
- e. Dayton Superior Corporation; Day-Chem White Pigmented Cure (J-10-W).

- f. Euclid Chemical Company (The); Kurez VOX White Pigmented.
- g. Kaufman Products, Inc.; Thinfilm 450.
- h. Lambert Corporation; Aqua Kure-White.
- i. L&M Construction Chemicals, Inc.; L&M Cure R-2.
- j. Meadows, W. R., Inc.; 1200-White.
- k. Symons Corporation; Resi-Chem White.
- l. Tamms Industries, Inc.; Horncure 200-W.
- m. Unitex; Hydro White.
- n. Vexcon Chemicals, Inc.; Certi-Vex Enviocure White 100.

## 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. Color stain: Match Architect's sample or as selected by Architect from manufacturer's full range of stains.
- C. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery with emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.
- D. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- E. 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 requirements, and as follows:
  - 1. Types I and II, non-load bearing and types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- F. Chemical Surface Retarder: Water-soluble, liquid-set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch.
  - 1. Products:
    - a. Burke by Edeco; True Etch Surface Retarder.
    - b. ChemMasters; Exposee.
    - c. Conspec Marketing & Manufacturing Co., Inc.; Delay S.
    - d. Euclid Chemical Company (The); Surface Retarder S.
    - e. Kaufman Products, Inc.; Expose.
    - f. Metalcrete Industries; Surfard.
    - g. Nox-Crete Products Group, Kinsman Corporation; Crete-Nox TA.
    - h. Scofield, L. M. Company; Lithotex.
    - i. Sika Corporation, Inc.; Rugasol-S.
    - j. Vexcon Chemicals, Inc.; Certi-Vex Envioset.
- G. Pigmented Mineral Dry-Shake Hardener: Factory-packaged dry combination of portland cement, graded quartz aggregate, color pigments, and plasticizing admixture. Use color pigments that are finely ground, nonfading mineral oxides interground with cement.

1. Products:
    - a. Conspec Marketing & Manufacturing Co., Inc.; Conshake 600 Colortone.
    - b. Dayton Superior Corporation; Quartz Tuff.
    - c. Euclid Chemical Company (The); Surfex.
    - d. Lambert Corporation; Colorhard.
    - e. L&M Construction Chemicals, Inc.; Quartz Plate FF.
    - f. MBT Protection and Repair, ChemRex Inc.; Mastercron.
    - g. Metalcrete Industries; Floor Quartz.
    - h. Scofield, L. M. Company; Lithochrome Color Hardener.
    - i. Symons Corporation; Hard Top.
  2. Color: Match Architect's sample or as selected by Architect from manufacturer's full range.
- H. Rock Salt: Sodium chloride crystals, kiln dried, coarse gradation with 100 percent passing 3/8-inch sieve and 85 percent retained on a No. 8 sieve.

## 2.8 PAVEMENT MARKINGS

- A. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with FS TT-P-115, Type I or II or AASHTO M 248, Type N or F.
  1. Color: White, Yellow, Blue. See Section 321216 for color locations.
- B. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, with drying time of less than 45 minutes.
  1. Color: White, Yellow, Blue. See Section 321216 for color locations.
- C. Glass Beads: AASHTO M 247, Type 1.

## 2.9 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.
  1. Use a qualified independent testing agency for preparing and reporting proposed concrete mixture designs for the trial batch method.
- B. Proportion mixtures to provide normal-weight concrete with the following properties:
  1. Compressive Strength (28 Days): 4000 psi
  2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.45
  3. Select slump limit from options in subparagraph below or revise to suit Project.
  4. Slump Limit: 4 inches, plus or minus 1 inch.
- C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
  1. Air Content: 5-8 percent nominal maximum aggregate size.



- D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
  - 1. Use water-reducing admixture, high-range, water-reducing admixture, high-range, water-reducing and retarding admixture, plasticizing, and retarding admixture in concrete, as required, for placement and workability.
  - 2. Specify admixtures as part of submittal. Verify that admixtures proposed do not adversely effect stained concrete and will not modify colors of stain.
  - 3. Coordinate acceptability of admixtures with architect.
- F. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements as follows:
  - 1. Fly Ash or Pozzolan: 25 percent.
  - 2. Ground Granulated Blast-Furnace Slag: 50 percent.
  - 3. Combined Fly Ash or Pozzolan, and Ground Granulated Blast-Furnace Slag: 50 percent, with fly ash or pozzolan not exceeding 25 percent.
- G. Synthetic Fiber: Uniformly disperse in concrete mix at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd. where specified and approved in mix submittal.
- H. Color Stain: Add stain to concrete per manufacturers recommendations and to meet color required by architect and owner on areas of stained concrete.

## 2.10 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates for each batch discharged and used in the Work.
  - 1. When air temperature is between 85 deg F and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
  - 1. For concrete mixes of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
  - 2. For concrete mixes larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
  - 3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.
- B. Proof-roll prepared subbase surface below concrete pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.
  - 1. Completely proof-roll subbase in one direction. Limit vehicle speed to 3 mph.
  - 2. Proof-roll with a loaded 10-wheel tandem-axle dump truck weighing not less than 15 tons or similar axel weight vehicle.
  - 3. Subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch require correction according to requirements in Division 31 Section "Earth Moving."
- C. Proceed with concrete pavement operations only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

### **3.2 PREPARATION**

- A. Remove loose material from compacted subbase surface immediately before placing concrete.

### **3.3 EDGE FORMS AND SCREED CONSTRUCTION**

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

### **3.4 STEEL REINFORCEMENT**

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- D. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

- E. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

### 3.5 JOINTS

- A. General: Form construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.
  - 1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour unless pavement terminates at isolation joints.
  - 1. Continue steel reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.
  - 2. Provide tie bars at sides of pavement strips where indicated.
  - 3. Butt Joints: Use bonding agent at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
  - 4. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
  - 5. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.
- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
  - 1. Locate expansion joints at intervals of 50 feet, unless otherwise indicated.
  - 2. Extend joint fillers full width and depth of joint.
  - 3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
  - 4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
  - 5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
  - 6. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
- D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:
  - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat

grooving of contraction joints after applying surface finishes. Eliminate groover 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-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.

Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

- E. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

### 3.6 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast in. Notify other trades to permit installation of their work.
- B. Remove snow, ice, or frost from subbase surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.
- C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
- D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.
- E. Do not add water to concrete during delivery or at Project site.
- F. Do not add water to fresh concrete after testing.
- G. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- H. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
  1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.
- I. Place concrete in two operations; strike off initial pour for entire width of placement and to the required depth below finish surface. Lay welded wire fabric or fabricated bar mats immediately in final position. Place top layer of concrete, strike off, and screed.
  1. Remove and replace concrete that has been placed for more than 15 minutes without being covered by top layer, or use bonding agent if approved by Architect.
- J. Screed pavement surfaces with a straightedge and strike off.

- K. Commence initial floating using bull floats or darbies to impart an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.
- L. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
  - 1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
  - 2. Do not use frozen materials or materials containing ice or snow.
  - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mix designs.
- M. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:
  - 1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F 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. Using liquid nitrogen to cool concrete is Contractor's option.
  - 2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
  - 3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

### 3.7 FLOAT FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.
- B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
  - 1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
  - 2. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.
  - 3. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.
  - 4. Coordinate with architect the locations of each type of finish.

### 3.8 SPECIAL FINISHES

- A. Monolithic Exposed-Aggregate Finish: Expose coarse aggregate in pavement surfaces as follows:
  - 1. Immediately after float finishing, spray-apply chemical surface retarder to pavement according to manufacturer's written instructions.
  - 2. Cover pavement surface with plastic sheeting, sealing laps with tape, and remove when ready to continue finishing operations.
  - 3. Without dislodging aggregate, remove excess mortar by lightly brushing surface with a stiff, nylon-bristle broom.
  - 4. Fine-spray surface with water and brush. Repeat water flushing and brushing cycle until cement film is removed from aggregate surfaces to depth required.
- B. Coordinate the locations of finishes with the architect and owner prior to placing concrete.

### 3.9 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- B. Comply with ACI 306.1 for cold-weather protection.
- C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. 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.
- D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:
  - 1. Moist 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 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, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
  - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

### 3.10 PAVEMENT TOLERANCES

- A. Comply with tolerances of ACI 117 and as follows:
1. Elevation: 1/4 inch.
  2. Thickness: Plus 3/8 inch, minus 1/4 inch.
  3. Surface: Gap below 10-foot-long, unlevelled straightedge not to exceed 1/4 inch.
  4. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch.
  5. Vertical Alignment of Tie Bars and Dowels: 1/4 inch.
  6. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: 1/2 inch.
  7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches.
  8. Joint Spacing: 3 inches.
  9. Contraction Joint Depth: Plus 1/4 inch, no minus.
  10. Joint Width: Plus 1/8 inch, no minus.
  11. .

### 3.11 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Services: 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 1 composite sample for each 100 cu. yd. or 5000 sq. ft. or fraction thereof of each concrete mix 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 composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
  3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
  4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
  5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
  6. Compressive-Strength Tests: ASTM C 39/C 39M; test 1 specimen at 7 days and 2 specimens at 28 days.
    - a. A compressive-strength test shall be the average compressive strength from 2 specimens obtained from same composite sample and tested at 28 days.
- C. Strength of each concrete mix will be satisfactory if average of any 3 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.

- D. 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.
- E. 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.
- F. 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.
- G. Remove and replace concrete pavement where test results indicate that it does not comply with specified requirements.
- H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

### **3.12 REPAIRS AND PROTECTION**

- A. Remove and replace concrete pavement that is broken, damaged, or defective or that does not comply with requirements in this Section.
- B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.
- C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.
- D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

**END OF SECTION 32 1313**



## SECTION 32 1373

### CONCRETE PAVING JOINT SEALANTS

#### 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. Expansion and contraction joints within cement concrete pavement.
  - 2. Joints between cement concrete and asphalt pavement.
- B. Related Sections include the following:
  - 1. Division 07 Section "Joint Sealants" for sealing nontraffic and traffic joints in locations not specified in this Section.
  - 2. Division 32 Section "Asphalt Paving" for constructing joints between concrete and asphalt pavement.
  - 3. Division 32 Section "Concrete Paving" for constructing joints in concrete pavement.

##### 1.3 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Verification: For each type and color of joint sealant required. Install joint-sealant samples in 1/2-inch wide joints formed between two 6-inch long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

##### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance for a minimum of 5-years.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- C. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants, as determined by Architect.

1. Use manufacturer's standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Submit not fewer than eight pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

## **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

## **1.6 PROJECT CONDITIONS**

- A. Do not proceed with installation of joint sealants under the following conditions:
  1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
  2. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (4.4 deg C).
  3. When joint substrates are wet or covered with frost.
  4. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
  5. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

### **2.2 MATERIALS, GENERAL**

- A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.

- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

## 2.3 COLD-APPLIED JOINT SEALANTS

### A. Multi-component Non-sag Urethane Sealant:

#### 1. Products:

- a. Sikaflex – 2c NS; Sika Corporation or approved equal (Sooneborn NP-2, Tremco 240, Pecora Dynatrol 2).

#### 2. Type and Grade: M (multi-component) and NS (non-sag).

#### 3. Class: 25.

#### 4. Additional Movement Capability: 50 percent movement in extension and 50 percent in compression for a total of 100 percent movement.

#### 5. Use Related to Exposure: NT (non-traffic) and T (Traffic).

#### 6. Uses Related to Joint Substrates: M, G, A, O, I.

#### 7. Applications: Exterior and interior joints and gaps in vertical and horizontal surfaces. Submerged or immersion grade applications also apply.

### B. Multicomponent Jet-Fuel-Resistant Sealant for Concrete: Pourable, chemically curing elastomeric formulation complying with the following requirements for formulation and with ASTM C 920 for type, grade, class, and uses indicated:

#### 1. Urethane Formulation: Type M; Grade P; Class 12-1/2; Uses T, M, and, as applicable to joint substrates indicated, O.

#### a. Products:

- 1) Pecora Corporation; Urexpam NR-300; Sikaflex 2c SL.

### C. Single-Component Jet-Fuel-Resistant Urethane Sealant for Concrete: Single-component, pourable, coal-tar-modified, urethane formulation complying with ASTM C 920 for Type S; Grade P; Class 25; Uses T, M, and, as applicable to joint substrates indicated, O.

#### 1. Products:

- a. Sonneborn, Div. of ChemRex, Inc.; Sonomeric 1; Sikaflex 1a.

### D. Type NS Silicone Sealant for Concrete: Single-component, low-modulus, neutral-curing, nonsag silicone sealant complying with ASTM D 5893 for Type NS.

#### 1. Products:

- a. Crafcro Inc.; RoadSaver Silicone.
- b. Dow Corning Corporation; 888.

### E. Type SL Silicone Sealant for Concrete and Asphalt: Single-component, low-modulus, neutral-curing, self-leveling silicone sealant complying with ASTM D 5893 for Type SL.

#### 1. Products:

- a. Crafcro Inc.; RoadSaver Silicone SL.

- b. Dow Corning Corporation; 890-SL.

## **2.4 JOINT-SEALANT BACKER MATERIALS**

- A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.
- B. Round Backer Rods for Cold- and Hot-Applied Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

## **2.5 PRIMERS**

- A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

# **PART 3 - EXECUTION**

## **3.1 EXAMINATION**

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

## **3.2 PREPARATION**

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.
- B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

## **3.3 INSTALLATION OF JOINT SEALANTS**

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

- C. Install backer materials of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
  - 1. Do not leave gaps between ends of backer materials.
  - 2. Do not stretch, twist, puncture, or tear backer materials.
  - 3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.
  
- D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
  - 1. Place sealants so they directly contact and fully wet joint substrates.
  - 2. Completely fill recesses provided for each joint configuration.
  - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
  
- E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
  - 1. Remove excess sealants from surfaces adjacent to joint.
  - 2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.
  
- F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions, unless otherwise indicated.
  
- G. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

### **3.4 CLEANING**

- A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

### **3.5 PROTECTION**

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations with repaired areas are indistinguishable from the original work.

**END OF SECTION 32 1373**

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## **DIVISION 33 – UTILITIES**

Section 33 0500

Common Work Results for Utilities

Section 33 4100

Storm Utility Drainage Piping

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## SECTION 33 0500

### COMMON WORK RESULTS FOR UTILITIES

#### 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 joining materials.
  - 2. Transition fittings.
  - 3. Dielectric fittings.
  - 4. Sleeves.
  - 5. Identification devices.
  - 6. Grout.
  - 7. Flowable fill.
  - 8. Piped utility demolition.
  - 9. Piping system common requirements.
  - 10. Equipment installation common requirements.
  - 11. Painting.
  - 12. Concrete bases.
  - 13. Metal supports and anchorages.

##### 1.3 DEFINITIONS

- A. Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.
- B. Concealed 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.
- C. PVC: Polyvinyl chloride plastic.
- D. DI: Ductile Iron pipe

##### 1.4 SUBMITTALS

- A. Product Data: For the following:
  - 1. Dielectric fittings.
  - 2. Identification devices.

- B. Welding certificates.

## 1.5 QUALITY ASSURANCE

- A. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

## 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. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- B. Coordinate installation of identifying devices after completing covering and painting if devices are applied to surfaces.
- C. Coordinate size and location of concrete bases. Formwork, reinforcement, and concrete requirements are specified in Division 03.

## PART 2 - PRODUCTS

### 2.1 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  - 1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness, unless otherwise indicated.
    - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
  - 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- D. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

- E. Solvent Cements for Joining Plastic Piping:
  - 1. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
- F. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

## 2.2 TRANSITION FITTINGS

- A. Transition Fittings, General: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
- B. Transition Couplings NPS 1-1/2 and Smaller:
  - 1. Underground Piping: Manufactured piping coupling or specified piping system fitting.
  - 2. Aboveground Piping: Specified piping system fitting.
- C. AWWA Transition Couplings NPS 2 and Larger:
  - 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. Cascade Waterworks Mfg. Co.
    - b. Dresser, Inc.; DMD Div.
    - c. Ford Meter Box Company, Inc. (The); Pipe Products Div.
    - d. JCM Industries.
    - e. Smith-Blair, Inc.
    - f. Viking Johnson.
  - 3. Description: AWWA C219, metal sleeve-type coupling for underground pressure piping.
- D. Plastic-to-Metal Transition Fittings:
  - 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. Spears Manufacturing Co.
  - 3. Description: PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions.
- E. Plastic-to-Metal Transition Unions:
  - 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. Colonial Engineering, Inc.
- b. NIBCO INC.
- c. Spears Manufacturing Co.

F. Flexible Transition Couplings for Underground Nonpressure Drainage Piping:

- 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. Cascade Waterworks Mfg. Co.
  - b. Fernco, Inc.
  - c. Mission Rubber Company.
  - d. Plastic Oddities.

G. Description: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

**2.3 DIELECTRIC FITTINGS**

A. Dielectric Fittings, General: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

B. Dielectric Unions:

- 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. Capitol Manufacturing Co.
  - b. Central Plastics Company.
  - c. Epco Sales, Inc.
  - d. Hart Industries, International, Inc.
  - e. Watts Water Technologies, Inc.
  - f. Zurn Plumbing Products Group; Wilkins Div.
- 3. Description: Factory fabricated, union, NPS 2 and smaller.
  - a. Pressure Rating: 150 psig minimum.

C. Dielectric Flanges:

- 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. Capitol Manufacturing Co.
  - b. Central Plastics Company.
  - c. Epco Sales, Inc.
  - d. Watts Water Technologies, Inc.
3. Description: Factory-fabricated, bolted, companion-flange assembly, NPS 2-1/2 to NPS 4 and larger.
- a. Pressure Rating: 175 psig minimum.
- D. Dielectric-Flange Kits:
- 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. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Central Plastics Company.
    - d. Pipeline Seal and Insulator, Inc.
  - 3. Description: Nonconducting materials for field assembly of companion flanges, NPS 2-1/2 and larger.
    - a. Pressure Rating: 150 psig minimum.
    - b. Gasket: Neoprene or phenolic.
    - c. Bolt Sleeves: Phenolic or polyethylene.
    - d. Washers: Phenolic with steel backing washers.
- E. Dielectric Couplings:
- 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. Calpico, Inc.
    - b. Lochinvar Corporation.
  - 3. Description: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining, NPS 3 and smaller.
    - a. Pressure Rating: 300 psig at 225 deg F
    - b. End Connections: Threaded.
- F. Dielectric Nipples:
- 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. Perfection Corporation.
  - b. Precision Plumbing Products, Inc.
  - c. Victaulic Company.
3. Description: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining.
  - a. Pressure Rating: 300 psig at 225 deg F.
  - b. End Connections: Threaded or grooved.

## 2.4 SLEEVES

- A. Mechanical sleeve seals for pipe penetrations are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- C. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized, plain ends.
- D. Cast-Iron Sleeves: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- E. Molded PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.
- F. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.
- G. Molded PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

## 2.5 IDENTIFICATION DEVICES

- A. General: Products specified are for applications referenced in other Division 33 Sections. If more than single type is specified for listed applications, selection is Installer's option.
- B. Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.
  1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.
  2. Location: Accessible and visible.

## 2.6 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.

## 2.7 FLOWABLE FILL

- A. Description: Low-strength-concrete, flowable-slurry mix.
  1. Cement: ASTM C 150, Type I, portland.
  2. Density: 115- to 145-lb/cu. ft.
  3. Aggregates: ASTM C 33, natural sand, fine and crushed gravel or stone, coarse.
  4. Aggregates: ASTM C 33, natural sand, fine.
  5. Admixture: ASTM C 618, fly-ash mineral.
  6. Water: Comply with ASTM C 94/C 94M.
  7. Strength: 100 to 200 psig at 28 days.

## PART 3 - EXECUTION

### 3.1 PIPED UTILITY 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 piped utility 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. Fill abandoned piping with flowable fill, 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 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 DIELECTRIC FITTING APPLICATIONS

- A. Dry Piping Systems: Connect piping of dissimilar metals with the following:
  1. NPS 2 and Smaller: Dielectric unions.
  2. NPS 2-1/2 to NPS 12: Dielectric flanges or dielectric flange kits.
- B. Wet Piping Systems: Connect piping of dissimilar metals with the following:
  1. NPS 2 and Smaller: Dielectric couplings or dielectric nipples or nipples.
  2. NPS 2-1/2 to NPS 4 : Dielectric nipples.

3. NPS 2-1/2 to NPS 8: Dielectric nipples or dielectric flange kits.
4. NPS 10 and NPS 12: Dielectric flange kits.

### 3.3 PIPING INSTALLATION

- A. Install piping according to the following requirements and Division 33 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 the Coordination Drawings.
- 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 to permit valve servicing.
- 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. Select system components with pressure rating equal to or greater than system operating pressure.
- I. Sleeves are not required for core-drilled holes.
- J. Permanent sleeves are not required for holes formed by removable PE sleeves.
- K. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
  1. Cut sleeves to length for mounting flush with both surfaces.
  2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
    - a. PVC or Steel Pipe Sleeves: For pipes smaller than NPS 6.
- L. Verify final equipment locations for roughing-in.
- M. Refer to equipment specifications in other Sections for roughing-in requirements.

### 3.4 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 33 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. 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.
- E. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- G. Grooved Joints: Assemble joints with grooved-end pipe coupling with coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.
- H. 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 (0.20 percent maximum lead content) complying with ASTM B 32.
- I. 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.
- J. Pressure-Sealed Joints: Assemble joints for plain-end copper tube and mechanical pressure seal fitting with proprietary crimping tool to according to fitting manufacturer's written instructions.
- K. Plastic Piping Solvent-Cemented 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. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 appendixes.
  - 3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
  - 4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
  - 5. PVC Nonpressure Piping: Join according to ASTM D 2855.
  - 6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.
- L. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- M. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
- N. Plastic 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 PE Pipe and Fittings: Use butt fusion.
  - 2. Plain-End PE Pipe and Socket Fittings: Use socket fusion.

- O. Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

### **3.5 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. Install dielectric fittings at connections of dissimilar metal pipes.

### **3.6 EQUIPMENT INSTALLATION**

- A. Install equipment level and plumb, unless otherwise indicated.
- B. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference with other installations. Extend grease fittings to an accessible location.
- C. Install equipment to allow right of way to piping systems installed at required slope.

### **3.7 PAINTING**

- A. Painting of piped utility systems, equipment, and components is specified in Division 09 painting Sections.
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

### **3.8 IDENTIFICATION**

- A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.
  - 1. Plastic markers, with application systems. Install on insulation segment if required for hot noninsulated piping. Place direct bury marker 12-18 inches above top of pipe but not less than 12-inches below finish grade.

### **3.9 GROUTING**

- A. Mix and install grout for 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 33 0500**

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## SECTION 33 4100

### STORM UTILITY DRAINAGE PIPING

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. This Section includes gravity-flow, nonpressure storm drainage outside the building, with the following components:
  - 1. Special fittings for expansion and deflection.
  - 2. Cleanouts.
  - 3. Drains.
  - 4. Precast concrete manholes, inlet boxes, catch basins.

##### 1.3 DEFINITIONS

- A. PVC: Polyvinyl chloride plastic.
- B. CP: Non-reinforced concrete pipe.
- C. RCP: Reinforced concrete pipe.

##### 1.4 PERFORMANCE REQUIREMENTS

- A. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: 10-foot head of water. Pipe joints shall be at least silttight, unless otherwise indicated.

##### 1.5 SUBMITTALS

- A. Product Data: For the following:
  - 1. Special pipe fittings.
  - 2. Drains.
  - 3. Storage.
  - 4. Pipes.
- B. Shop Drawings: For the following:
  - 1. Manholes: Include plans, elevations, sections, details, and frames and covers. Include design calculations, and concrete design-mix report for cast-in-place manholes.

2. Catch Basins and Stormwater Inlets. Include plans, elevations, sections, details, and frames, covers, and grates.
  3. Stormwater Detention Structures: Include plans, elevations, sections, details, frames and covers, design calculations, and concrete design-mix report.
- C. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from storm drainage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.
- D. Profile Drawings: Show system piping in elevation. Draw profiles at horizontal scale of not less than 1 inch equals 50 feet and vertical scale of not less than 1 inch equals 5 feet. Indicate manholes and piping. Show types, sizes, materials, and elevations of other utilities crossing system piping.
- E. Field quality-control test reports.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Do not store plastic manholes, pipe, and fittings in direct sunlight.
- B. Protect pipe, pipe fittings, and seals from dirt and damage.
- C. Handle manholes according to manufacturer's written rigging instructions.
- D. Handle catch basins and stormwater inlets according to manufacturer's written rigging instructions.

## **1.7 PROJECT CONDITIONS**

- A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
  1. Notify Architect, Construction Manager, and Owner no fewer than two days in advance of proposed interruption of service. Coordinate interruptions during weekly meetings and at pre-construction meeting.
  2. Do not proceed with interruption of service without Architect's, Construction Manager's, and Owner's written permission.

## **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. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include local pre-cast manufacturers but are subject to approval of the engineer and architect.

## 2.2 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, fitting, and joining materials.

## 2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service class.
- B. Gaskets: ASTM C 564, rubber.
- C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

## 2.4 PVC PIPE AND FITTINGS

- A. PVC Pressure Pipe: AWWA C900, Class 150 for gasketed joints and using ASTM F 477, elastomeric seals.
  - 1. Fittings NPS 4 to NPS 8: PVC pressure fittings complying with AWWA C907, for gasketed joints and using ASTM F 477, elastomeric seals.
  - 2. Fittings NPS 10 and Larger: Ductile-iron, compact fittings complying with AWWA C153, for push-on joints and using AWWA C111, rubber gaskets.
- B. PVC Water-Service Pipe and Fittings: ASTM D 1785, Schedule 80 pipe, with plain ends for solvent-cemented joints with ASTM D 2467, Schedule 80, socket-type fittings.
- C. PVC Cellular-Core Pipe and Fittings: ASTM F 891, Sewer and Drain Series, PS 50 minimum stiffness pipe with ASTM D 3034, SDR 35, socket-type fittings for solvent-cemented joints.
- D. PVC Sewer Pipe and Fittings, NPS 15 and Smaller: ASTM D 3034, SDR 35, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.
- E. PVC Sewer Pipe and Fittings, NPS 18 and Larger: ASTM F 679, T 2 wall thickness, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.
- F. PVC Profile Gravity Sewer Pipe and Fittings: ASTM F 794 pipe, with bell-and-spigot ends; ASTM D 3034 fittings, with bell ends; and ASTM F 477, elastomeric seals.

## 2.5 CONCRETE PIPE AND FITTINGS

- A. Nonreinforced-Concrete Sewer Pipe and Fittings: ASTM C 14, Class I, II or III, with bell-and-spigot ends and gasketed joints with ASTM C 443, rubber gaskets.
- B. Piping in paragraph below is available in 5 classes and 3 wall thicknesses, and in NPS 12 to NPS 144. Not all classes and wall thicknesses are available. Joints are gasket type. Contractor, at his option, may use non-reinforced pipe for sizes up to 21-inches if structural requirements based on load on pipe are not exceeded for that pipe. If reinforced pipe is selected, choose the pipe class and wall thickness to suit availability and structural requirements based on loads and cover.
- C. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76, with bell-and-spigot ends and gasketed joints with ASTM C 443, rubber gaskets.

1. Class III

## 2.6 NONPRESSURE-TYPE PIPE COUPLINGS

- A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
- B. Sleeve Materials:
  1. For Concrete Pipes: ASTM C 443, rubber.
  2. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
  3. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
  4. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
- C. Unshielded Flexible Couplings: Elastomeric sleeve with stainless-steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
  1. Manufacturers:
    - a. Dallas Specialty & Mfg. Co.
    - b. Fernco Inc.
    - c. Logan Clay Products Company (The).
    - d. Mission Rubber Company; a division of MCP Industries, Inc.
    - e. NDS Inc.
    - f. Plastic Oddities, Inc.
- D. Shielded Flexible Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
  1. Manufacturers:
    - a. Cascade Waterworks Mfg.
    - b. Dallas Specialty & Mfg. Co.
    - c. Mission Rubber Company; a division of MCP Industries, Inc.
- E. Ring-Type Flexible Couplings: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.
  1. Manufacturers:
    - a. Fernco Inc.
    - b. Logan Clay Products Company (The).
    - c. Mission Rubber Company; a division of MCP Industries, Inc.

## 2.7 CLEANOUTS

- A. Gray-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.



1. Manufacturers:
    - a. Josam Company.
    - b. MIFAB Manufacturing, Inc.
    - c. Smith, Jay R. Mfg. Co.
    - d. Wade Div.; Tyler Pipe.
    - e. Watts Industries, Inc.
    - f. Watts Industries, Inc.; Enpoco, Inc. Div.
    - g. Zurn Industries, Inc.; Zurn Specification Drainage Operation.
  2. Top-Loading Classification(s): Light, Medium, Heavy, and Extra-heavy duty depending on location and expected driving load on cleanout.
  3. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.
- B. PVC Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping. Place in grey iron housing with clamping device and round, secured, scoriated, gray-iron cover.
1. Manufacturers:
    - a. Canplas Inc.
    - b. IPS Corporation.
    - c. NDS Inc.
    - d. Plastic Oddities, Inc.
    - e. Sioux Chief Manufacturing Company, Inc.
    - f. Zurn Industries, Inc.; Zurn Light Commercial Specialty Plumbing Products.

## 2.8 DRAINS

- A. Gray-Iron Area Drains: ASME A112.21.1M, round body with anchor flange and round secured grate. Include bottom outlet with inside calk or spigot connection, of sizes indicated.
1. Manufacturers:
    - a. Josam Company.
    - b. MIFAB Manufacturing, Inc.
    - c. Smith, Jay R. Mfg. Co.
    - d. Wade Div.; Tyler Pipe.
    - e. Watts Industries, Inc.
    - f. Watts Industries, Inc.; Enpoco, Inc. Div.
    - g. Zurn Industries, Inc.; Zurn Specification Drainage Operation.
  2. Top-Loading Classification(s): Medium and heavy duty depending on location and expected driving load.

## 2.9 MANHOLES

- A. Standard Precast Concrete Manholes: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
1. Diameter: 48 inches minimum, unless otherwise indicated and as needed for pipe sizes.

2. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
  3. Base Section: 9-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
  4. Riser Sections: 4-inch minimum thickness, and lengths to provide depth indicated.
  5. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
  6. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
  7. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
  8. Steps: Not used.
  9. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and diameter matching manhole frame and cover. Include sealant recommended by ring manufacturer.
  10. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover.
  11. Manhole Frames and Covers: Ferrous; 24-inch ID by 7- to 9-inch riser with 4-inch-minimum width flange and 26-inch- diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."
    - a. Material: ASTM A 536, Grade 60-40-18 ductile or ASTM A 48, Class 35 gray iron, unless otherwise indicated and to match existing manhole frames and covers.
    - b. Protective Coating: Foundry-applied, SSPC-Paint 16, coal-tar, epoxy-polyamide paint; 15-mil minimum thickness applied to all surfaces, unless otherwise indicated.
- B. Cast-in-Place Concrete Manholes: Construct of reinforced-concrete bottom, walls, and top; designed according to ASTM C 890 for A-16 (ASSHTO HS20-44), heavy-traffic, structural loading; of depth, shape, dimensions, and appurtenances indicated.
1. Ballast: Increase thickness of concrete, as required to prevent flotation.
  2. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
  3. Steps: Not used.
  4. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and diameter matching manhole frame and cover. Include sealant recommended by ring manufacturer.
  5. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover.
  6. Manhole Frames and Covers: Ferrous; 24-inch ID by 7- to 9-inch riser with 4-inch-minimum width flange and 26-inch- diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."
    - a. Material: ASTM A 536, Grade 60-40-18 ductile or ASTM A 48, Class 35 gray iron, unless otherwise indicated and to match existing frames and covers.
    - b. Protective Coating: Foundry-applied, SSPC-Paint 16, coal-tar, epoxy-polyamide paint 15-mil minimum thickness applied to all surfaces, unless otherwise indicated.

## 2.10 CONCRETE

- A. General: Cast-in-place concrete according to ACI 318/318R, ACI 350R, and the following:
1. Cement: ASTM C 150, Type II.
  2. Fine Aggregate: ASTM C 33, sand.

3. Coarse Aggregate: ASTM C 33, crushed gravel.
  4. Water: Potable.
- B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water-cementitious materials ratio.
1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
  2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.
- C. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water-cementitious materials ratio.
1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
  2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

## 2.11 CATCH BASINS

- A. Standard Precast Concrete Catch Basins: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
1. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
  2. Riser Sections: 4-inch minimum thickness, and lengths to provide depth indicated.
  3. Top Section: Flat-slab-top type with hole for frame and grate is indicated.
  4. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
  5. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
  6. Grade Rings: Include 2 or 3 reinforced-concrete rings, of 6- to 9-inch total thickness, that match frame and grate.
  7. Steps: Not Used.
  8. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section. Size sections and box or manhole to fit pipes without necessary
- B. Cast-in-Place Concrete, Catch Basins: Construct of reinforced concrete; designed according to ASTM C 890 for structural loading; of depth, shape, dimensions, and appurtenances indicated.
1. Bottom, Walls, and Top: Reinforced concrete.
  2. Channels and Benches: Concrete.
  3. Steps: Not used.
- C. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16, structural loading. Include flat grate with small square or short-slotted drainage openings.
1. Size: 24 by 24 inches minimum, unless otherwise indicated.
  2. Grate Free Area: Approximately 50 percent, unless otherwise indicated.
- D. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16, structural loading. Include 24-inch ID by 7- to 9-inch riser with 4-inch minimum width flange, and 26-inch-diameter flat grate with small, square or short-slotted drainage openings.
1. Grate Free Area: Approximately 50 percent, unless otherwise indicated.

## **2.12 STORMWATER INLETS**

- A. Gutter Inlets: Horizontal gutter opening, of materials and dimensions indicated. Include heavy-duty frames and grates. All grates to be bicycle safe.
- B. Combination Inlets: Vertical curb and horizontal gutter openings, of materials and dimensions indicated. Include heavy-duty frames and grates.

## **2.13 DRY WELLS (NOT USED)**

## **2.14 STORMWATER DISPOSAL SYSTEM (NOT USED)**

### **PART 3 - EXECUTION**

#### **3.1 EARTHWORK**

- A. Excavation, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

#### **3.2 PIPING APPLICATIONS**

- A. Pipe couplings and special pipe fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
  - 1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping, unless otherwise indicated.
    - a. Flexible or rigid couplings for same or minor difference OD pipes.
    - b. Unshielded, increaser/reducer-pattern, flexible or rigid couplings for pipes with different OD.
    - c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.
  - 2. Use pressure-type pipe couplings for force-main joints.
- B. Gravity-Flow, Nonpressure Sewer Piping: Use any of the following pipe materials for each size range:
  - 1. PVC water-service pipe; PVC Schedule 40, water-service-pipe fittings; and solvent-cemented joints.
  - 2. PVC sewer pipe and fittings; gaskets; and gasketed joints.
  - 3. Class 2, nonreinforced-concrete sewer pipe and fittings, gaskets, and gasketed joints.
  - 4. Ductile-iron culvert pipe, ductile-iron standard or compact fittings, gaskets, and gasketed joints.
  - 5. Reinforced-concrete sewer pipe and fittings, gaskets, and gasketed joints.
  - 6. Corrugated steel pipe and fittings, standard and special-joint bands, and banded joints.
  - 7. Corrugated aluminum pipe and fittings, standard and special-joint bands, and banded joints.
  - 8. Corrugated PE pipe and fittings, silttight couplings, and coupled joints.

### 3.3 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
- C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
- D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- E. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed by tunneling, jacking, or a combination of both.
- F. Install gravity-flow, nonpressure drainage piping according to the following:
  - 1. Install piping pitched down in direction of flow, at slope indicated.
  - 2. Install piping with restrained joints at tee fittings and at changes in direction for pressure pipe. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.
  - 3. Install piping with cover indicated.
  - 4. Notify engineer of clearance problems that would result in changes to grade and alignment.
  - 5. Install hub-and-spigot, cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
  - 6. Install ductile-iron culvert piping according to ASTM A 716.
  - 7. Install ductile-iron and special fittings according to AWWA C600 or AWWA M41.
  - 8. Install corrugated steel piping according to ASTM A 798/A 798M.
  - 9. Install corrugated aluminum piping according to ASTM B 788/B 788M.
  - 10. Install PVC cellular-core piping according to ASTM D 2321 and ASTM F 1668.
  - 11. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
  - 12. Install PVC profile gravity sewer piping according to ASTM D 2321 and ASTM F 1668.
  - 13. Install nonreinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."
  - 14. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

### 3.4 PIPE JOINT CONSTRUCTION

- A. Basic pipe joint construction is specified in Division 33 Section "Common Work Results for Utilities." Where specific joint construction is not indicated, follow piping manufacturer's written instructions.
- B. Join gravity-flow, nonpressure drainage piping according to the following:
  - 1. Join ductile-iron culvert piping according to AWWA C600 for push-on joints.
  - 2. Join ductile-iron and special fittings according to AWWA C600 or AWWA M41.

3. Join corrugated steel sewer piping according to ASTM A 798/A 798M.
  4. Join corrugated aluminum sewer piping according to ASTM B 788/B 788M.
  5. Join corrugated PE piping according to CPPA 100 and the following:
    - a. Use silttight couplings for Type 1, silttight joints.
  6. Join PVC cellular-core piping according to ASTM D 2321 and ASTM F 891 for solvent-cement joints.
  7. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric gasket joints.
  8. Join PVC profile gravity sewer piping according to ASTM D 2321 for elastomeric-seal joints or ASTM F 794 for gasketed joints.
  9. Join nonreinforced-concrete sewer piping according to ASTM C 14 and ACPA's "Concrete Pipe Installation Manual" for rubber-gasket joints.
  10. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasket joints.
  11. Join dissimilar pipe materials with nonpressure-type flexible or rigid couplings.
- C. Join dissimilar pipe materials with pressure-type couplings.

### 3.5 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extension from sewer pipe to cleanout at grade. Use same pipe type as sewer line that the cleanout is connected to. Install piping so cleanouts open in direction of flow in sewer pipe.
  1. Use light-duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
  2. Use medium-duty, top-loading classification cleanouts in paved foot-traffic areas.
  3. Use heavy-duty, top-loading classification cleanouts in vehicle-traffic service areas.
  4. Use extra-heavy-duty, top-loading classification cleanouts in roads areas.
- B. Set cleanout frames and covers in earth in cast-in-place concrete block, 12 inches around outside of cover. At contractors option, a square block can be used that is at least 12-inches wider than the cover. Set with tops 1 inch above surrounding earth grade.
- C. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.

### 3.6 DRAIN INSTALLATION

- A. Install type of drains in locations indicated.
  1. Use light-duty, top-loading classification drains in earth or unpaved foot-traffic areas.
  2. Use medium-duty, top-loading classification drains in paved foot-traffic areas.
  3. Use heavy-duty, top-loading classification drains in vehicle-traffic service areas.
  4. Use extra-heavy-duty, top-loading classification drains in roads areas.
- B. Embed drains in 4-inch minimum depth of concrete around bottom and sides.
- C. Fasten grates to drains if indicated.
- D. Set drain frames and covers with tops flush with pavement surface.
- E. Assemble trench sections with flanged joints.

- F. Embed trench sections in 4-inch minimum concrete around bottom and sides.

### **3.7 MANHOLE INSTALLATION**

- A. General: Install manholes, complete with appurtenances and accessories indicated.
- B. Install precast concrete manhole sections according to ASTM C 891.
- C. Construct cast-in-place manholes as indicated.
- D. Install PE sheeting on earth where cast-in-place-concrete manholes are to be built.
- E. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere, unless otherwise indicated.

### **3.8 CATCH BASIN INSTALLATION**

- A. Construct catch basins to sizes and shapes indicated.
- B. Set frames and grates to elevations indicated.
- C. Align boxes so that frame and grates are square to adjacent sidewalks, curbs or roadways.

### **3.9 STORMWATER INLET AND OUTLET INSTALLATION**

- A. Construct inlet head walls, aprons, and sides of reinforced concrete, as indicated.
- B. Construct riprap of broken stone, as indicated.
- C. Install outlets that spill onto grade, anchored with concrete, where indicated.
- D. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.
- E. Construct energy dissipaters at outlets, as indicated.

### **3.10 DRY WELL INSTALLATION (NOT USED)**

### **3.11 CONCRETE PLACEMENT**

- A. Place cast-in-place concrete according to ACI 318/318R.

### **3.12 DRAINAGE SYSTEM INSTALLATION**

- A. Assemble and install components according to manufacturer's written instructions.
- B. Install with top surfaces of components, except piping, flush with finished surface.
- C. Assemble channel sections to form slope down toward drain outlets. Use sealants, adhesives, fasteners, and other materials recommended by system manufacturer.

- D. Embed channel sections and drainage specialties in 4-inch minimum concrete around bottom and sides.
- E. Fasten grates to channel sections if indicated.
- F. Assemble channel sections with flanged or interlocking joints.
- G. Embed channel sections in 4-inch minimum concrete around bottom and sides.

### 3.13 CONNECTIONS

- A. Connect nonpressure, gravity-flow drainage piping in building's storm building drains specified in Division 22 Section "Facility Storm Drainage Piping."
- B. Connect force-main pressure piping to building's storm drainage force mains specified in Division 22 Section "Facility Storm Drainage Piping." Terminate piping where indicated.
  - 1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch overlap, with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
  - 2. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.
- C. Connect to sediment interceptors specified in Division 22 Section "Sanitary Waste Interceptors."

### 3.14 CHAMBER SYSTEMS (NOT USED)

### 3.15 ABANDONED STORM DRAINAGE SYSTEMS

- D. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:
  - 1. Close open ends of piping with at least 8-inch-thick, brick masonry bulkheads.
  - 2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.
- E. Abandoned Manholes and Structures: Excavate around manholes and structures as required and use one procedure below:
  - 1. Remove manhole or structure and close open ends of remaining piping.
  - 2. Remove top of manhole or structure down to at least 36 inches below final grade. Fill to within 12 inches of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.
- F. Backfill to grade according to Division 31 Section "Earth Moving."



### 3.16 IDENTIFICATION

- G. Materials and their installation are specified in Division 31 Section "Earth Moving." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.
  - 1. Use warning tape or detectable warning tape over ferrous piping.
  - 2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

### 3.17 FIELD QUALITY CONTROL

- H. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
  - 1. Submit separate reports for each system inspection.
  - 2. Defects requiring correction include the following:
    - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    - c. Crushed, broken, cracked, or otherwise damaged piping.
    - d. Infiltration: Water leakage into piping.
    - e. Exfiltration: Water leakage from or around piping.
  - 3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
  - 4. Reinspect and repeat procedure until results are satisfactory.
- I. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
  - 1. Do not enclose, cover, or put into service before inspection and approval.
  - 2. Test completed piping systems according to authorities having jurisdiction.
  - 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
  - 4. Submit separate report for each test.
  - 5. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
    - a. Exception: Piping with soiltight joints unless required by authorities having jurisdiction.
    - b. Option: Test plastic piping according to ASTM F 1417.
    - c. Option: Test concrete piping according to ASTM C 924.
- J. Leaks and loss in test pressure constitute defects that must be repaired.
- K. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

### 3.18 CLEANING

- L. Clean interior of piping of dirt and superfluous materials.

**END OF SECTION 33 4100**

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