

PROJECT MANUAL FOR: University Physicians Medical Building – Ground Floor  
CHCC Clinic Renovation

PROJECT NUMBER: CP221951

AT  
UNIVERSITY OF MISSOURI – Columbia Campus  
Columbia, MISSOURI

FOR:

THE CURATORS OF THE UNIVERSITY OF MISSOURI

PREPARED BY:  
bcDesignGroup  
12101 W. 110<sup>th</sup> St., Suite 100  
Overland Park, KS 66210

DATE: 08.29.2022

I hereby certify that these Drawings Cover, G100, G101, A100, A101, A200, A600, A601, and/or Specifications 02 4119, 02 4126, and Divisions 6-10 have been prepared by me, or under my supervision. I further certify that to the best of my knowledge these Drawings and/or Specifications are as required by and in compliance with Building Codes of the University of Missouri.

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



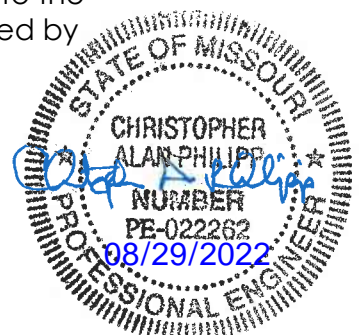
I hereby certify that these Drawings: M000, MD100, M100, M500, M501, P000, PD100, PD101, P100, P101, P400, P401, P500, FP000, FPD101, FP101 and Division 20 – Seismic, Division 21 – Fire Suppression, Division 22 – Plumbing, and Division 23 – Heating Ventilating and Air Conditioning Specifications have been prepared by me, or under my supervision. I further certify that to the best of my knowledge these Drawings and/or Specifications are as required by and in compliance with Building Codes of the University of Missouri.

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



I hereby certify that these Drawings: E000, ED100, ED101, E100, E101, E500, E501 and Division 26 – Electrical Specifications, and/or Specifications 271513, 283111 have been prepared by me, or under my supervision. I further certify that to the best of my knowledge these Drawings and/or Specifications are as required by and in compliance with Building Codes of the University of Missouri.

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



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TABLE OF CONTENTS

<u>TITLE</u>	<u>PAGE</u>
<u>DIVISION 1</u>	<u>GENERAL REQUIREMENTS</u>
Advertisement for Bids	
1.A Bid for Lump Sum Contract	1.A 1-7
1.B Bidder's Statement of Qualifications	BSQ/1-2
1.B.2 Supplier Diversity Compliance Evaluation	SD 1-2
1.B.3 Application for Waiver	SD 3-4
1.B.4 Affidavit for Affirmative Action	SD 5-6
1.B.5 Certifying Supplier Diversity Agencies	SD 7
1.B.6 Newspapers for Outreach to Diverse Suppliers	SD 8
1.B.7 Affidavit of Supplier Diversity Participation	SD 9
1.C Information for Bidders	IFB/1-5
1.D General Conditions	GC/1-26
1.E Special Conditions	SC 1-15
1.E.1 Scheduling Specification	SS 3
1.E.4 Shop Drawing and Submittal Log	SDSL 1-8
1.E.5 Operating Instructions and Service Manual Log	OMML 1-2
1.E.6 Closeout Log	CLOSL 1-2
1.E.7 Commissioning Plan	COM 1-11
1.F Index of Drawings	INDEX 1
1.G Prevailing Wage Rate	PW 1-4

<u>DIVISION 2</u>	<u>SITE WORK</u>
02 4119	Selective Demolition
02 4126	Cutting and Patching
<u>DIVISION 3</u>	<u>CONCRETE (NOT USED)</u>
<u>DIVISION 4</u>	<u>MASONRY (NOT USED)</u>
<u>DIVISION 5</u>	<u>METALS (NOT USED)</u>
<u>DIVISION 6</u>	<u>WOOD AND PLASTICS</u>
06 4023	Interior Architectural Woodwork
<u>DIVISION 7</u>	<u>THERMAL AND MOISTURE PROTECTION</u>
07 8413	Penetration Firestopping
07 8446	Fire-Resistive Smoke Joint System
07 9200	Joint Sealants
<u>DIVISION 8</u>	<u>DOORS, WINDOWS &amp; GLASS</u>
08 1113	Hollow Metal Doors and Frames
08 1416	Flush Wood Doors
08 7111	Door Hardware
08 8000	Glazing
<u>DIVISION 9</u>	<u>FINISHES</u>
09 2116	Gypsum Board Assemblies
09 3000	Tiling
09 5113	Acoustical Panel Ceilings
09 6513	Resilient Base
09 6516	Resilient Sheet Flooring
09 6519	Luxury Resilient Tile Flooring
09 6813	Tile Carpeting
09 7200	Vinyl-Coated Fabric Wall Coverings
09 9100	Painting
09 9656	Epoxy Coatings
<u>DIVISION 10</u>	<u>SPECIALTIES</u>
10 2813	Toilet Accessories
10 4400	Fire-Protection Specialties
<u>DIVISION 11</u>	<u>EQUIPMENT (NOT USED)</u>
<u>DIVISION 12</u>	<u>FURNISHINGS (NOT USED)</u>
<u>DIVISION 13</u>	<u>SPECIAL CONSTRUCTION (NOT USED)</u>

<u>DIVISION 14</u>	<u>CONVEYING SYSTEMS (NOT USED)</u>
<u>DIVISION 20</u> 20 0800	<u>SEISMIC PROTECTION</u> Seismic Protection
<u>DIVISION 21</u> 21 0500 21 1100	<u>FIRE SUPPRESSION</u> Common Work Results for Fire Suppression Water Based Fire Suppression Systems
<u>DIVISION 22</u> 22 0500 22 0523 22 0529 22 0553 22 0719 22 1116 22 1316 22 1319 22 4000	<u>PLUMBING</u> Common Work Results for Plumbing General-Duty Valves for Plumbing Piping Hangers and Supports for Plumbing Piping and Equipment Identification for Plumbing Piping and Equipment Plumbing Piping Insulation Domestic Water Piping Sanitary Waste and Vent Piping Sanitary Waste Piping Specialties Plumbing Fixtures
<u>DIVISION 23</u> 23 0100 23 0500 23 0513 23 0519 23 0523 23 0529 23 0593 23 0700 23 0900 23 2113 23 3113 23 3300 23 3600 23 3713	<u>HEATING, VENTILATING, AND AIR CONDITIONING</u> Basic Mechanical Requirements Basic Mechanical Materials and Methods Motors Meters and Gages Valves Hangers and Supports Test, Adjust and Balance Mechanical Insulation Control Systems Hydronic Piping Metal Ducts Duct Accessories Air Terminal Units Diffusers, Registers and Grilles
<u>DIVISION 26</u> 26 0500 26 0519 26 0526 26 0529 26 0533 26 0534 26 0553 26 0600	<u>ELECTRICAL</u> Common Work Results for Electrical Conductors and Cables Grounding and Bonding Hangers and Supports Raceways Boxes, Cabinets and Enclosures Identification for Electrical Systems Electrical Demolition

26 0923 Lighting Control Devices  
26 2726 Wiring Devices  
26 2816 Enclosed Switches  
26 5100 Lighting

DIVISION 27

27 1513

COMMUNICATIONS

Communications Copper Horizontal Cabling

DIVISION 28

28 3111

ELECTRONIC SAFETY AND SECURITY

Digital, Addressable Fire-Alarm System

**END OF SECTION**

CAMPUS FACILITIES

General Services Bldg.  
Columbia, Missouri 65211  
Telephone: (573) 882-6800

ADVERTISEMENT FOR BIDS

Sealed bids for:

UNIVERSITY PHYSICIANS MEDICAL BUILDING –  
GROUND FLOOR CHCC CLINIC RENOVATION  
UNIVERSITY OF MISSOURI  
COLUMBIA, MISSOURI

PROJECT NUMBER: CP221951

CONSTRUCTION ESTIMATE: \$585,090 - \$650,100

will be received by the Curators of the University of Missouri, Owner, at Campus Facilities, Planning, Design & Construction, Room L100 (Front Reception Desk), General Services Building, University of Missouri, Columbia, Missouri 65211, until 1:30 p.m., C.T., September 29, 2022 and then immediately opened and publicly read aloud.

Drawings, specifications, and other related contract information may be obtained at <http://operations-webapps.missouri.edu/pdc/adsite/ad.html>. Electronic bid sets are available at no cost and may be printed as desired by the plan holders. No paper copies will be issued. If paper copies are desired, it is the responsibility of the user to print the files or have them printed.

Questions regarding the scope of work should be directed to Jackie Dinkins with bcDesignGroup at (913) 232-2123 or [jackied@bc-dg.com](mailto:jackied@bc-dg.com). Questions regarding commercial conditions should be directed to Jude Wawrzyniak at (573) 882-9340 or [wawrzyniakj@health.missouri.edu](mailto:wawrzyniakj@health.missouri.edu).

A prebid meeting will be held at 9:30 a.m., C.T., September 7, 2022 in the General Services Bldg., Room 194B, followed by a site walk-through.

Information regarding bid results will be available the day following the bid opening by calling (573) 882-1133

A Diversity Participation goal of 10% MBE, 10% Combined WBE, DBE, Veteran Owned Business and 3% SDVE has been established for this contract.

The Owner reserves the right to waive informalities in bids and to reject any and all bids.

Individuals with special needs as addressed by the Americans with Disabilities Act may contact (573) 882-1133.

Advertisement Date: August 29, 2022

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SECTION 1.A

BID FOR LUMP SUM CONTRACT

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

BID OF \_\_\_\_\_  
(hereinafter called "Bidder") a corporation\* organized and existing under laws of the State of \_\_\_\_\_  
\_\_\_\_\_  
a partnership\* consisting of \_\_\_\_\_,  
an individual\* trading as \_\_\_\_\_,  
a joint venture\* consisting of \_\_\_\_\_  
\_\_\_\_\_.

\*Insert Corporation(s), partnership or individual, as applicable.

TO: Curators of the University of Missouri, Campus Facilities, Planning Design & Construction, Room L100 (Front Reception Desk), General Services Building, University of Missouri, Columbia, MO 65211

1. Bidder, in compliance with invitation for bids for construction work in accordance with Drawings and Specifications prepared by BCDESIGNGROUP, entitled "UNIVERSITY PHYSICIANS MEDICAL BUILDING – GROUND FLOOR CHCC CLINIC RENOVATION", project number CP221951, dated 08.29.2022 having examined Contract Documents and site of proposed work, and being familiar with all conditions pertaining to construction of proposed project, including availability of materials and labor, hereby proposes to furnish all labor, materials and supplies to construct project in accordance with Contract Documents, within time set forth herein at prices stated below. Prices shall cover all expenses, including taxes not covered by the University of Missouri's tax exemption status, incurred in performing work required under Contract documents, of which this Bid is a part.

Bidder acknowledges receipt of following addenda:

Addendum No. _____	Dated _____
Addendum No. _____	Dated _____
Addendum No. _____	Dated _____
Addendum No. _____	Dated _____

2. In following Bid(s), amount(s) shall be written in both words and figures. In case of discrepancy between words and figures, words shall govern.

3. **BID PRICING**

a. **Base Bid:**

The Bidder agrees to furnish all labor, materials, tools, and equipment required to renovate the area; all as indicated on the Drawings and described in these Specifications for sum of:

\_\_\_\_\_ DOLLARS (\$\_\_\_\_\_).

b. **Unit Prices:**

(1) For changing specified quantities of work from those indicated by



Contract Drawings and Specifications, upon written instructions of Owner, the following Unit Prices shall prevail in accordance with General Conditions.

(2) The following Unit Prices include all labor, overhead and profit, materials, equipment, appliances, bailing, shoring, shoring removal, etc., to cover all work.

(3) The following Unit Prices are required where applicable to particular Base Bid and/or Alternate being submitted.

(4) Only a single Unit Price shall be given and it shall apply for either MORE or LESS work than that indicated on Drawings and called for in Specifications as indicated to be included in Base Bid and/or Alternates. In the event that more or less units than so indicated is actually furnished, Change Orders will be issued for increased or decreased amounts as approved by the Owner.

(5) Bidder understands that the Owner will not be liable for any Unit Price or any amount in excess of Base Bid and any Alternate(s) accepted at time of award of Contract, except as expressed in written Change Orders duly executed and delivered by Owner's Representative.

FILL IN ONLY ONE PRICE PER LINE

(6) Floor Patching / Leveler as defined in Section(s) 09 6513, 09 6516 and 09 6519.16

Base Bid quantity = 1060 sf.      \$\_\_\_\_\_/sft.

c. Allowance:

Bidder shall include in the base bid sum an allowance of \$5,000 for Field-directed firestopping of unforeseen existing penetrations not shown in the Contract Documents and discovered after completion of demolition, and similar unforeseen items, authorized by the Owner's Representative. This allowance shall not include firestopping of any new penetrations required by new work. This allowance amount shall not include contractor's overhead and profit. The Contractor shall include overhead and profit on the allowance amount in his bid.

4. PROJECT COMPLETION

a. Contract Period - Contract period begins on the day the Contractor receives unsigned Contract, Performance Bond, Payment Bond, and "Instructions for Execution of Contract, Bonds, and Insurance Certificates." Bidder agrees to complete project within two hundred and forty (240) calendar days from receipt of aforementioned documents. Fifteen (15) calendar days have been allocated in construction schedule for receiving aforementioned documents from Bidder.

b. Commencement - Contractor agrees to commence work on this project after the "Notice to Proceed" is issued by the Owner. "Notice to Proceed" will be issued within seven (7) calendar days after Owner receives properly prepared and executed Contract documents listed in paragraph 4.a. above.

d. Special scheduling requirements:

- i. UPMB Occupancy - The University Physician's Medical Building (UPMB) will continue to be occupied during the course of this project but the office suite to the east on the ground floor will be vacant and considered unoccupied. Suite 0002 to the south of the construction are on the ground floor will remain occupied. All existing UPMB operations in other floors are to be maintained at all times.
- ii. Utility Outages – Any and all utility outages in portions of the UPMB outside of the defined UPMB Ground Floor project area, required to complete any work shall be reviewed in advance with the Owner's Representative and then submitted at least seven (7) calendar days in advance as a request for approval by the Owner's Representative and then scheduled accordingly.
- iii. Construction Access & Staging – All construction access shall be from the north, or rear service-side of the UPMB via the northwest Stair and adjacent Service Elevator. No construction access is permitted from the south, or front public-side of the UPMB without pre-approval from the Owner's Representative. Refer to Construction Access and Staging Drawing on the Cover sheet.

The owner will provide an oversized dumpster for shared use by UPMB Occupants and the Contractor for this project. Contractor shall coordinate use and keep Owner's Representative apprised to when dumpster needs emptied due to construction debris and periods of anticipated heavy usage.

- iv. Work Hours - Work hours for this project are considered as Monday-Friday, 7:00am – 5:00pm. Other work hours are acceptable if submitted, reviewed, coordinated, scheduled and approved at least 48-hours in advance with the Owner's Representative.
- v. Excessive Noisy Work – There are clinics located on each 1<sup>st</sup>, 2<sup>nd</sup>, and 3<sup>rd</sup> floors that will maintain occupancy throughout the duration of the project. Clinic hours are 7:30 am – 5:30 pm.
  - a. Noisy Work is preferred to occur on Monday and Friday afternoons during normal business hours.
  - b. Alternatively, Noisy Work can be scheduled and sequenced to occur after normal business hours when the clinic is closed, when submitted, reviewed and approved by the Owner's Representative at least 48-hours in advance.
- vi. Work Occurring on Floors Above (3<sup>rd</sup>, 2<sup>nd</sup>, 1<sup>st</sup> and/or 4<sup>th</sup> Floors) – Generally, all necessary work to occur on floors above the Ground Floor shall be reviewed, submitted, approved and

scheduled to occur after normal business hours at least 48-hours in advance with the Owner's Representative.

Certain minor access and/or work that needs to occur on any floors above may be allowed to occur during normal business hours upon review, approval and advance scheduling with the Owner's Representative.

- vii. Infectious Control Provisions – Infectious Control (IFC) provisions are not required for the UPMB Ground Floor since the floor is considered completely vacated and non-occupied during the contract period and is currently a non-patient floor occupancy.

Any work on the other UPMB Floors, shall practice all MU Health Care IFC provisions. Additionally, such work shall be coordinated, scheduled and approved to occur after normal business hours when the clinics are closed.

5. SUBCONTRACTOR LIST:

Bidder hereby certifies that the following subcontractors will be used in performance of Work:

NOTE: Failure to list subcontractors for each category of work identified on this form or listing more than one subcontractor for any category of work without designating the portion of work performed by each shall be grounds for rejection of bid. List name, city, and state of designated subcontractor, for each category of work listed in Bid For Lump Sum Contract. If work within a category will be performed by more than one subcontractor, Bidder shall provide name, city, and state of each subcontractor and specify exact portion of work to be performed by each. If acceptance/non-acceptance of Alternates will affect designation of a subcontractor, Bidder shall provide information, for each affected category, with this bid form. If Bidder intends to perform any designated subcontract work by using Bidder's own employees, then Bidder shall list their own name, city, and state. The bidder may petition the Owner to change a listed subcontractor only within 48 hours of the bid opening. See Information For Bidders Section 16 List of Subcontractors for requirements.

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Work to be performed	Subcontractor Name,	City, State
<b>Mechanical</b>	_____	_____
<b>Electrical</b>	_____	_____
<b>Plumbing</b>	_____	_____

6. SUPPLIER DIVERSITY PARTICIPATION GOALS

a. The Contractor shall have as a goal, subcontracting with Minority Business Enterprise (MBE) of ten percent (10%), with Service Disabled Veteran Owned Business (SDVE) of three percent (3%); and with Women Business Enterprise (WBE), Disadvantage Business Enterprise (DBE), and/or Veteran Owned Business of ten percent (10%) of awarded contract price for work to be performed.

b. Requests for waiver of this goal shall be submitted on the attached Application For Waiver form. A determination by the Director of Facilities Planning & Development, UM, that a good faith effort has not been made by Contractor to achieve above stated goal may result in rejection of bid.

c. The Undersigned proposes to perform work with following Supplier Diversity participation level:

MBE PERCENTAGE PARTICIPATION: \_\_\_\_\_ percent (\_\_\_\_%)

SDVE PERCENTAGE PARTICIPATION: \_\_\_\_\_ percent (\_\_\_\_%)

WBE, DBE, and/or VETERAN PERCENTAGE PARTICIPATION: \_\_\_\_\_ percent (\_\_\_\_%)

d. A Supplier Diversity Compliance Evaluation form shall be submitted with this bid for each diverse subcontractor to be used on this project.

7. BIDDER'S ACKNOWLEDGMENTS

a. Bidder declares that he has had an opportunity to examine the site of the work and he has examined Contract Documents therefore; that he has carefully prepared his bid upon the basis thereof; that he has carefully examined and checked bid, materials, equipment and labor required thereunder, cost thereof, and his figures therefore. Bidder hereby states that amount, or amounts, set forth in bid is, or are, correct and that no mistake or error has occurred in bid or in Bidder's computations upon which this bid is based. Bidder agrees that he will make no claim for reformation, modifications, revisions or correction of bid after scheduled closing time for receipt of bids.

b. Bidder agrees that bid shall not be withdrawn for a period of sixty (60) days after scheduled closing time for receipt of bids.

c. Bidder understands that Owner reserves right to reject any or all bids and to waive any informalities in bidding.

d. Accompanying the bid is a bid bond, or a certified check, or an irrevocable letter of credit, or a cashier's check payable without condition to "The Curators of the University of Missouri" which is an amount at least equal to five percent (5%) of amount of largest possible total bid herein submitted, including consideration of Alternates.

e. Accompanying the bid is a Bidder's Statement of Qualifications. Failure of Bidder to submit the Bidder's Statement of Qualifications with the bid may cause the bid to be rejected. Owner does not maintain Bidder's Statements of Qualifications

on file.

f. It is understood and agreed that bid security of two (2) lowest and responsive Bidders will be retained until Contract has been executed and an acceptable Performance Bond and Payment Bond has been furnished. It is understood and agreed that if the bid is accepted and the undersigned fails to execute the Contract and furnish acceptable Performance/Payment Bond as required by Contract Documents, accompanying bid security will be realized upon or retained by Owner. Otherwise, the bid security will be returned to the undersigned.

8. BIDDER'S CERTIFICATE

Bidder hereby certifies:

a. His bid is genuine and is not made in interest of or on behalf of any undisclosed person, firm or corporation, and is not submitted in conformity with any agreement or rules of any group, association or corporation.

b. He has not directly or indirectly induced or solicited any other bidder to put in a false or sham bid.

c. He has not solicited or induced any person, firm or corporation to refrain from bidding.

d. He has not sought by collusion or otherwise to obtain for himself any advantage over any other Bidder or over Owner.

e. He will not discriminate against any employee or applicant for employment because of race, color, religion, sex or national origin in connection with performance of work.

f. By virtue of policy of the Board of Curators, and by virtue of statutory authority, a preference will be given to materials, products, supplies, provisions and all other articles produced, manufactured, mined or grown within the State of Missouri. By virtue of policy of the Board of Curators, preference will also be given to all Missouri firms, corporations, or individuals, all as more fully set forth in "Information For Bidders."

9. BIDDER'S SIGNATURE

Note: All signatures shall be original; not copies, photocopies, stamped, etc.

Authorized Signature	Date
Printed Name	Title
Company Name	
Mailing Address	
City, State, Zip	
Phone No.	Federal Employer ID No.
Fax No.	E-Mail Address
Circle one:    Individual    Partnership    Corporation    Joint Venture	
If a corporation, incorporated under the laws of the State of _____	
Licensed to do business in the State of Missouri?    ___yes    ___no	

(Each Bidder shall complete bid form by manually signing on the proper signature line above and supplying required information called for in connection with the signature. Information is necessary for proper preparation of the Contract, Performance Bond and Payment Bond. Each Bidder shall supply information called for in accompanying "Bidder's Statement of Qualifications.")

**END OF SECTION**

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**UNIVERSITY OF MISSOURI  
BIDDER'S STATEMENT OF QUALIFICATIONS**

Submit with Bid for Lump Sum Contract in separate envelope appropriately labeled. Attach additional sheet if necessary.

1. Company Name \_\_\_\_\_

Phone# \_\_\_\_\_ Fax #: \_\_\_\_\_

Address \_\_\_\_\_

2. Number of years in business \_\_\_\_\_. If not under present firm name, list previous firm names and types of organization.

\_\_\_\_\_  
\_\_\_\_\_

3. List contracts on hand (complete the following schedule, include telephone number).

Project & Address	Owner/Owner's Representative	Phone Number	Architect	Amount of your Contract	Percent Completed
-------------------	---------------------------------	-----------------	-----------	-------------------------------	----------------------

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

4. General character of work performed by your company personnel.

\_\_\_\_\_

5. List important projects completed in the last five (5) years on a type similar to the work now bid for, including approximate cost and telephone number.

Project & Address	Owner/Owner's Representative	Phone Number	Architect	Amount of your Contract	Percent Completed
-------------------	---------------------------------	-----------------	-----------	----------------------------	----------------------

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

6. Other experience qualifying you for the work now bid.

\_\_\_\_\_  
\_\_\_\_\_

7. No default has been made in any contract complete or incomplete except as noted below:

(a) Number of contracts on which default was made \_\_\_\_\_

(b) Description of defaulted contracts and reason therefor

\_\_\_\_\_  
\_\_\_\_\_

8. (a) Have you or your company participated in any contract subject to an equal opportunity clause similar to that described in the General Conditions?

Yes \_\_\_\_\_ No \_\_\_\_\_

(b) Have you filed all required compliance reports?

Yes \_\_\_\_\_ No \_\_\_\_\_



- (c) Is fifty percent or more of your company owned by a minority?  
Yes \_\_\_\_\_ No \_\_\_\_\_
- (d) Is fifty percent or more of your company owned by a woman?  
Yes \_\_\_\_\_ No \_\_\_\_\_
- (e) Is fifty percent or more of your company owned by a service disabled veteran?  
Yes \_\_\_\_\_ No \_\_\_\_\_
- (f) Is fifty percent or more of your company owned by a veteran?  
Yes \_\_\_\_\_ No \_\_\_\_\_
- (g) Is your company a Disadvantaged Business Enterprise?  
Yes \_\_\_\_\_ No \_\_\_\_\_

9. Have you or your company been suspended or debarred from working at any University of Missouri campus?  
Yes \_\_\_\_\_ No \_\_\_\_\_ (If the answer is "yes", give details.)

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10. Have any administrative or legal proceedings been started against you or your company alleging violation of any wage and hour regulations or laws?  
Yes \_\_\_\_\_ No \_\_\_\_\_ (If the answer is "yes", give details.)

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11. Workers Compensation Experience Modification Rates (last 3 yrs): \_\_\_\_\_ / \_\_\_\_\_ / \_\_\_\_\_  
Incidence Rates (last 3 years): \_\_\_\_\_ / \_\_\_\_\_ / \_\_\_\_\_

12. List banking references.

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- 13. (a) Do you have a current confidential financial statement on file with Owner?  
Yes \_\_\_\_\_ No \_\_\_\_\_ (If not, and if desired, Bidder may submit such statement with bid, in a separate sealed and labeled envelope.)
- (b) If not, upon request will you file a detailed confidential financial statement within three (3) days?  
Yes \_\_\_\_\_ No \_\_\_\_\_

Dated at \_\_\_\_\_ this \_\_\_\_\_ day of \_\_\_\_\_ 20\_\_\_\_\_

---

Name of Organization

---

Signature

---

Printed Name

---

Title of Person Signing

END OF SECTION

**SUPPLIER DIVERSITY COMPLIANCE EVALUATION FORM**

This form shall be completed by Bidders and submitted with the Bidder's Statement of Qualifications form for each diverse firm who will function as a subcontractor on the contract.

The undersigned submits the following data with respect to this firm's assurance to meet the goal for Supplier Diversity participation.

I. Project: \_\_\_\_\_

II. Name of General Contractor: \_\_\_\_\_

III. Name of Diverse Firm: \_\_\_\_\_  
Address: \_\_\_\_\_

Phone No.: \_\_\_\_\_ Fax No.: \_\_\_\_\_

Status (check one) MBE \_\_\_\_\_ WBE \_\_\_\_\_ Veteran \_\_\_\_\_ Service Disabled Veteran \_\_\_\_\_ DBE \_\_\_\_\_

IV. Describe the subcontract work to be performed. (List Base Bid work and any Alternate work separately):

Base Bid: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

V. Dollar amount of contract to be subcontracted to the Diverse firm:  
Base Bid: \_\_\_\_\_

Alternate(s), (Identify separately): \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

VI. Is the proposed subcontractor listed in the Directory of M/W/DBE Vendors, Directory of Serviced Disabled Veterans and/or the Directory of Veterans maintained by the State of Missouri?

Yes \_\_\_\_\_ No \_\_\_\_\_

Is the proposed subcontractor certified as a diverse supplier by any of the following: federal government agencies, state agencies, State of Missouri city or county government agencies, Minority and/or WBE certifying agencies?

Yes \_\_\_\_\_

No \_\_\_\_\_

If yes, please provide details and attach a copy of the certification.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Does the proposed subcontractor have a signed document from their attorney certifying the Supplier as a Diverse and meeting the 51% owned and committed requirement?

Yes \_\_\_\_\_

No \_\_\_\_\_

If yes, please attach letter.

Signature:

\_\_\_\_\_

Name:

\_\_\_\_\_

Title:

\_\_\_\_\_

Date:

\_\_\_\_\_

**APPLICATION FOR WAIVER**

This form shall be completed and submitted with the Bidder's Statement of Qualifications. Firms wishing to be considered for award are required to demonstrate that a good faith effort has been made to include diverse suppliers. This form will be used to evaluate the extent to which a good faith effort has been made. The undersigned submits the following data with respect to the firm's efforts to meet the goal for Supplier Diversity Participation.

1. List pre-bid conferences your firm attended where Supplier Diversity requirements were discussed.

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2. Identify advertising efforts undertaken by your firm which were intended to recruit potential diverse subcontractors for various aspects of this project. Provide names of newspapers, dates of advertisements and copies of ads that were run.

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3. Note specific efforts to contact in writing those diverse suppliers capable of and likely to participate as subcontractors for this project.

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4. Describe steps taken by your firm to divide work into areas in which diverse suppliers/contractors would be capable of performing.

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5. What efforts were taken to negotiate with prospective diverse suppliers/contractors for specific sub-bids? Include the names, addresses, and telephone numbers of diverse suppliers/contractors contacted, a description of the information given to diverse suppliers/contractors regarding plans and specifications for the assigned work, and a statement as to why additional agreements were not made with diverse suppliers/contractors.

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6. List reasons for rejecting a diverse supplier/contractor which has been contacted.

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8. Describe the follow-up contacts with diverse suppliers/contractors made by your firm after the initial solicitation.

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9. Describe the efforts made by your firm to provide interested diverse suppliers/contractors with sufficiently detailed information about the plans, specifications and requirements of the contract.

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10. Describe your firm's efforts to locate diverse suppliers/contractors.

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Based on the above stated good faith efforts made to include supplier diversity, the bidder hereby requests that the original supplier diversity percentage goal be waived and that the percentage goal for this project be set at \_\_\_\_\_ percent.

The undersigned hereby certifies, having read the answers contained in the foregoing Application for Waiver, that they are true and correct to the best of his/her knowledge, information and belief.

Signature \_\_\_\_\_

Name \_\_\_\_\_

Title \_\_\_\_\_

Company \_\_\_\_\_

Date \_\_\_\_\_

**AFFIDAVIT**

"The undersigned swears that the foregoing statements are true and correct and include all material information necessary to identify and explain the operation of \_\_\_\_\_ (name of firm) as well as the ownership thereof. Further, the undersigned agrees to provide through the prime contractor or directly to the Contracting Officer current, complete and accurate information regarding actual work performed on the project, the payment therefore and any proposed changes, if any, of the project, the foregoing arrangements and to permit the audit and examination of books, records and files of the named firm. Any material misrepresentation will be grounds for terminating any contract which may be awarded and for initiating action under federal or state laws concerning false statements."

Note - If, after filing this information and before the work of this firm is completed on the contract covered by this regulation, there is any significant change in the information submitted, you must inform the Director of Facilities Planning and Development of the change either through the prime contractor or directly.

Signature \_\_\_\_\_

Name \_\_\_\_\_

Title \_\_\_\_\_

Date \_\_\_\_\_

Corporate Seal (where appropriate)

Date \_\_\_\_\_

State of \_\_\_\_\_

County of \_\_\_\_\_

On this \_\_\_\_\_ day of \_\_\_\_\_, 19\_,  
before me appeared (name) \_\_\_\_\_ to me personally known, who, being  
duly sworn, did execute the foregoing affidavit, and did state that he or she was properly authorized by (name of firm)

\_\_\_\_\_  
\_\_\_\_\_ to execute the affidavit and did so as his or her own free act and deed.

(Seal)

Notary Public \_\_\_\_\_

Commission expires \_\_\_\_\_

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**AFFIDAVIT FOR AFFIRMATIVE ACTION**

State of Missouri                    )  
  )  
County of                                )                    ss.

\_\_\_\_\_ first being duly sworn on his/her oath states: that he/she is the (sole proprietor, partner, or officer) of \_\_\_\_\_ a (sole proprietorship, partnership, corporation), and as such (sole proprietor, partner, or officer) is duly authorized to make this affidavit on behalf of said (sole proprietorship, partnership, corporation); that under the contract known as " \_\_\_\_\_ " Project No. \_\_\_\_\_ less than 50 persons in the aggregate will be employed and therefore, the applicable Affirmative Action requirements as set forth in the "Nondiscrimination in Employment Equal Opportunity," Supplemental Special Conditions, and Article 13 in the General Conditions do not apply.

\_\_\_\_\_

Subscribed and sworn before me this \_\_\_\_\_ day of \_\_\_\_\_, 19\_\_\_\_\_.

My commission expires \_\_\_\_\_, 19\_\_\_\_\_.



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## CERTIFYING SUPPLIER DIVERSITY AGENCIES

Diverse firms are defined in General Conditions Articles 1.1.7 and those businesses must be certified as disadvantaged by an approved agency. The Bidder is responsible for obtaining information regarding the certification status of a firm. A list of certified firms may be obtained by contacting the agencies listed below. Any firm listed as disadvantaged by any of the following agencies will be classified as a diverse firm by the Owner.

St. Louis Development Corporation  
1520 Market St., Ste. 2000  
St. Louis, MO 63103  
P: 314.982.1400  
W: [www.stlouis-mo.gov/slcdc/](http://www.stlouis-mo.gov/slcdc/)

Bi-State Development  
211 N. Broadway, Ste. 700  
St. Louis, MO 63102  
P: 314.982.1400  
W: [www.metrostlouis.dbesystem.com](http://www.metrostlouis.dbesystem.com)

St. Louis Minority Business Council  
211 N. Broadway, Ste. 1300  
St. Louis, MO 63102  
P: 314.231.5555  
W: [www.slmbc.org](http://www.slmbc.org)

U.S. Small Business Administration - St. Louis, MO  
8(a) Contractors, Minority Small Business  
1222 Spruce Street, Suite 10.103  
St. Louis, MO 63101  
P: 314.539.6600  
W: [www.sba.gov](http://www.sba.gov)

Lambert St. Louis International Airport  
Business Diversity Development Office  
11495 Navaid  
Bridgeton, MO 63044  
P: 314-426-8111  
W: [www.flystl.com/business/business-diversity-development-1/directories](http://www.flystl.com/business/business-diversity-development-1/directories)

City of Kansas City, Missouri  
Human Relations Department, MBE/WBE Division  
4th Floor, City Hall  
414 E. 12<sup>th</sup> Street  
Kansas City, MO 64106  
P: 816.513.1836  
W: [kcmohrd.mwdbe.com/?TN=kcmohrd](http://kcmohrd.mwdbe.com/?TN=kcmohrd)

Mid-States Minority Supplier Development Council  
505 N. 7<sup>th</sup> Street, Ste. 1820  
St. Louis, MO 63101  
P: 314.278.5616  
W: [midstatesdc.org](http://midstatesdc.org)

U.S. Small Business Administration - Kansas City, MO  
8(a) Contractors, Minority Small Business  
1000 Walnut, Suite 500  
Kansas City, MO 64106  
P: 816.426.4900  
W: [kcmohrd.mwdbe.com/?TN=kcmohrd](http://kcmohrd.mwdbe.com/?TN=kcmohrd)

Missouri Department of Transportation  
Division of Construction  
1617 Missouri Blvd.  
P.O. Box 270  
Jefferson City, MO 65102  
P: 573.526.2978  
W: [www.modot.org/mrcc-directory](http://www.modot.org/mrcc-directory)

Illinois Department of Transportation  
MBE/WBE Certification Section  
2300 Dirksen Parkway  
Springfield, IL 62764  
217/782-5490; 217/785-1524 (Fax)  
W: [webapps.dot.illinois.gov/UCP/ExternalSearch](http://webapps.dot.illinois.gov/UCP/ExternalSearch)

State of Missouri OA  
Office of Equal Opportunity  
301 W. High St. HSC Rm 870-B  
Jefferson City, MO 65101  
P: 877.259.2963  
W: [oa.mo.gov/sites/default/files/sdvelisting.pdf](http://oa.mo.gov/sites/default/files/sdvelisting.pdf)  
[oeo.mo.gov/](http://oeo.mo.gov/)

## Minority Newspapers

Dos Mundos Bilingual Newspaper  
902A Southwest Blvd.  
Kansas City, MO 64108  
816-221-4747  
[www.dosmundos.com](http://www.dosmundos.com)

Kansas City Hispanic News  
2918 Southwest Blvd.  
Kansas City, MO 64108  
816/472-5246  
[www.kchispanicnews.com](http://www.kchispanicnews.com)

The Kansas City Globe  
615 E. 29th Street  
Kansas City, MO 64109  
816-531-5253  
[www.thekcglobe.com/about\\_us.php](http://www.thekcglobe.com/about_us.php)

St. Louis American  
4144 Lindell  
St. Louis, MO 63108  
314-533-8000  
[www.stlamerican.com](http://www.stlamerican.com)

St. Louis Chinese American News  
1766 Burns Ave, Suite 201  
St. Louis, MO 63132  
314-432-3858  
[www.scanews.com](http://www.scanews.com)

St. Louis Business Journal  
815 Olive St., Suite 100  
St. Louis, MO 63101  
314-421-6200  
[www.bizjournal.com/stlouis](http://www.bizjournal.com/stlouis)

Kansas City Business Journal  
1100 Main Street, Suite 210  
Kansas City, MO 64105  
816-421-5900  
[www.bizjournals.com/kansascity](http://www.bizjournals.com/kansascity)

## **AFFIDAVIT OF SUPPLIER DIVERSITY PARTICIPATION**

The apparent low Bidder shall complete and submit this form within 48 hours of bid opening for each Diverse firm that will participate on the contract.

1. Diverse Firm: \_\_\_\_\_  
 Contact Name: \_\_\_\_\_  
 Address: \_\_\_\_\_  
 Phone No.: \_\_\_\_\_ E-Mail: \_\_\_\_\_

Status (check one) MBE  WBE  Veteran  Service Disabled Veteran  DBE   
 If MBE, Certified as (circle one): 1) Black American 2) Hispanic American 3) Native American 4) Asian American

2. Is the proposed diverse firm certified by an approved agency [see IFB article 15]? Yes  No

Agency: \_\_\_\_\_ [attach copy of certification authorization from agency]

Certification Number: \_\_\_\_\_

3. Diverse firm scope work and bid/contract dollar amount of participation (List Base Bid and Alternate work separately). The final Dollar amount will be determined at substantial completion:

	Scope of Work	Bid/Contract Amount	Final Dollar Amount
Base Bid			
Alternate #1			
Alternate #2			
Alternate #3			
Alternate #4			
Alternate #5			
Alternate #6			

The undersigned certifies that the information contained herein (i.e. Scope of Work and Bid/Contract Amount) is true and correct to the best of their knowledge, information and belief.

General Contractor: \_\_\_\_\_ Diverse Firm: \_\_\_\_\_

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

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

Title: \_\_\_\_\_ Title: \_\_\_\_\_

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

The undersigned certifies that the information contained herein (i.e. Scope of Work and Final Dollar Amount) is true and correct to the best of their knowledge, information and belief. If the Final Dollar Amount is different than the Bid/Contract Amount, then attach justification for the difference.

Contractor: \_\_\_\_\_ Diverse Firm: \_\_\_\_\_

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

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

Title: \_\_\_\_\_ Title: \_\_\_\_\_

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

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University of Missouri

INFORMATION FOR BIDDERS

Page No.

1. Contract Documents..... FB/1

2. Bidder's Obligation ..... FB/1

3. Interpretation of Documents ..... FB/1

4. Bids ..... FB/1

5. Modification and Withdrawal of Bids..... FB/2

6. Signing of Bids ..... FB/2

7. Bid Security ..... FB/2

8. Bidder's Statement of Qualifications ..... FB/2

9. Award of Contract..... FB/2

10. Contract Execution..... FB/2

11. Contract Security..... FB/3

12. Time of Completion ..... FB/3

13. Number of Contract Documents..... FB/3

14. Missouri Products and Missouri Firms..... FB/3

15. Supplier Diversity ..... FB/3

16. List of Subcontractors ..... FB/5

**1. Contract Documents**

**1.1** Drawings, specifications, and other contract documents, pursuant to work, which is to be done, may be obtained shown in the Advertisement for Bids and Special Conditions.

**2. Bidder Obligations**

**2.1** Before submitting bids, each bidder shall carefully examine the drawings and specifications and related contract documents, visit site of work, and fully inform themselves as to all existing conditions, facilities, restrictions, and other matters which can affect the work or the cost thereof.

**2.2** Each bidder shall include in their bid the cost of all work and materials required to complete the contract in a first-class manner as hereinafter specified.

**2.3** Failure or omission of any bidder to receive or examine any form, instrument, addendum, or other document, or to visit the site and acquaint themselves with existing conditions, shall in no way relieve them from any obligation with respect to their bid or contract, and no extra compensation will be allowed by reason of anything or matter concerning which bidder should have fully informed themselves prior to bidding.

**2.4** Submission of bids shall be deemed acceptance of the above obligations and each and every obligation required to be performed by all of the contract documents in the event the bid is accepted.

**3. Interpretation of Documents**

**3.1** If any prospective bidder is in doubt as to the true meaning of any part of the drawings and specifications or contract documents, they shall submit a written request to the Architect for an interpretation.

**3.2** Requests for such interpretations shall be delivered to the Architect at least one (1) week prior to time for receipt of bids.

**3.3** Bids shall be based only on interpretations issued in the form of addenda mailed to each person who is on the

Architect's record as having received a set of the contract documents.

**4. Bids**

**4.1** Bids shall be received separately or in combination as shown in and required by the Bid for Lump Sum contract. Bids will be completed so as to include insertion of amounts for alternate bids, unit prices and cost accounting data.

**4.2** Bidders shall apportion each base bid between various phases of the work, as stipulated in the Bid for Lump Sum contract. All work shall be done as defined in the specifications and as indicated on the drawings.

**4.3** Bids shall be presented in sealed envelopes which shall be plainly marked "Bids for (indicate name of project from cover sheet)" and mailed or delivered to the building and room number specified in the Advertisement for Bids. Bidders shall be responsible for actual delivery of bids during business hours, and it shall not be sufficient to show that a bid was mailed in time to be received before scheduled closing time for receipt of bids, nor shall it be sufficient to show that a bid was somewhere in a university facility.

**4.4** The bidder's price shall include all federal sales, excise, and similar taxes, which may be lawfully assessed in connection with their performance of work and purchase of materials to be incorporated in the work. City & State taxes shall not be included as defined within Article 3.16 of the General Conditions for Construction Contract included in the contract documents.

**4.5** Bids shall be submitted on a single bid form, furnished by the Owner or Architect. Do not remove the bid form from the specifications.

**4.6** No bidder shall stipulate in their bid any conditions not contained in the bid form.

**4.7** The Owner reserves the right to waive informalities in bids and to reject any or all bids.

## **5. Modification and Withdrawal of Bids**

**5.1** The bidder may withdraw their bid at any time before the scheduled closing time for receipt of bids, but no bidder may withdraw their bid after the scheduled closing time for receipt of bids.

**5.2** Only telegrams, letters and other written requests for modifications or correction of previously submitted bids, contained in a sealed envelope which is plainly marked "Modification of Bid on (name of project on cover sheet)," which are addressed in the same manner as bids, and are received by Owner before the scheduled closing time for receipt of bids will be accepted and bids corrected in accordance with such written requests.

## **6. Signing of Bids**

**6.1** Bids which are signed for a partnership shall be **manually** signed in the firm name by at least one partner, or in the firm name by Attorney-in-Fact. If signed by Attorney-in-Fact there should be attached to the bid, a Power of Attorney evidencing authority to sign the bid dated the same date as the bid and executed by all partners of the firm.

**6.2** Bids that are signed for a corporation shall have the correct corporate name thereon and the signature of an authorized officer of the corporation manually written below corporate name. Title of office held by the person signing for the corporation shall appear below the signature of the officer.

**6.3** Bids that are signed by an individual doing business under a firm name, shall be manually signed in the name of the individual doing business under the proper firm name and style.

**6.4** Bids that are signed under joint venture shall be manually signed by officers of the firms having authority to sign for their firm.

## **7. Bid Security**

**7.1** Each bid shall be accompanied by a bid bond, certified check, or cashier's check, acceptable to and payable without condition to The Curators of the University of Missouri, in an amount at least equal to five percent (5%) of bidder's bid including additive alternates.

**7.2** Bid security is required as a guarantee that bidder will enter into a written contract and furnish a performance bond within the time and in form as specified in these specifications; and if successful bidder fails to do so, the bid security will be realized upon or retained by the Owner. The apparent low bidder shall notify the Owner in writing within 48 hours (2 workdays) of the bid opening of any circumstance that may affect the bid security including, but not limited to, a bidding error. This notification will not guarantee release of the bidder's security and/or the bidder from the Bidder's Obligations.

**7.3** If a bid bond is given as a bid security, the amount of the bond may be stated as an amount equal to at least five percent (5%) of the bid, including additive alternates, described in the bid. The bid bond shall be executed by the bidder and a responsible surety licensed in the State of Missouri with a Best's rating of no less than A-/XI.

**7.4** It is specifically understood that the bid security is a guarantee and shall not be considered as liquidated damages for failure of bidder to execute and deliver their contract and performance bond, nor limit or fix bidder's liability to Owner for any damages sustained because of failure to execute and deliver the required contract and performance bond.

**7.5** Bid security of the two (2) lowest and responsive Bidders will be retained by the Owner until a contract has been executed and an acceptable bond has been furnished, as required hereby, when such bid security will be returned. Surety bid bonds of all other bidders will be destroyed and all other alternative forms of bid bonds will be returned to them within ten (10) days after Owner has determined the two (2) lowest and responsive bids.

## **8. Bidder's Statement of Qualifications**

**8.1** Each bidder submitting a bid shall present evidence of their experience, qualifications, financial responsibility and ability to carry out the terms of the contract by completing and submitting with their bid the schedule of information set forth in the form furnished in the bid form.

**8.2** Such information, a single copy required in a separate sealed envelope, will be treated as confidential information by the Owner, within the meaning of Missouri Statute 610.010.

**8.3** Bids not accompanied with current Bidder's Statement of Qualifications may be rejected.

## **9. Award of Contract**

**9.1** The Owner reserves the right to let other contracts in connection with the work, including, but not by way of limitation, contracts for furnishing and installation of furniture, equipment, machines, appliances, and other apparatus.

**9.2** In awarding the contract, the Owner may take into consideration the bidder's, and their subcontractor's, ability to handle promptly the additional work, skill, facilities, capacity, experience, ability, responsibility, previous work, financial standing of bidder, and the bidder's ability to provide the required bonds and insurance; quality, efficiency and construction of equipment proposed to be furnished; period of time within which equipment is proposed to be furnished and delivered; success in achieving the specified Supplier Diversity goal, or demonstrating a good faith effort as described in Article 15; necessity of prompt and efficient completion of work herein described, and the bidder's status as suspended or debarred. Inability of any bidder to meet the requirements mentioned above may be cause for rejection of their bid.

## **10. Contract Execution**

**10.1** The Contractor shall submit within fifteen (15) days from receipt of notice, the documents required in Article 9 of the General Conditions for Construction Contract included in the contract documents.

**10.2** No bids will be considered binding upon the Owner until the documents listed above have been furnished. Failure of Contractor to execute and submit these documents within the time period specified will be treated, at the option of the

Owner, as a breach of the bidder's bid security under Article 7 and the Owner shall be under no further obligation to Bidder.

#### **11. Contract Security**

**11.1** When the Contract sum exceeds \$50,000, the Contractor shall procure and furnish a Performance bond and a Payment bond in the form prepared by Owner. Each bond shall be in the amount equal to one hundred percent (100%) of the contract sum, as well as adjustments to the Contract Sum. The Performance Bond shall secure and guarantee Contractor's faithful performance of this Contract, including but not limited to Contractor's obligation to correct defects after final payment has been made as required by the Contract Documents. The Payment Bond shall secure and guarantee payment of all persons performing labor on the Project under this Contract and furnishing materials in connection with this Contract. These Bonds shall be in effect through the duration of the Contract plus the Guaranty Period as required by the Contract Documents.

**11.2** The bonds required hereunder shall be meet all requirements of Article 11 of the General Conditions for Construction Contract included in the contract documents.

**11.3** If the surety of any bond furnished by Contractor is declared bankrupt or becomes insolvent or its right to conduct business in the State of Missouri is terminated, or it ceases to meet the requirements of this Article 11, Contractor shall within ten (10) days substitute another bond and surety, both of which must be acceptable to Owner. If Contractor fails to make such substitution, Owner may procure such required bonds on behalf of Contractor at Contractor's expense.

#### **12. Time of Completion**

**12.1** Contractors shall agree to commence work within five (5) days of the date "Notice to Proceed" is received from the Owner, and the entire work shall be completed by the completion date specified or within the number of consecutive calendar days stated in the Special Conditions. The duration of the construction period, when specified in consecutive calendar days, shall begin when the contractor receives notice requesting the documents required in Article 9 of the General Conditions for Construction Contract included in the contract documents.

#### **13. Number of Contract Documents**

**13.1** The Owner will furnish the Contractor a copy of the executed contract and performance bond.

**13.2** The Owner will furnish the Contractor the number of copies of complete sets of drawings and specifications for the work, as well as clarification and change order drawings pertaining to change orders required during construction as set forth in the Special Conditions.

#### **14. Missouri Products and Missouri Firms**

**14.1** The Curators of the University of Missouri have adopted a policy which is binding upon all employees and departments of the University of Missouri, and which by contract, shall be binding upon independent contractors and subcontractors with the University of Missouri whereby all other things being equal, and when the same can be secured without additional cost over foreign products, or products of other states, a preference shall be granted in all construction, repair and purchase contracts, to all products, commodities,

materials, supplies, and articles mined, grown, produced, and manufactured in marketable quantity and quality in the State of Missouri, and to all firms, corporations or individuals doing business as Missouri firms, corporations, or individuals. Each bidder submitting a bid agrees to comply with and be bound by the foregoing policy.

#### **15. SUPPLIER DIVERSITY**

##### **15.1 Award of Contract**

The Supplier Diversity participation goal for this project is stated on the Bid for Lump Sum Contract Form, and the Owner will take into consideration the bidder's success in achieving the Supplier Diversity participation goal in awarding the contract. Inability of any bidder to meet this requirement may be cause for rejection of their bid.

A 3-point Service-Disabled Veteran Enterprises (SDVE) bonus preference shall apply to this contract. The 3 bonus points can be obtained by a certified, Missouri based SDVE performing a commercially useful function, (as defined in Article 1 of the General Conditions of the Contract for Construction) either by submitting a bid directly to the Owner, or through the utilization of certified SDVE subcontractors and/or suppliers, whose participation provides at least 3% of the total bid amount. A firm does not perform a commercially useful function if its role is limited to that of an extra participant in a transaction, contract, or project through which funds are passed in order to obtain the appearance of SDVE participation. In determining whether a firm is such an extra participant, the Owner will examine similar transactions, particularly those in which SDVEs do not participate. The 3-point bonus preference shall be calculated and applied by reducing the bid amount of the eligible bidder by three (3) percent of the apparent low responsive bidder's bid. Based on this calculation, if the eligible bidder's resulting total bid valuation is less than the apparent low responsive bidder's bid, the eligible bid becomes the apparent low responsive bid. This reduction is for evaluation purposes only and will have no impact on the actual amount(s) of the eligible bidder's bid or the amount(s) of any contract awarded. The submitted bid form must include a minimum of 3% SDVE participation to obtain the three (3) point bonus. For every SDVE firm utilized, a completed AFFIDAVIT OF SUPPLIER DIVERSITY PARTICIPATION form shall be submitted to the Owner within 24 hours of the receipt of bids. Failure to do so may be grounds for rejection of the SDVE bonus preference.

##### **15.2 List of Supplier Diversity Firms**

**15.2.1** The bidder shall submit as part of their bid a list of diverse firms performing as contractor, subcontractors, and/or suppliers. The list shall specify the single designated diverse firm name and address. If acceptance or non-acceptance of alternates will affect the designation of a subcontractor, provide information for each affected category.

**15.2.2** Failure to include a complete list of diverse firms may be grounds for rejection of the bid.

**15.2.3** The list of diverse firms shall be submitted in addition to any other listing of subcontractors required in the Bid for Lump Sum Contract Form.

##### **15.3 Supplier Diversity Percentage Goal**

The bidder shall have a minimum goal of subcontracting with diverse contractors, subcontractors, and suppliers, the percent



of contract price stated in the Supplier Diversity goal paragraph of the Bid for Lump Sum Contract Form.

#### **15.4 Supplier Diversity Percent Goal Computation**

**15.4.1** The total dollar value of the work granted to the diverse firms by the successful bidder is counted towards the applicable goal of the entire contract, unless otherwise noted below.

**15.4.2** The bidder may count toward the Supplier Diversity goal only expenditures to diverse firms that perform a commercially useful function in the work of a contract. A diverse firm is considered to perform a commercially useful function when it is responsible for executing a distinct element of the work and carrying out its responsibilities by actually performing, managing and supervising the work involved. A bidder that is a certified diverse firm may count as 100% of the contract towards the Supplier Diversity goal. For projects with separate MBE, SDVE, and WBE/Veteran/DBE goals, a MBE firm bidding as the prime bidder is expected to obtain the required SDVE, and WBE/Veteran/ DBE participation; a WBE or Veteran or DBE firm bidding as the prime bidder is expected to obtain the required MBE and SDVE participation and a SDVE firm bidding as the prime bidder is expected to obtain the required MBE, and WBE/Veteran/ DBE participation.

**15.4.3** When a MBE, WBE, Veteran Business Enterprise, DBE, or SDVE performs work as a participant in a joint venture, only the portion of the total dollar value of the contract equal to the distinct, clearly defined portion of the work of the contract that the MBE, WBE, Veteran Business Enterprise, DBE, or SDVE performs with its own forces shall count toward the MBE, WBE, Veteran Business Enterprise, DBE, or SDVE individual contract percentages.

**15.4.4** The bidder may count toward its Supplier Diversity goal expenditures for materials and supplies obtained from diverse suppliers and manufacturers, provided the diverse firm assumes the actual and contractual responsibility for the provision of the materials and supplies.

**15.4.4.1** The bidder may count its entire expenditure to a diverse manufacturer. A manufacturer shall be defined as an individual or firm that produces goods from raw materials or substantially alters them before resale.

**15.4.4.2** The bidder may count its entire expenditure to diverse suppliers that are not manufacturers provided the diverse supplier performs a commercially useful function as defined above in the supply process.

**15.4.4.3** The bidder may count 25% of its entire expenditures to diverse firms that do not meet the definition of a subcontractor, a manufacturer, nor a supplier. Such diverse firms may arrange for, expedite, or procure portions of the work but are not actively engaged in the business of performing, manufacturing, or supplying that work.

**15.4.5** The bidder may count toward the Supplier Diversity goal that portion of the total dollar value of the work awarded to a certified joint venture equal to the percentage of the ownership and control of the diverse partner in the joint venture.

#### **15.5 Certification by Bidder of Diverse Firms**

**15.5.1.** The bidder shall submit with its bid the information requested in the "Supplier Diversity Compliance Evaluation Form" for every diverse firm the bidder intends to award work to on the contract.

**15.5.2.** Diverse firms are defined in Article 1 – (Supplier Diversity Definitions) of the General Conditions of the Contract for Construction included in the contract documents, and as those businesses certified as disadvantaged by an approved agency. The bidder is responsible for obtaining information regarding the certification status of a firm. A list of certified firms may be obtained by contacting the agencies listed in the proposal form document “Supplier Diversity Certifying Agencies.” Any firm listed as disadvantaged by any of the identified agencies will be classified as a diverse firm by the Owner.

**15.5.3.** Bidders are urged to encourage their prospective diverse contractors, subcontractors, joint venture participants, team partners, and suppliers who are not currently certified to obtain certification from one of the approved agencies.

#### **15.6 Supplier Diversity Participation Waiver**

**15.6.1** The bidder is required to make a good faith effort to locate and contract with diverse firms. If a bidder has made a good faith effort to secure the required diverse firms and has failed, the bidder shall submit with the bid, the information requested in "Application for Supplier Diversity Participation Waiver." The Contracting Officer will review the bidder's actions as set forth in the bidder's "Application for Waiver" and any other factors deemed relevant by the Contracting Officer to determine if a good faith effort has been made to meet the applicable percentage goal. If the bidder is judged not to have made a good faith effort, the bid may be rejected. Bidders who demonstrate that they have made a good faith effort to include Supplier Diversity participation may be awarded the contract regardless of the percent of Supplier Diversity participation, provided the bid is otherwise acceptable and is determined to be the best bid.

**15.6.2** To determine good faith effort of the bidder, the Contracting Officer may evaluate factors including, but not limited to, the following:

**15.6.2.1** The bidder's attendance at pre-proposal meetings scheduled to inform bidders and diverse firms of contracting and subcontracting opportunities and responsibilities associated with Supplier Diversity participation.

**15.6.2.2** The bidder's advertisements in general circulation trade association, and diverse (minority) focused media concerning subcontracting opportunities.

**15.6.2.3** The bidder's written notice to specific diverse firms that their services were being solicited in sufficient time to allow for their effective participation.

**15.6.2.4** The bidder's follow-up attempts to the initial solicitation(s) to determine with certainty whether diverse firms were interested.

**15.6.2.5** The bidder's efforts to divide the work into packages suitable for subcontracting to diverse firms.

**15.6.2.6** The bidder's efforts to provide interested diverse firms with sufficiently detailed information about the drawings, specific actions and requirements of the contract, and clear scopes of work for the firms to bid on.

**15.6.2.7** The bidder's efforts to solicit for specific sub-bids from diverse firms in good faith. Documentation should include names, addresses, and telephone numbers of firms contacted a description of all information provided the diverse firms, and an explanation as to why agreements were not reached.

**15.6.2.8** The bidder's efforts to locate diverse firms not on the directory list and assist diverse firms in becoming certified as such.

**15.6.2.9** The bidder's initiatives to encourage and develop participation by diverse firms.

**15.6.2.10** The bidder's efforts to help diverse firms overcome legal or other barriers impeding the participation of diverse firms in the construction contract.

**15.6.2.11** The availability of diverse firms and the adequacy of the bidder's efforts to increase the participation of such business provided by the persons and organizations consulted by the bidder.

## **15.7 Submittal of Forms**

**15.7.1** The bidder will include the Supplier Diversity Compliance Evaluation Form(s), or the Application for Waiver and other form(s) as required above in the envelope containing the "Bidder's Statement of Qualifications", see Article 8.

## **15.8 Additional Bid/Proposer Information**

**15.8.1** The Contracting Officer reserves the right to request additional information regarding Supplier Diversity participation and supporting documentation from the apparent low bidder. The bidder shall respond in writing to the Contracting Officer within 24 hours (1 workday) of a request.

**15.8.2** The Contracting Officer reserves the right to request additional information after the bidder has responded to prior 24-hour requests. This information may include follow up and/or clarification of the information previously submitted.

**15.8.3** The Owner reserves the right to consider additional diverse subcontractor and supplier participation submitted by the bidder after bids are opened under the provisions within these contract documents that describe the Owner's right to accept or reject subcontractors including, but not limited to, Article 16 below. The Owner may elect to waive the good faith effort requirement if such additional participation achieves the Supplier Diversity goal.

**15.8.4** The Bidder shall provide the Owner information related to the Supplier Diversity participation included in the bidder's proposal, including, but is not limited to, the complete Application for Waiver, evidence of diverse certification of participating firms, dollar amount of participation of diverse firms, information supporting a good faith effort as described in Article 15.6 above, and a list of all diverse firms that submitted bids to the Bidder with the diverse firm's price and the name and the price of the firm awarded the scope of work bid by the diverse firm.

## **16. List of Subcontractors**

**16.1** If a list of subcontractors is required on the Bid for Lump Sum Contract Form, the bidders shall list the name, city and state of the firm(s) which will accomplish that portion of the contract requested in the space provided. This list is separate from both the list of diverse firms required in Article 15.2, and the complete list of subcontractors required in Article 10.1 of this document. Should the bidder choose to perform any of the listed portions of the work with its own forces, the bidder shall enter its own name, city and state in the space provided. If acceptance or non-acceptance of alternates will affect the designation of a subcontractor, the bidder shall provide that information on the bid form.

**16.2** Failure of the bidder to supply the list of subcontractors required or the listing of more than one subcontractor for any category without designating the portion of the work to be performed by each, shall be grounds for the rejection of the bid. The bidder can petition the Owner to change a listed subcontractor within 48 hours of the bid opening. The Owner reserves the right to make the final determination on a petition to change a subcontractor. The Owner will consider factors such as clerical and mathematical bidding errors, listed subcontractor's inability to perform the work for the bid used, etc. Any request to change a listed subcontractor shall include at a minimum, contractor's bid sheet showing tabulation of the bid; all subcontractor bids with documentation of the time they were received by the contractor; and a letter from the listed subcontractor on their letterhead stating why they cannot perform the work if applicable. The Owner reserves the right to ask for additional information.

**16.3** Upon award of the contract, the requirements of Article 10 of this document and Article 5 of the General Conditions of the Contract for Construction included in the contract documents will apply.

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University of Missouri

**General Conditions**

of the

**Contract**

for

**Construction**

August 2020 Edition

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## TABLE OF ARTICLES

	<b>PAGE</b>
<b>1. GENERAL PROVISIONS.....</b>	<b>GC/1</b>
1.1 Basic Definitions .....	GC/1
1.2 Specifications and Drawings .....	GC/3
1.3 Required Provisions Deemed Inserted.....	GC/4
<b>2. OWNER.....</b>	<b>GC/4</b>
2.1 Information and Services Required of the Owner .....	GC/4
2.2 Owner's Right to Stop the Work.....	GC/4
2.3 Owner's Right to Carry Out the Work .....	GC/4
2.4 Extent of Owner Rights .....	GC/4
<b>3. CONTRACTOR .....</b>	<b>GC/5</b>
3.1 Contractor's Warranty.....	GC/5
3.2 Compliance with Laws, Permits, Regulations and Inspections .....	GC/5
3.3 Anti-Kickback .....	GC/6
3.4 Supervision and Construction Procedures .....	GC/6
3.5 Use of Site .....	GC/7
3.6 Review of Contract Documents and Field Conditions by Contractor.....	GC/8
3.7 Cleaning and Removal.....	GC/8
3.8 Cutting and Patching .....	GC/8
3.9 Indemnification.....	GC/9
3.10 Patents .....	GC/9
3.11 Materials, Labor, and Workmanship .....	GC/9
3.12 Approved Equal.....	GC/10
3.13 Shop Drawings, Product Data and Samples .....	GC/11
3.14 Record Drawings .....	GC/12
3.15 Operating Instructions and Service Manual.....	GC/12
3.16 Taxes .....	GC/13
3.17 Contractor's Construction Schedules.....	GC/13
<b>4. ADMINISTRATION OF THE CONTRACT .....</b>	<b>GC/14</b>
4.1 Rights of the Owner.....	GC/14
4.2 Rights of the Architect.....	GC/15
4.3 Review of the Work.....	GC/15
4.4 Claims.....	GC/15
4.5 Claims for Concealed or Unknown Conditions.....	GC/15
4.6 Claim for Additional Cost .....	GC/16
4.7 Claims for Additional Time.....	GC/16
4.8 Resolution of Claims and Disputes.....	GC/16
4.9 Administrative Review .....	GC/17
<b>5. SUBCONTRACTORS .....</b>	<b>GC/17</b>
5.1 Award of Subcontracts .....	GC/17
5.2 Subcontractual Relations .....	GC/17
5.3 Contingent Assignment of Subcontract .....	GC/17
<b>6. SEPARATE CONTRACTS AND COOPERATION .....</b>	<b>GC/18</b>
<b>7. CHANGES IN THE WORK.....</b>	<b>GC/18</b>
7.1 Change Orders .....	GC/18
7.2 Construction Change Directive.....	GC/19
7.3 Overhead and Profit.....	GC/20
7.4 Extended General Conditions.....	GC/20
7.5 Emergency Work.....	GC/21

<b>8. TIME .....</b>	<b>GC/21</b>
8.1 Progress and Completion.....	GC/21
8.2 Delay in Completion.....	GC/21
8.3 Liquidated Damages.....	GC/22
<b>9. PAYMENTS AND COMPLETION.....</b>	<b>GC/22</b>
9.1 Commencement, Prosecution and Completion.....	GC/22
9.2 Contract Sum .....	GC/23
9.3 Schedule of Values .....	GC/23
9.4 Applications for Payment .....	GC/24
9.5 Approval for Payment .....	GC/25
9.6 Decisions to Withhold Approval .....	GC/25
9.7 Progress Payments.....	GC/25
9.8 Failure of Payment.....	GC/26
9.9 Substantial Completion.....	GC/26
9.10 Partial Occupancy or Use .....	GC/26
9.11 Final Completion and Final Payment .....	GC/26
<b>10. PROTECTION OF PERSONS AND PROPERTY .....</b>	<b>GC/27</b>
10.1 Safety Precautions and Programs .....	GC/27
10.2 Safety of Persons and Property.....	GC/27
<b>11. INSURANCE &amp; BONDS .....</b>	<b>GC/28</b>
11.1 Insurance.....	GC/28
11.2 Commercial General Liability .....	GC/28
11.3 Licensed for Use Vehicle Liability .....	GC/28
11.4 Workers' Compensation Insurance.....	GC/29
11.5 Liability Insurance General Requirements .....	GC/29
11.6 Builder's Risk Insurance .....	GC/30
11.7 Bonds.....	GC/31
<b>12. UNCOVERING AND CORRECTION OF THE WORK.....</b>	<b>GC/31</b>
12.1 Uncovering of the Work .....	GC/31
12.2 Correction of the Work.....	GC/31
12.3 Acceptance of Nonconforming Work.....	GC/32
<b>13. MISCELLANEOUS PROVISIONS .....</b>	<b>GC/32</b>
13.1 Written Notice .....	GC/32
13.2 Rights and Remedies .....	GC/32
13.3 Tests and Inspections.....	GC/32
13.4 Nondiscrimination in Employment Equal Opportunity .....	GC/33
13.5 Supplier Diversity Goal Program .....	GC/33
13.6 Wage Rates.....	GC/34
13.7 Records.....	GC/36
13.8 Codes and Standards.....	GC/36
13.9 General Provisions.....	GC/36
13.10 Certification.....	GC/37
<b>14. TERMINATION OR SUSPENSION OF THE CONTRACT .....</b>	<b>GC/37</b>
14.1 Termination by Owner for Cause .....	GC/37
14.2 Suspension by the Owner for Convenience .....	GC/38
14.3 Owner's Termination for Convenience .....	GC/38

**ARTICLE 1  
GENERAL PROVISIONS**

**1.1 Basic Definitions**

As used in the Contract Documents, the following terms shall have the meanings and refer to the parties designated in these definitions.

**1.1.1 Owner**

The Curators of the University of Missouri. The Owner may act through its Board of Curators or any duly authorized committee or representative thereof.

**1.1.2 Contracting Officer**

The Contracting Officer is the duly authorized representative of the Owner with the authority to execute contracts. Communications to the Contracting Officer shall be forwarded via the Owner's Representative.

**1.1.3 Owner's Representative**

The Owner's Representative is authorized by the Owner as the administrator of the Contract and will represent the Owner during the progress of the Work. Communications from the Architect to the Contractor and from the Contractor to the Architect shall be through the Owner's Representative, unless otherwise indicated in the Contract Documents.

**1.1.4 Architect**

When the term "Architect" is used herein, it shall refer to the Architect or the Engineer specified and defined in the Contract for Construction or its duly authorized representative. Communications to the Architect shall be forwarded to the address shown in the Contract for Construction.

**1.1.5 Contractor**

The Contractor is the person or entity with whom the Owner has entered into the Contract for Construction. The term "Contractor" means the Contractor or the Contractor's authorized representative.

**1.1.6 Subcontractor and Lower-tier Subcontractor**

A Subcontractor is a person or organization who has a contract with the Contractor to perform any of the Work. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or its authorized representative. The term "Subcontractor" also is applicable to those furnishing materials to be incorporated in the Work whether work performed is at the Owner's site or off site, or both. A lower-tier Subcontractor is a person or organization who has a contract with a Subcontractor or another lower-tier Subcontractor to perform any of the Work at the site. Nothing contained in the Contract Documents shall create contractual relationships between the Owner or the Architect and any Subcontractor or lower-tier Subcontractor of any tier.

**1.1.7 Supplier Diversity Definitions**

Businesses that fall into the Supplier Diversity classification shall mean an approved certified business concern which is at least fifty-one percent (51%) owned and controlled by one (1) or more diverse suppliers as described below.

**.1 Minority Business Enterprises (MBE)**

Minority Business Enterprise [MBE] shall mean an approved certified business concern which is at least fifty-one percent (51%) owned and controlled by one (1) or more minorities as defined below or, in the case of any publicly-owned business, in which at least fifty-one percent (51%) of the stock of which is owned by one (1) or more minorities as defined below, and whose management and daily business operations are controlled by one (1) or more minorities as defined herein.

**.1.1** "African Americans", which includes persons having origins in any of the black racial groups of Africa.

**.1.2** "Hispanic Americans", which includes persons of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race.

**.1.3** "Native Americans", which includes persons of American Indian, Eskimo, Aleut, or Native Hawaiian origin.

**.1.4** "Asian-Pacific Americans", which includes persons whose origins are from Japan, China, Taiwan, Korea, Vietnam, Laos, Cambodia, the Philippines, Samoa, Guam, the U.S. Trust Territories of the Pacific, or the Northern Marianas.

**.1.5** "Asian-Indian Americans", which includes persons whose origins are from India, Pakistan, or Bangladesh.

**.2 Women Business Enterprise (WBE)**

Women Business Enterprise [WBE] shall mean an approved certified business concern which is at least fifty-one percent (51%) owned and controlled by one (1) or more women or, in the case of any publicly-owned business, in which at least fifty-one percent (51%) of the stock of which is owned by one (1) or more women, and whose management and daily business operations are controlled by one (1) or more women.

**.3 Veteran Owned Business**

Veteran Owned Business shall mean an approved certified business concern which is at least fifty-one percent (51%) owned and controlled by one (1) or more Veterans or, in the case of any publicly-owned business, in which at least fifty-one percent (51%) of the stock of which is owned by one (1) or more Veterans, and whose management and daily business operations are controlled by one (1) or more Veterans. Veterans must be certified by the appropriate federal agency responsible for veterans' affairs.

**.4 Service Disabled Veteran Enterprise (SDVE)**

Service Disabled Veteran Enterprise (SDVE) shall mean a business certified by the State of Missouri Office of Administration as a Service Disabled Veteran Enterprise, which is at least fifty-one percent (51%) owned and controlled by one (1) or more Served Disabled Veterans or, in the case of any publicly-owned business, in which at least



fifty-one percent (51%) of the stock of which is owned by one (1) or more Service Disabled Veterans, and whose management and daily business operations are controlled by one (1) or more Serviced Disabled Veterans.

**.5 Disadvantaged Business Enterprise (DBE)**

A Disadvantaged Business Enterprise (DBE) is a for-profit small business concern where a socially and economically disadvantaged individual owns at least 51% interest and also controls management and daily business operations. These firms can and also be referred to as Small Disadvantaged Businesses (SDB). Eligibility requirements for certification are stated in 49 CFR (Code of Federal Regulations), part 26, Subpart D.

U.S. citizens that are African-Americans, Hispanics, Native Americans, Asian-Pacific and Subcontinent Asian Americans, and women are presumed to be socially and economically disadvantaged. Also recognized as DBE's are Historically Black Colleges and Universities (HBCU) and small businesses located in Federal HUB Zones.

To be regarded as economically disadvantaged, an individual must have a personal net worth that does not exceed \$1.32 million. To be seen as a small business, a firm must meet Small Business Administration (SBA) size criteria (500 employees or less) and have average annual gross receipts not to exceed \$22.41 million. To be considered a DBE/SDB, a small business owned and controlled by socially and/or economically disadvantaged individuals must receive DBE certification from one of the recognized Missouri state agencies to be recognized in this classification.

**1.1.9 Work**

Work shall mean supervision, labor, equipment, tools, material, supplies, incidentals operations and activities required by the Contract Documents or reasonably inferable by Contractor therefrom as necessary to produce the results intended by the Contract Documents in a safe, expeditious, orderly, and workmanlike manner, and in the best manner known to each respective trade.

**1.1.10 Approved**

The terms "approved", "equal to", "directed", "required", "ordered", "designated", "acceptable", "satisfactory", and similar words or phrases will be understood to have reference to action on the part of the Architect and/or the Owner's Representative.

**1.1.11 Contract Documents**

The Contract Documents consist of (1) the executed Contract for Construction, (2) these General Conditions of the Contract for Construction, (3) any Supplemental Conditions or Special Conditions identified in the Contract for Construction, (4) the Specifications identified in the Contract for Construction, (5) the Drawings identified in the Contract for Construction, (6) Addenda issued prior to the receipt of bids, (7) Contractor's bid addressed to Owner, including Contractor's completed Qualification Statement, (8)

Contractor's Performance Bond and Contractor's Payment Bond, (9) Notice to Proceed, (10) and any other exhibits and/or post bid adjustments identified in the Contract for Construction, (11) Advertisement for Bid, (12) Information for Bidders, and (13) Change Orders issued after execution of the Contract. All other documents and technical reports and information are not Contract Documents, including without limitation, Shop Drawings, and Submittals.

**1.1.12 Contract**

The Contract Documents form the Contract and are the exclusive statement of agreement between the parties. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior representations or agreements, either written or oral. The Contract Documents shall not be construed to create a contractual relationship of any kind between the Owner and a Subcontractor or any lower-tier Subcontractor.

**1.1.13 Change Order**

The Contract may be amended or modified without invalidating the Contract, only by a Change Order, subject to the limitations in Article 7 and elsewhere in the Contract Documents. A Change Order is a written instrument signed by the Owner and the Contractor stating their agreement to a change in the Work, the amount of the adjustment to the Contract Sum, if any, and the extent of the adjustment to the Contract Time, if any. Agreement to any Change Order shall constitute a final settlement of all matters relating to the change in the work which is the subject of the Change Order, including, but not limited to, all direct and indirect costs associated with such change and any and all adjustments of the Contract sum, time and schedule.

**1.1.14 Substantial Completion**

The terms "Substantial Completion" or "substantially complete" as used herein shall be construed to mean the completion of the entire Work, including all submittals required under the Contract Documents, except minor items which in the opinion of the Architect, and/or the Owner's Representative will not interfere with the complete and satisfactory use of the facilities for the purposes intended.

**1.1.15 Final Completion**

The date when all punch list items are completed, including all closeout submittals and approval by the Architect is given to the Owner in writing.

**1.1.16 Supplemental and Special Conditions**

The terms "Supplemental Conditions" or "Special Conditions" shall mean the part of the Contract Documents which amend, supplement, delete from, or add to these General Conditions.

**1.1.17 Day**

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

**1.1.18 Knowledge.**

The terms “knowledge,” “recognize” and “discover,” their respective derivatives and similar terms in the Contract Documents, as used in reference to the Contractor, shall be interpreted to mean that which the Contractor knows or should know, recognizes or should recognize and discovers or should discover in exercising the care, skill, and diligence of a diligent and prudent contractor familiar with the work. Analogously, the expression “reasonably inferable” and similar terms in the Contract Documents shall be interpreted to mean reasonably inferable by a diligent and prudent contractor familiar with the work.

#### **1.1.19 Punch List**

“Punch List” means the list of items, prepared in connection with the inspection of the Project by the Owner’s Representative or Architect in connection with Substantial Completion of the Work or a portion of the Work, which the Owner’s Representative or Architect has designated as remaining to be performed, completed or corrected before the Work will be accepted by the Owner.

#### **1.1.20 Public Works Contracting Minimum Wage**

The public works contracting minimum wage shall be equal to one hundred twenty percent of the average hourly wage in a particular locality, as determined by the Missouri economic research and information center within the department of economic development, or any successor agency.

#### **1.1.21 Force Majeure**

An event or circumstance that could not have been reasonably anticipated and is out of the control of both the Owner and the Contractor.

### **1.2 Specifications and Drawings**

**1.2.1** The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, construction system, standards and workmanship and performance of related services for the Work identified in the Contract for Construction. Specifications are separated into titled divisions for convenience of reference only. 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. Such separation will not operate to make the Owner or the Architect an arbiter of labor disputes or work agreements.

**1.2.2** The drawings herein referred to, consist of drawings prepared by the Architect and are enumerated in the Contract Documents.

**1.2.3** Drawings are intended to show general arrangements, design, and dimensions of work and are partly diagrammatic. Dimensions shall not be determined by scale or rule. If figured dimensions are lacking, they

shall be supplied by the Architect on the Contractor's written request to the Owner's Representative.

**1.2.4** 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 shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the intended results.

**1.2.5** In the event of inconsistencies within or between parts of the Contract Documents, or between the Contract Documents and applicable standards, codes and ordinances, the Contractor shall (1) provide the better quality or greater quantity of Work or (2) comply with the more stringent requirement; either or both in accordance with the Owner’s Representative’s interpretation. On the Drawings, given dimensions shall take precedence over scaled measurements and large scale drawings over small scale drawings. Before ordering any materials or doing any Work, the Contractor and each Subcontractor shall verify measurements at the Work site and shall be responsible for the correctness of such measurements. Any difference which may be found shall be submitted to the Owner’s Representative and Architect for resolution before proceeding with the Work. If a minor change in the Work is found necessary due to actual field conditions, the Contractor shall submit detailed drawings of such departure for the approval by the Owner’s Representative and Architect before making the change.

**1.2.6** Data in the Contract Documents concerning lot size, ground elevations, present obstructions on or near the site, locations and depths of sewers, conduits, pipes, wires, etc., position of sidewalks, curbs, pavements, etc., and nature of ground and subsurface conditions have been obtained from sources the Architect believes reliable, but the Architect and Owner do not represent or warrant that this information is accurate or complete. The Contractor shall verify such data to the extent possible through normal construction procedures, including but not limited to contacting utility owners and by prospecting.

**1.2.7** Only work included in the Contract Documents is authorized, and the Contractor shall do no work other than that described therein.

**1.2.8** Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become familiar with local conditions under which the Work is to be performed and correlated personal observations with requirements of the Contract Documents. Contractor represents that it has performed its own investigation and examination of the Work site and its surroundings and satisfied itself before entering into this Contract as to:

- .1 conditions bearing upon transportation, disposal, handling, and storage of materials;

- .2 the availability of labor, materials, equipment, water, electrical power, utilities and roads;
- .3 uncertainties of weather, river stages, flooding and similar characteristics of the site;
- .4 conditions bearing upon security and protection of material, equipment, and Work in progress;
- .5 the form and nature of the Work site, including the surface and sub-surface conditions;
- .6 the extent and nature of Work and materials necessary for the execution of the Work and the remedying of any defects therein; and
- .7 the means of access to the site and the accommodations it may require and, in general, shall be deemed to have obtained all information as to risks, contingencies and other circumstances.
- .8 the ability to complete work without disruption to normal campus activities, except as specifically allowed in the contract documents.

The Owner assumes no responsibility or liability for the physical condition or safety of the Work site or any improvements located on the Work site. The Contractor shall be solely responsible for providing a safe place for the performance of the Work. The Owner shall not be required to make any adjustment in either the Contract Sum or Contract Time concerning any failure by the Contractor or any Subcontractor to comply with the requirements of this Paragraph.

**1.2.9** Drawings, specifications, and copies thereof furnished by the Owner are and shall remain the Owner's property. They are not to be used on another project and, with the exception of one contract set for each party to the Contract, shall be returned to the Owner's Representative on request, at the completion of the Work.

### **1.3 Required Provisions Deemed Inserted**

Each and every provision of law and clause required by law to be inserted in this Contract shall be deemed to be inserted herein, and the Contract shall be read and enforced as though it were included herein; and if through mistake or otherwise any such provision is not inserted, or is not correctly inserted, then upon the written application of either party the Contract shall forthwith be physically amended to make such insertion or correction.

## **ARTICLE 2 OWNER**

### **2.1 Information and Services Required of the Owner**

**2.1.1** Permits and fees are the responsibility of the Contractor under the Contract Documents, unless specifically stated in the contract documents that the Owner will secure and pay for specific necessary approvals, easements, assessments, and charges required for construction, use or occupancy of permanent

structures, or for permanent changes in existing facilities.

**2.1.2** When requested in writing by the Contractor, information or services under the Owner's control, which are reasonably necessary to perform the Work, will be furnished by the Owner with reasonable promptness to avoid delay in the orderly progress of the Work.

### **2.2 Owner's Right to Stop the Work**

**2.2.1** If the Contractor fails to correct Work which is not in strict accordance with the requirements of the Contract Documents or fails to carry out Work in strict accordance with the Contract Documents, the Owner's Representative 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 Owner to stop the Work will not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity. Owner's lifting of Stop Work Order shall not prejudice Owner's right to enforce any provision of this Contract.

### **2.3 Owner's Right to Carry Out the Work**

**2.3.1** If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents, and fails within a seven (7) day period after receipt of a written notice from the Owner to correct such default or neglect, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. In such case, an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the cost of correcting such deficiencies, including compensation for the Architect's additional services and expenses made necessary by such default or neglect. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to Owner. However, such notice shall be waived in the event of an emergency with the potential for property damage or the endangerment of students, faculty, staff, the public or construction personnel, at the sole discretion of the Owner.

**2.3.2** In the event the Contractor has not satisfactorily completed all items on the Punch List within thirty (30) days of its receipt, the Owner reserves the right to complete the Punch List without further notice to the Contractor or its surety. In such case, Owner shall be entitled to deduct from payments then or thereafter due the Contractor the cost of completing the Punch List items, including compensation for the Architect's additional services. If payments then or thereafter due Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to Owner.

### **2.4 Extent of Owner Rights**

**2.4.1** The rights stated in this Article 2 and elsewhere in the Contract Documents are cumulative and not in limitation of any rights of the Owner (1) granted in the Contract Documents, (2) at law or (3) in equity.

**2.4.2** In no event shall the Owner have control over, charge of, or any responsibility for construction means, methods, techniques, sequences or procedures or for safety precautions and programs in connection with the Work, notwithstanding any of the rights and authority granted the Owner in the Contract Documents.

### **ARTICLE 3 CONTRACTOR**

#### **3.1 Contractor's Warranty**

**3.1.1** The Contractor warrants all equipment and materials furnished, and work performed, under this Contract, against defective materials and workmanship for a period of twelve months after acceptance as provided in this Contract, unless a longer period is specified, regardless of whether the same were furnished or performed by the Contractor or any Subcontractors of any tier. Upon written notice from the Owner of any breach of warranty during the applicable warranty period due to defective material or workmanship, the affected part or parts thereof shall be repaired or replaced by the Contractor at no cost to the Owner. Should the Contractor fail or refuse to make the necessary repairs, replacements, and tests when requested by the Owner, the Owner may perform, or cause the necessary work and tests to be performed, at the Contractor's expense, or exercise the Owner's rights under Article 14.

**3.1.2** Should one or more defects mentioned above appear within the specified period, the Owner shall have the right to continue to use or operate the defective part or apparatus until the Contractor makes repairs or replacements or until such time as it can be taken out of service without loss or inconvenience to the Owner.

**3.1.3** The above warranties are not intended as a limitation, but are in addition to all other express warranties set forth in this Contract and such other warranties as are implied by law, custom, and usage of trade. The Contractor, and its surety or sureties, if any, shall be liable for the satisfaction and full performance of the warranties set forth herein.

**3.1.4** Neither the final payment nor any provision in the Contract Documents nor partial or entire occupancy of the premises by the Owner, nor expiration of warranty stated herein, will constitute an acceptance of Work not done in accordance with the Contract Documents or relieve the Contractor of liability in respect to any responsibility for non-conforming work. The Contractor shall immediately remedy any defects in the Work and pay for any damage to other Work resulting therefrom upon written notice from the Owner. Should the Contractor fail or refuse to remedy the non-conforming work, the Owner may perform, or cause to be performed the work necessary to bring the work into conformance with the Contract Documents at the Contractor's expense.

**3.1.5** The Contractor agrees to defend, indemnify, and save harmless The Curators of the University of Missouri, their Officers, Agents, Employees and Volunteers, from and against all loss or expense from any injury or damages to property of others suffered or incurred on account of any breach of the aforesaid obligations and covenants. The Contractor agrees to investigate, handle, respond to and provide defense for and defend against any such liability, claims, and demands at the sole expense of the Contractor, or at the option of the University, agrees to pay to or reimburse the University for the defense costs incurred by the University in connection with any such liability claims, or demands. The parties hereto understand and agree that the University is relying on, and does not waive or intend to waive by any provision of this Contract, any monetary limitations or any other rights, immunities, and protections provided by the State of Missouri, as from time to time amended, or otherwise available to the University, or its officers, employees, agents or volunteers.

#### **3.2 Compliance with Laws, Permits, Regulations and Inspections**

**3.2.1** The Contractor shall, without additional expense to the Owner, comply with all applicable laws, ordinances, rules, statutes, and regulations (collectively referred to as "Laws").

**3.2.2** Since the Owner is an instrumentality of the State of Missouri, municipal, or political subdivision, ordinances, zoning ordinances, and other like ordinances are not applicable to construction on the Owner's property, and the Contractor will not be required to submit plans and specifications to any municipal or political subdivision authority to obtain construction permits or any other licenses or permits from or submit to, inspection by any municipality or political subdivision relating to the construction on the Owner's property, unless required by the Owner in these Contract Documents or otherwise in writing.

**3.2.3** All fees, permits, inspections, or licenses required by municipality or political subdivision for operation on property not belonging to the Owner, shall be obtained by and paid for by the Contractor. The Contractor, of its own expense, is responsible to ensure that all inspections required by said permits or licenses on property, easements, or utilities not belonging to the Owner are conducted as required therein. All connection charges, assessments or transportation fees as may be imposed by any utility company or others are included in the Contract Sum and shall be the Contractor's responsibility, as stated in 2.1.1 above.

**3.2.4** If the Contractor has knowledge that any Contract Documents are at variance with any Laws, including Americans with Disabilities Act – Standards for Accessible Design, ordinances, rules, regulations or codes applying to the Work, Contractor shall promptly notify the Architect and the Owner's Representative, in writing, and any necessary changes will be adjusted as provided in Contract Documents.

However, it is not the Contractor's primary responsibility to ascertain that the Contract Documents are in accordance with applicable Laws, unless such Laws bear upon performance of the Work.

### **3.3 Anti-Kickback**

**3.3.1** No member or delegate to Congress, or resident commissioner, shall be admitted to any share or part of this Contract or to any benefit that may arise therefrom, but this provision shall not be construed to extend to this Contract if made with a corporation for its general benefit.

**3.3.2** No official of the Owner who is authorized in such capacity and on behalf of the Owner to negotiate, make, accept or approve, or to take part in negotiating, making, accepting, or approving any architectural, engineering, inspection, construction, or material supply contract or any Subcontract of any tier in connection with the construction of the Work shall have a financial interest in this Contract or in any part thereof, any material supply contract, Subcontract of any tier, insurance contract, or any other contract pertaining to the Work.

### **3.4 Supervision and Construction Procedures**

**3.4.1** The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences, and procedures and for coordinating all portions of the Work under the Contract. The Contractor shall supply sufficient and competent supervision and personnel, and sufficient material, plant, and equipment to prosecute the Work with diligence to ensure completion thereof within the time specified in the Contract Documents, and shall pay when due any laborer, Subcontractor of any tier, or supplier.

**3.4.2** The Contractor, if an individual, shall give the Work an adequate amount of personal supervision, and if a partnership or corporation or joint venture the Work shall be given an adequate amount of personal supervision by a partner or executive officer, as determined by the Owner's Representative.

**3.4.3** The Contractor and each of its Subcontractors of any tier shall submit to the Owner such schedules of quantities and costs, progress schedules in accordance with 3.17.2 of this document, payrolls, reports, estimates, records, and other data as the Owner may request concerning Work performed or to be performed under the Contract.

**3.4.4** The Contractor shall be represented at the site by a competent superintendent from the beginning of the Work until its final acceptance, whenever contract work is being performed, unless otherwise permitted in writing by the Owner's Representative. The superintendent for the Contractor shall exercise general supervision over the

Work and such superintendent shall have decision making authority of the Contractor. Communications given to the superintendent shall be binding as if given to the Contractor. The superintendent shall not be changed by the contractor without approval from the Owner's Representative.

**3.4.5** The Contractor shall establish and maintain a permanent bench mark to which access may be had during progress of the Work, and Contractor shall establish all lines and levels, and shall be responsible for the correctness of such. Contractor shall be fully responsible for all layout work for the proper location of Work in strict accordance with the Contract Documents.

**3.4.6** The Contractor shall establish and be responsible for wall and partition locations. If applicable, separate contractors shall be entitled to rely upon these locations and for setting their sleeves, openings, or chases.

**3.4.7** The Contractor's scheduled outage/tie-in plan, time, and date for any utilities is subject to approval by the Owner's Representative. Communication with the appropriate entity and planning for any scheduled outage/tie-in of utilities shall be the responsibility of the Contractor. Failure of Contractor to comply with the provisions of this Paragraph shall cause Contractor to forfeit any right to an adjustment of the Contract Sum or Contract Time for any postponement, rescheduling or other delays ordered by Owner in connection with such Work. The Contractor shall follow the following procedures for all utility outages/tie-ins or disruption of any building system:

- .1** All shutting of valves, switches, etc., shall be by the Owner's personnel.
- .2** Contractor shall submit its preliminary outage/tie-in schedule with its baseline schedule.
- .3** The Contractor shall request an outage/tie-in meeting at least two weeks before the outage/tie-in is required.
- .4** The Owner's Representative will schedule an outage/tie-in meeting at least one week prior to the outage/tie-in.

**3.4.8** The Contractor shall coordinate all Work so there shall be no prolonged interruption of existing utilities, systems and equipment of Owner. Any existing plumbing, heating, ventilating, air conditioning, or electrical disconnection necessary, which affect portions of this construction or building or any other building, must be scheduled with the Owner's Representative to avoid any disruption of operation within the building under construction or other buildings or utilities. In no case shall utilities be left disconnected at the end of a work day or over a weekend. Any interruption of utilities, either intentionally or accidentally, shall not relieve the Contractor from repairing and restoring the utility to normal service. Repairs and restoration shall be made before the workers responsible for the repair and restoration leave the job.

**3.4.9** The Contractor shall be responsible for repair of damage to property on or off the project occurring during construction of project, and all such repairs shall be made to meet code requirements or to the satisfaction of the Owner's Representative if code is not applicable.

**3.4.10** The Contractor shall be responsible for all shoring required to protect its work or adjacent property and shall pay for any damage caused by failure to shore or by improper shoring or by failure to give proper notice. Shoring shall be removed only after completion of permanent supports.

**3.4.11** The Contractor shall maintain at his own cost and expense, adequate, safe and sufficient walkways, platforms, scaffolds, ladders, hoists and all necessary, proper, and adequate equipment, apparatus, and appliances useful in carrying on the Work and which are necessary to make the place of Work safe and free from avoidable danger for students, faculty, staff, the public and construction personnel, and as may be required by safety provisions of applicable laws, ordinances, rules regulations and building and construction codes.

**3.4.12** During the performance of the Work, the Contractor shall be responsible for providing and maintaining warning signs, lights, signal devices, barricades, guard rails, fences, and other devices appropriately located on site which shall give proper and understandable warning to all persons of danger of entry onto land, structure, or equipment, within the limits of the Contractor's work area.

**3.4.13** The Contractor shall pump, bail, or otherwise keep any general excavations free of water. The Contractor shall keep all areas free of water before, during and after concrete placement. The Contractor shall be responsible for protection, including weather protection, and proper maintenance of all equipment and materials installed, or to be installed by him.

**3.4.14** The Contractor shall be responsible for care of the Work and must protect same from damage of defacement until acceptance by the Owner. All damaged or defaced Work shall be repaired or replaced to the Owner's satisfaction, without cost to the Owner.

**3.4.15** When requested by the Owner's Representative, the Contractor, at no extra charge, shall provide scaffolds or ladders in place as may be required by the Architect or the Owner for examination of Work in progress or completed.

**3.4.16** The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors of any tier and their agents and employees, and any entity or other persons performing portions of the Work.

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

**3.4.18** The Contractor shall be responsible for inspection of portions of the Work already performed under this Contract to determine that such portions are in proper condition to receive subsequent Work.

### **3.5 Use of Site**

**3.5.1** The Contractor shall limit operations and storage of material to the area within the Work limit lines shown on Drawings, except as necessary to connect to exiting utilities, shall not encroach on neighboring property, and shall exercise caution to prevent damage to existing structures.

**3.5.2** Only materials and equipment, which are to be used directly in the Work, shall be brought to and stored on the Work site by the Contractor. After equipment is no longer required for the Work, it shall be promptly removed from the Work site. Protection of construction materials and equipment stored at the Work site from weather, theft, damage and all other adversity is solely the responsibility of the Contractor.

**3.5.3** No project signs shall be erected without the written approval of the Owner's Representative.

**3.5.4** The Contractor shall ensure that the Work is at all times performed in a manner that affords reasonable access, both vehicular and pedestrian, to the site of the Work and all adjacent areas. Particular attention shall be paid to access for emergency vehicles, including fire trucks. Wherever there is the possibility of interfering with normal emergency vehicle operations, Contractor shall obtain permission from both campus and municipal emergency response entities prior to limiting any access. The Work shall be performed, to the fullest extent reasonably possible, in such a manner that public areas adjacent to the site of the Work shall be free from all debris, building materials and equipment likely to cause hazardous conditions. Without limitation of any other provision of the Contract Documents, Contractor shall not interfere with the occupancy or beneficial use of (1) any areas and buildings adjacent to the site of the Work or (2) the Work in the event of partial occupancy. Contractor shall assume full responsibility for any damage to the property comprising the Work or to the owner or occupant of any adjacent land or areas resulting from the performance of the Work.

**3.5.5** The Contractor shall not permit any workers to use any existing facilities at the Work site, including, without limitation, lavatories, toilets, entrances, and parking areas other than those designated by Owner. The Contractor, Subcontractors of any tier, suppliers and employees shall comply with instructions or regulations of the Owner's

Representative governing access to, operation of, and conduct while in or on the premises and shall perform all Work required under the Contract Documents in such a manner as not to unreasonably interrupt or interfere with the conduct of Owner's operations. Any request for Work, a suspension of Work or any other request or directive received by the Contractor from occupants of existing buildings shall be referred to the Owner's Representative for determination.

**3.5.6** The Contractor and the Subcontractor of any tier shall have its' name, acceptable abbreviation or recognizable logo and the name of the city and state of the mailing address of the principal office of the company, on each motor vehicle and motorized self-propelled piece of equipment which is used in connection with the project. The signs are required on such vehicles during the time the Contractor is working on the project.

### **3.6 Review of Contract Documents and Field Conditions by Contractor**

**3.6.1** The Contractor shall carefully study and compare the Contract Documents with each other and with information furnished by the Architect and Owner and shall at once report in writing to the Architect and Owner's Representative any errors, inconsistencies or omissions discovered. If the Contractor performs any construction activity which it knows or should have known involves a recognized error, inconsistency or omission in the Contract Documents without such written notice to the Architect and Owner's Representative, the Contractor shall assume appropriate responsibility for such performance and shall bear an appropriate amount of the attributable costs for correction.

**3.6.2** 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 with the Contract Documents before commencing activities. Errors, inconsistencies or omissions discovered shall be reported in writing to the Architect and Owner's Representative within twenty-four (24) hours. During the progress of work, Contractor shall verify all field measurements prior to fabrication of building components or equipment, and proceed with the fabrication to meet field conditions. Contractor shall consult all Contract Documents to determine the exact location of all work and verify spatial relationships of all work. Any question concerning said location or spatial relationships shall be submitted to the Owner's Representative. Specific locations for equipment, pipelines, ductwork and other such items of work, where not dimensioned on plans, shall be determined in consultation with Owner's Representative and Architect. Contractor shall be responsible for the proper fitting of the Work in place.

**3.6.3** The Contractor shall provide, at the proper time, such material as required for support of the Work. If

openings or chases are required, whether shown on Drawings or not, the Contractor shall see they are properly constructed. If required openings or chases are omitted, the Contractor shall cut them at the Contractors own expense, but only as directed by the Architect, through the Owner Representative.

**3.6.4** Should the Contract Documents fail to particularly describe materials or goods to be used, it shall be the duty of the Contractor to inquire of the Architect and the Owner's Representative what is to be used and to supply it at the Contractor's expense, or else thereafter replace it to the Owner's Representative's satisfaction. At a minimum, the Contractor shall provide the quality of materials as generally specified throughout the Contract Documents.

### **3.7 Cleaning and Removal**

**3.7.1** The Contractor shall keep the Work site and surrounding areas free from accumulation of waste materials, rubbish, debris, and dirt resulting from the Work and shall clean the Work site and surrounding areas as requested by the Architect and the Owner's Representative, including mowing of grass greater than 6 inches high. The Contractor shall be responsible for the cost of clean up and removal of debris from premises. The building and premises shall be kept clean, safe, in a workmanlike manner, and in compliance with OSHA standards at all times. At completion of the Work, the Contractor shall remove from and about the Work site tools, construction equipment, machinery, fencing, and surplus materials. Further, at the completion of the work, all dirt, stains, and smudges shall be removed from every part of the building, all glass in doors and windows shall be washed, and entire Work shall be left broom clean in a finished state ready for occupancy. The Contractor shall advise his Subcontractors of any tier of this provision, and the Contractor shall be fully responsible for leaving the premises in a finished state ready for use to the satisfaction of the Owner's Representative. If the Contractor fails to comply with the provisions of this paragraph, the Owner may do so and the cost thereof shall be charged to the Contractor.

### **3.8 Cutting and Patching**

**3.8.1** The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly.

**3.8.2** The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or separate contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the Owner or a separate contractor except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner or a separate contractor the Contractor's consent to cutting or otherwise altering the Work.

**3.8.3** If the Work involves renovation and/or alteration of existing improvements, Contractor acknowledges that cutting

and patching of the Work is essential for the Work to be successfully completed. Contractor shall perform any cutting, altering, patching, and/or fitting of the Work necessary for the Work and the existing improvements to be fully integrated and to present the visual appearance of an entire, completed, and unified project. In performing any Work which requires cutting or patching, Contractor shall use its best efforts to protect and preserve the visual appearance and aesthetics of the Work to the reasonable satisfaction of both the Owner's Representative and Architect.

### **3.9 Indemnification**

**3.9.1** To the fullest extent permitted by law, the Contractor shall defend, indemnify, and hold harmless the Owner, the Architect, Architect's consultants, and the agents, employees, representatives, insurers and re-insurers of any of the foregoing (hereafter collectively referred to as the "Indemnitees") from and against claims, damages (including loss of use of the Work itself), punitive damages, penalties and civil fines unless expressly prohibited by law, losses and expenses, including, but not limited to, attorneys' fees, arising out of or resulting from performance of the Work to the extent caused in whole or in part by negligent acts or omissions or other fault of Contractor, a Subcontractor of any tier, or anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by the negligent acts or omissions or other fault of a party indemnified hereunder. The Contractor's obligations hereunder are in addition to and shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that the Owner may possess. If one or more of the Indemnitees demand performance by the Contractor of obligations under this paragraph or other provisions of the Contract Documents and if Contractor refuses to assume or perform, or delays in assuming or performing Contractor's obligations, Contractor shall pay each Indemnitee who has made such demand its respective attorneys' fees, costs, and other expenses incurred in enforcing this provision. The defense and indemnity required herein shall be a binding obligation upon Contractor whether or not an Indemnitee has made such demand. Even if a defense is successful to a claim or demand for which Contractor is obligated to indemnify the Indemnitees from under this Paragraph, Contractor shall remain liable for all costs of defense.

**3.9.2** The indemnity obligations of Contractor under this Section 3.9 shall survive termination of this Contract or final payment thereunder. In the event of any claim or demand made against any party which is entitled to be indemnified hereunder, the Owner may in its sole discretion reserve, return or apply any monies due or to become due the Contractor under the Contract for the purpose of resolving such claims; provided, however, that the Owner may release such funds if the Contractor provides the Owner with reasonable assurance of

protection of the Owner's interests. The Owner shall in its sole discretion determine if such assurances are reasonable. Owner reserves the right to control the defense and settlement of any claim, action or proceeding which Contractor has an obligation to indemnify the Indemnitees against under Paragraph 3.9.1.

**3.9.3** In claims against any person or entity indemnified under this Section 3.9 by an employee of the Contractor, a Subcontractor of any tier, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under this Section 3.9 shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or a Subcontractor of any tier under workers' or workmen's compensation acts, disability benefit acts or other employee benefit acts.

**3.9.4** The obligations of the Contractor under Paragraph 3.9.1 shall not extend to the liability of the Architect, his agents or employees, arising out of the preparation and approval of maps, drawings, opinions, reports, surveys, Change Orders, designs, or Specifications.

### **3.10 Patents**

**3.10.1** The Contractor shall hold and save harmless the Owner and its officers, agents, servants, and employees from liability of any nature or kind, including cost and expense, for, or on account of, any patented or otherwise protected invention, process, article, or appliance manufactured or used in the performance of the Contract, including its use by the Owner, unless otherwise specifically stipulated in the Contract Documents.

**3.10.2** If the Contractor uses any design, device, or material covered by letters patent or copyright, he shall provide for such use by suitable agreement with the Owner of such patented or copyrighted design, device, or material. It is mutually agreed and understood, without exception, that the Contract Sum includes and the Contractor shall pay all royalties, license fees or costs arising from the use of such design, device, or material in any way involved in the Work. The Contractor and/or sureties shall indemnify and save harmless the Owner from any and all claims for infringement by reason of the use of such patented or copyrighted design, device, or material or any trademark or copyright in connection with Work agreed to be performed under this Contract and shall indemnify the Owner for any cost, expense, or damage it may be obligated to pay by reason of such infringement at any time during the prosecution of the Work or after completion of the Work.

### **3.11 Materials, Labor, and Workmanship**

**3.11.1** Materials and equipment incorporated into the Work shall strictly conform to the Contract Documents and representations and approved Samples provided by Contractor and shall be of the most suitable grade of their respective kinds for their respective uses, and shall be fit and sufficient for the purpose intended, merchantable, of good



new material and workmanship, and free from defect. Workmanship shall be in accordance with the highest standard in the industry and free from defect in strict accordance with the Contract Documents.

**3.11.2** Materials and fixtures shall be new and of latest design unless otherwise specified, and shall provide the most efficient operating and maintenance costs to the Owner. All Work shall be performed by competent workers and shall be of best quality.

**3.11.3** The Contractor shall carefully examine the Contract Documents and shall be responsible for the proper fitting of his material, equipment, and apparatus into the building.

**3.11.4** The Contractor shall base his bid only on the Contract Documents.

**3.11.5** Materials and workmanship shall be subject to inspection, examination, and test by the Architect and the Owner's Representative at any and all times during manufacture, installation, and construction of any of them, at places where such manufacture, installation, or construction is performed.

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

**3.11.7** Unless otherwise specifically noted, the Contractor shall provide and pay for supervision, labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for the proper execution and completion of the Work.

### **3.11.8 Substitutions**

**3.11.8.1** A substitution is a Contractor proposal of an alternate product or method in lieu of has been specified or shown in the Contract Documents, which is not an "or equal" as set forth in Section 3.12.1.

**3.11.8.2** Contractor may make a proposal to the Architect and the Owner's Representative to use substitute products or methods as set forth herein, but the Architect's and the Owner's Representative's decision concerning acceptance of a substitute shall be final. The Contractor must do so in writing and setting forth the following:

- .1** Full explanation of the proposed substitution and submittal of all supporting data including technical information, catalog cuts, warranties, test results, installation instructions, operating procedures, and other like information necessary for a complete evaluation of the substitution.
- .2** Reasons the substitution is advantageous and necessary, including the benefits to the Owner

and the Work in the event the substitution is acceptable.

- .3** The adjustment, if any, in the Contract Sum, in the event the substitution is acceptable.
- .4** The adjustment, if any, in the time of completion of the Contract and the construction schedule in the event the substitution is acceptable.
- .5** An affidavit stating that (a) the proposed substitution conforms to and meets all of the Contract Documents, except as specifically disclosed and set forth in the affidavit and (b) the Contractor accepts the warranty and correction obligations in connection with the proposed substitution as if originally specified by the Architect. Proposals for substitutions shall be submitted to the Architect and Owner's Representative in sufficient time to allow the Architect and Owner's Representative no less than ten (10) working days for review. No substitution will be considered or allowed without the Contractor's submittal of complete substantiating data and information as stated herein.

**3.11.8.3** Substitutions may be rejected without explanation in Owner's sole discretion and will be considered only under one or more of the following conditions:

- .1** Required for compliance with interpretation of code requirements or insurance regulations then existing;
- .2** Unavailability of specified products, through no fault of the Contractor;
- .3** Material delivered fails to comply with the Contract Documents;
- .4** Subsequent information discloses inability of specified products to perform properly or to fit in designated space;
- .5** Manufacturer/fabricator refuses to certify or guarantee performance of specified product as required; or
- .6** When in the judgment of the Owner or the Architect, a substitution would be substantially to the Owner's best interests, in terms of cost, time, or other considerations.

**3.11.8.4** Whether or not any proposed substitution is accepted by the Owner or the Architect, the Contractor shall reimburse the Owner for any fees charged by the Architect or other consultants for evaluating each proposed substitute.

### **3.12 Approved Equal**

**3.12.1** Whenever in the Contract Documents any article, appliance, device, or material is designated by the name of a manufacturer, vendor, or by any proprietary or trade name, the words "or approved equal," shall automatically follow and shall be implied unless specifically indicated otherwise. The standard products of manufacturers other than those specified will be accepted when, prior to the ordering or use thereof, it is proven to the satisfaction of the Owner's Representative and the Architect they are equal in design, appearance, spare parts availability, strength, durability,

usefulness, serviceability, operation cost, maintenance cost, and convenience for the purpose intended. Any general listings of approved manufacturers in any Contract Document shall be for informational purposes only and it shall be the Contractor's sole responsibility to ensure that any proposed "or equal" complies with the requirements of the Contract Documents.

**3.12.2** The Contractor shall submit to Architect and Owner's Representative a written and full description of the proposed "or equal" including all supporting data, including technical information, catalog cuts, warranties, test results, installation instructions, operating procedures, and similar information demonstrating that the proposed "or equal" strictly complies with the Contract Documents. The Architect or Owner's Representative shall take appropriate action with respect to the submission of a proposed "or equal" item. If Contractor fails to submit proposed "or equals" as set forth herein, it shall waive any right to supply such items. The Contract Sum and Contract Time shall not be adjusted as a result of any failure by Contractor to submit proposed "or equals" as provided for herein. All documents submitted in connection with preparing an "or equal" shall be clearly and obviously marked as a proposed "or equal" submission.

**3.12.3** No approvals or action taken by the Architect or Owner's Representative shall relieve Contractor from its obligation to ensure that an "or equal" article, appliance, devise or material strictly complies with the requirements of the Contract Documents. Contractor shall not propose "or equal" items in connection with Shop Drawings or other Submittals, and Contractor acknowledges and agrees that no approvals or action taken by the Architect or Owner's Representative with respect to Shop Drawings or other Submittals shall constitute approval of any "or equal" item or relieve Contractor from its sole and exclusive responsibility. Any changes required in the details and dimensions indicated in the Contract Documents for the incorporation or installation of any "or equal" item supplied by the Contractor shall be properly made and approved by the Architect at the expense of the Contractor. No "or equal" items will be permitted for components of or extensions to existing systems when, in the opinion of the Architect, the named manufacturer must be provided in order to ensure compatibility with the existing systems, including, but not limited to, mechanical systems, electrical systems, fire alarms, smoke detectors, etc. No action will be taken by the Architect with respect to proposed "or equal" items prior to receipt of bids, unless otherwise noted in the Special Conditions.

### **3.13 Shop Drawings, Product Data, Samples, and Coordination Drawings/BIM Models**

**3.13.1** Shop Drawings are drawings, diagrams, schedules and other data specifically prepared for the Work by the Contractor or a Subcontractor, sub-subcontractor,

manufacturer, supplier or distributor to illustrate some portion of the Work.

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

**3.13.3** Samples are physical samples which illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.

**3.13.4** Coordination Drawings are drawings for the integration of the Work, including work first shown in detail on shop drawings or product data. Coordination drawings show sequencing and relationship of separate units of work which must interface in a restricted manner to fit in the space provided, or function as indicated. Coordination Drawings are the responsibility of the contractor and are submitted for informational purposes. The Special Conditions will state whether coordination drawings are required. BIM models may be used for coordination in lieu of coordination drawings at the contractor's discretion, unless required in the Special Conditions. The final coordination drawings/BIM Model will not change the contract documents, unless approved by a fully executed change order describing the specific modifications that are being made to the contract documents.

**3.13.5** Shop Drawings, Coordination Drawings/BIM Models, Product Data, Samples and similar submittals (collectively referred to as "Submittals") are not Contract Documents. The purpose of their submittal is to demonstrate for those portions of the Work for which submittals are required the way the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents.

**3.13.6** The Contractor shall schedule submittal of Shop Drawings and Product Data to the Architect so that no delays will result in delivery of materials and equipment, advising the Architect of priority for checking of Shop Drawings and Product Data, but a minimum of two weeks shall be provided for this purpose. Because time is of the essence in this contract, unless noted otherwise in the Special Conditions or Technical Specifications, all submittals, shop drawings and samples must be submitted as required to maintain the contractor's plan for proceeding, but must be submitted within 90 days of the Notice To Proceed. If Contractor believes that this milestone is unreasonable for any submittal, Contractor shall request an extension of this milestone, within 60 days of Notice To Proceed, for each submittal that cannot meet the milestone. The request shall contain a reasonable explanation as to why the 90 day milestone is unrealistic, and shall specify a date on which the submittal will be transmitted, for approval by the Owner's Representative. Failure of the Contractor to comply with this section may result in delays in the submittal approval process and/or charges for expediting approval, both of which will be the responsibility of the Contractor.

**3.13.7** The Contractor, at its own expense, shall submit Samples required by the Contract Documents with reasonable promptness as to cause no delay in the Work or the activities of separate contractors and no later than twenty (20) days before materials are required to be ordered for scheduled delivery to the Work site. Samples shall be labeled to designate material or products represented, grade, place of origin, name of producer, name of Contractor and the name and number of the Owner's project. Quantities of Samples shall be twice the number required for testing so that Architect can return one set of the Samples. Materials delivered before receipt of Architect's approval may be rejected by Architect and in such event, Contractor shall immediately remove all such materials from the Work site. When requested by Architect or Owner's Representative, samples of finished masonry and field applied paints and finishes shall be located as directed and shall include sample panels built at the site of approximately twenty (20) square feet each.

**3.13.8** 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 by the Architect. Such Work shall be in accordance with approved submittals.

**3.13.9** By approving and submitting Shop Drawings, Product Data, Samples and similar submittals, the Contractor represents such Submittals strictly comply with the requirements of the Contract Documents and that the Contractor has determined and verified field measurements and field construction criteria related thereto, that materials are fit for their intended use and that the fabrication, shipping, handling, storage, assembly and installation of all materials, systems and equipment are in accordance with best practices in the industry and are in strict compliance with any applicable requirements of the Contract Documents. Contractor shall also coordinate each Submittal with other Submittals.

**3.13.10** Contractor shall be responsible for the correctness and accuracy of the dimensions, measurements and other information contained in the Submittals.

**3.13.11** Each Submittal will bear a stamp or specific indication that the Submittal complies with the Contract Documents and Contractor has satisfied its obligations under the Contract Documents with respect to Contractor's review and approval of that Submittal. Each Submittal shall bear the signature of the representative of Contractor who approved the Submittal, together with the Contractor's name, Owner's name, number of the Project, and the item name and specification section number.

**3.13.12** The Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples or similar submittals.

The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the Architect's approval thereof. Specifically, but not by way of limitation, Contractor acknowledges that Architect's approval of Shop Drawings shall not relieve Contractor for responsibility for errors and omissions in the Shop Drawings since Contractor is responsible for the correctness of dimensions, details and the design of adequate connections and details contained in the Shop Drawings.

**3.13.13** The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples or similar submittals, to revisions other than those requested by the Architect on previous Submittals.

**3.13.14** The Contractor represents and warrants that all Shop Drawings shall be prepared by persons and entities possessing expertise and experience in the trade for which the Shop Drawing is prepared and, if required by the Architect or applicable Laws, by a licensed engineer or other design professional.

### **3.14 Record Drawings**

**3.14.1** The Contractor shall maintain a set of Record Drawings on site in good condition and shall use colored pencils to mark up said set with "record information" in a legible manner to show: (1) bidding addendums, (2) executed change orders, (3) deviations from the Drawings made during construction; (4) details in the Work not previously shown; (5) changes to existing conditions or existing conditions found to differ from those shown on any existing drawings; (6) the actual installed position of equipment, piping, conduits, light switches, electric fixtures, circuiting, ducts, dampers, access panels, control valves, drains, openings, and stub-outs; and (7) such other information as either Owner or Architect may reasonably request. The prints for Record Drawing use will be a set of "blue line" prints provided by Architect to Contractor at the start of construction. Upon Substantial Completion of the Work, Contractor shall deliver all Record Drawings to Owner and Architect for approval. If not approved, Contractor shall make the revisions requested by Architect or Owner's Representative. Final payment and any retainage shall not be due and owing to Contractor until the final Record Drawings marked by Contractor as required above are delivered to Owner.

### **3.15 Operating Instructions and Service Manuals**

**3.15.1** The Contractor shall submit four (4) volumes of operating instructions and service manuals to the Architect before completing 50% of the adjusted contract amount. Payments beyond 50% of the adjusted contract amount may be withheld until all operating instructions and service manuals are received. The operating instructions and service manuals shall contain:

- .1** Start-up and Shutdown Procedures: Provide a step-by-step write up of all major equipment. When manufacturer's printed start-up, trouble shooting and shut-down procedures are available, they may be

incorporated into the operating manual for reference.

- .2 Operating Instructions: Written operating instructions shall be included for the efficient and safe operation of all equipment.
- .3 Equipment List: List of all major equipment as installed shall include model number, capacities, flow rate, and name-plate data.
- .4 Service Instructions: The Contractor shall be required to provide the following information for all pieces of equipment.
  - (a) Recommended spare parts including catalog number and name of local suppliers or factory representative.
  - (b) Belt sizes, types, and lengths.
  - (c) Wiring diagrams.
- .5 Manufacturer's Certificate of Warranty: Manufacturer's certificates of warranty shall be obtained for all major equipment. Warranty shall be obtained for at least one year from the date of Substantial Completion. Where longer period is required by the Contract Documents, the longer period shall govern.
- .6 Parts catalogs: For each piece of equipment furnished, a parts catalog or similar document shall be provided which identifies the components by number for replacement ordering.

### 3.15.2 Submission

- .1 Manuals shall be bound into volumes of standard 8 1/2" x 11" hard binders. Large drawings too bulky to be folded into 8 1/2" x 11" shall be separately bound or folded and in brown envelopes, cross-referenced and indexed with the manuals.
- .2 The manuals shall identify the Owner's project name, project number, and include the name and address of the Contractor and major Subcontractors of any tier who were involved with the activity described in that particular manual.

### 3.16 Taxes

**3.16.1** The Contractor shall pay all applicable sales, consumer, use, and similar taxes for the Work which are legally enacted when the bids are received, whether or not yet effective or scheduled to go into effect. However, certain purchases by the Contractor of materials incorporated in or consumed in the Work are exempt from certain sales tax pursuant to RSMo § 144.062. The Contractor shall be issued a Project Tax Exemption Certificate for this Work to obtain the benefits of RSMo § 144.062.

**3.16.2** The Contractor shall furnish this certificate to all subcontractors, and any person or entity purchasing materials for the Work shall present such certificate to all material suppliers as authorization to purchase, on behalf

of the Owner, all tangible personal property and materials to be incorporated into or consumed in the Work and no other on a tax-exempt basis. Such suppliers shall provide to the purchasing party invoices bearing the name of the exempt entity and the project identification number. Nothing in this section shall be deemed to exempt from any sales or similar tax the purchase of any construction machinery, equipment or tools used in construction, repairing or remodeling facilities for the Owner. All invoices for all personal property and materials purchased under a Project Tax Exemption Certificate shall be retained by the Contractor for a period of five years and shall be subject to audit by the Director of Revenue.

**3.16.3** Any excess resalable tangible personal property or materials which were purchased for the project under this Project Tax Exemption Certificate but which were not incorporated into or consumed in the Work shall either be returned to the supplier for credit or the appropriate sales or use tax on such excess property or materials shall be reported on a return and paid by such purchasing party not later than the due date of the purchasing party's Missouri sales or use tax return following the month in which it was determined that the materials were not used in the Work.

**3.16.4** If it is determined that sales tax is owed by the Contractor on property and materials due to the failure of the Owner to revise the certificate expiration date to cover the applicable date of purchase, Owner shall be liable for the tax owed.

**3.16.5** The Owner shall not be responsible for any tax liability due to Contractor's neglect to make timely orders, payments, etc. or Contractor's misuse of the Project Tax Exemption Certificate. Contractor represents that the Project Tax Exemption Certificate shall be used in accordance with RSMo § 144.062 and the terms of the Project Tax Exemption Certificate. Contractor shall indemnify the Owner for any loss or expense, including but not limited to, reasonable attorneys' fees, arising out of Contractor's use of the Project Tax Exemption Certificate.

### 3.17 Contractor's Construction Schedules

**3.17.1** The Contractor, within fifteen (15) days after the issuance of the Notice to Proceed, shall prepare and submit for the Owner's and Architect's information Contractor's construction schedule for the Work and shall set forth interim dates for completion of various components of the Work and Work Milestone Dates as defined herein. The schedule shall not exceed time limits current under the Contract Documents, shall be revised on a monthly basis or as requested by the Owner's Representative as required by the conditions of the Work, and shall provide for expeditious and practicable execution of the Work. The Contractor shall conform to the most recent schedule.

**3.17.2** The construction schedule shall be in a detailed format satisfactory to the Owner's Representative and the Architect and in accordance with the detailed schedule

requirements set forth in this document and the Special Conditions. If the Owner's Representative or Architect has a reasonable objection to the schedule submitted by Contractor, the construction schedule shall be promptly revised by the Contractor. The Contractor shall monitor the progress of the Work for conformance with the requirements of the construction schedule and shall promptly advise the Owner of any delays or potential delays.

**3.17.3** As time is of the essence to this contract, the University expects that the Contractor will take all necessary steps to insure that the project construction schedule shall be prepared in accordance with the specific requirements of the Special Conditions to this contract. At a minimum, contractor shall comply with the following:

- .1 The schedule shall be prepared using Primavera P3, Oracle P6, Microsoft Project or other software acceptable to the Owner's Representative.
- .2 The schedule shall be prepared and maintained in CPM format, in accordance with Construction CPM Scheduling, published by the Associated General Contractors of American (AGC).
- .3 Prior to submittal to the Owner's Representative for review, Contractor shall obtain full buy-in to the schedule from all major subcontractors, in writing if so requested by Owner's Representative.
- .4 Schedule shall be updated, in accordance with Construction CPM Scheduling, published by the AGC, on a monthly basis at minimum, prior to, and submitted with, the monthly pay application or as requested by the Owner's Representative.
- .5 Along with the update the Contractor shall submit a narrative report addressing all changes, delays and impacts, including weather to the schedule during the last month, and explain how the end date has been impacted by same.
- .6 The submission of the updated certifies that all delays and impacts that have occurred on or to the project during the previous month have been factored into the update and are fully integrated into the schedule and the projected completion date.

Failure to comply with any of these requirements will be considered a material breach of this contract. See Special Conditions for detailed scheduling requirements.

**3.17.4** In the event the Owner's Representative or Architect determines that the performance of the Work, as of a Milestone Date, has not progressed or reached the level of completion required by the Contract Documents, the Owner shall have the right to order the Contractor to take corrective measures necessary to expedite the progress of construction, including, without limitation, (1) working additional shifts or overtime, (2) supplying additional manpower, equipment, facilities, (3) expediting delivery of

materials, and (4) other similar measures (hereinafter referred to collectively as Extraordinary Measures). Such Extraordinary Measures shall continue until the progress of the Work complies with the stage of completion required by the Contract Documents. The Owner's right to require Extraordinary Measures is solely for the purpose of ensuring the Contractor's compliance with the construction schedule. The Contractor shall not be entitled to an adjustment in the Contract Sum concerning Extraordinary Measures required by the Owner under or pursuant to this Paragraph 3.17.3. The Owner may exercise the rights furnished the Owner under or pursuant to this Paragraph 3.17.3 as frequently as the Owner deems necessary to ensure that the Contractor's performance of the Work will comply with any Milestone Date or completion date set forth in the Contract Documents.

## **ARTICLE 4 ADMINISTRATION OF THE CONTRACT**

### **4.1 Rights of the Owner**

**4.1.1** The Owner's Representative will administer the Construction Contract. The Architect will assist the Owner's Representative with the administration of the Contract as indicated in these Contract Documents.

**4.1.2** If, in the judgment of the Owner's Representative, it becomes necessary to accelerate the work, the Contractor, when directed by the Owner's Representative in writing, shall cease work at any point and transfer its workers to such point or points and execute such portions of the work as may be required to enable others to hasten and properly engage and carry out the work, all as directed by the Owner's Representative. The additional cost of accelerating the work, if any, will be borne by the Owner, unless the Contractor's work progress is behind schedule as shown on the most recent progress schedule.

**4.1.3** If the Contractor refuses, for any reason, to proceed with what the Owner believes to be contract work, the Owner may issue a Construction Directive, directing the Contractor to proceed. Contractor shall be obligated to promptly proceed with this work. If Contractor feels that it is entitled to additional compensation for this work, it may file a claim for additional compensation and/or time, in accordance with 4.4 of this document.

**4.1.4** The Owner's Representative, may, by written notice, require a Contractor to remove from involvement with the Work, any of Contractor's personnel or the personnel of its Subcontractors of any tier whom the Owner's Representative may deem abusive, incompetent, careless, or a hindrance to proper and timely execution of the Work. The Contractor shall comply with such notice promptly, but without detriment to the Work or its progress.

**4.1.5** The Owner's Representative will schedule Work status meetings that shall be attended by representatives of the Contractor and appropriate Subcontractors of any tier.

Material suppliers shall attend status meetings if required by the Owner's Representative. These meetings shall include preconstruction meetings.

**4.1.6** The Owner does not allow smoking on University property.

## **4.2 Rights of the Architect**

**4.2.1** The Architect will interpret requirements of the Contract Documents with respect to the quality, quantity and other technical requirements of the Work itself within a reasonable time after written request of the Contractor. Contractor shall provide Owner's Representative a copy of such written request.

## **4.3 Review of the Work**

**4.3.1** The Architect and the Owner's Representative shall, at all times, have access to the Work; and the Contractor shall provide proper and safe facilities for such access.

**4.3.2** The Owner's Representative shall have authority to reject Work that does not strictly comply with the requirements of the Contract Documents. Whenever the Owner's Representative considers it necessary or advisable for implementation of the intent of the Contract Documents, Owner's Representative shall have the authority to require additional inspection or testing of the Work, whether or not such Work is fabricated, installed or completed.

**4.3.3** The fact that the Architect or the Owner's Representative observed, or failed to observe, faulty Work, or Work done which is not in accordance with the Contract Documents, regardless of whether or not the Owner has released final payment, shall not relieve the Contractor from responsibility for all damages and additional costs of the Owner as a result of defective or faulty Work.

## **4.4 Claims**

**4.4.1** A Claim is a demand or assertion by Contractor seeking, as a matter of right, adjustment or interpretation of Contract terms, payment of money, extension of time or any other relief with respect to the terms of the Contract. The term "Claim(s)" also includes demands and assertions of Contractor arising out of or relating to the Contract Documents, including Claims based upon breach of contract, mistake, misrepresentation, or other cause for Contract Modification or rescission. Claims must be made by written notice. Contractor shall have the responsibility to substantiate Claims.

**4.4.2** Claims by Contractor must be made promptly, and no later than within fourteen (14) days after occurrence of the event giving rise to such Claim. Claims must be made by written notice. Such notice shall include a detailed statement setting forth all reasons for the Claim and the amount of additional money and additional time

claimed by Contractor. The notice of Claims shall also strictly comply with all other provisions of the Contract Documents. Contractor shall not be entitled to rely upon any grounds or basis for additional money on additional time not specifically set forth in the notice of Claim. All Claims not made in the manner provided herein shall be deemed waived and of no effect. Contractor shall furnish the Owner and Architect such timely written notice of any Claim provided for herein, including, without limitation, those in connection with alleged concealed or unknown conditions, and shall cooperate with the Owner and Architect in any effort to mitigate the alleged or potential damages, delay or other adverse consequences arising out of the condition which is the cause of such a Claim.

**4.4.3** Pending final resolution of a Claim, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments that are not in dispute in accordance with the Contract Documents.

## **4.5 Claims for Concealed or Unknown Conditions**

**4.5.1** If conditions are encountered at the site which are (1) subsurface or otherwise concealed physical conditions which differ materially from those indicated in the Contract Documents, or (2) 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, then notice by the Contractor shall be given to the Owner's Representative promptly before conditions are disturbed, and in no event later than three (3) days after first observance of the conditions. The Owner's Representative will promptly investigate such conditions. If such conditions differ materially, as provided for above and cause an increase or decrease in the Contractor's cost, or time, required for performance of the Work, an equitable adjustment in the Contract sum or Contract Time, or both, shall be made, subject to the provisions and restrictions set for herein. If the Owner's Representative determines that the conditions at the site are not materially different from those indicated in the Contract Documents, and that no change in the terms of the Contract is justified, the Owner's Representative will so notify the Contractor in writing. If the Contractor disputes the finding of the Owner's Representative that no change in the terms of the Contract terms is justified, Contractor shall proceed with the Work, taking whatever steps are necessary to overcome or correct such conditions so that Contractor can proceed in a timely manner. The Contractor may have the right to file a Claim in accordance with the Contract Documents.

**4.5.2** It is expressly agreed that no adjustment in the Contract Time or Contract Sum shall be permitted, however, in connection with a concealed or unknown condition which does not differ materially from those conditions disclosed or which reasonably should have been disclosed by the Contractor's (1) prior inspections, tests, reviews and preconstruction investigations for the Project, or (2) inspections, tests, reviews and preconstruction inspections

which the Contractor had the opportunity to make or should have performed in connection with the Project.

#### **4.6 Claim for Additional Cost**

**4.6.1** If the Contractor makes a Claim for an increase in the Contract Sum, written notice as provided herein shall be given before proceeding to execute the Work. In addition to all other requirements for notice of a Claim, said notice shall detail and itemize the amount of all Claims and shall contain sufficient data to permit evaluation of same by Owner.

#### **4.7 Claims for Additional Time**

**4.7.1** If the Contractor makes a Claim for an increase in the Contract Time, written notice as provided herein shall be given. In addition to other requirements for notice of a Claim, Contractor shall include an estimate of the probable effect of delay upon the progress of the Work, utilizing a CPM Time Impact Schedule Analysis, (TIA) as defined in the AGC Scheduling Manual. In the case of a continuing delay, only one Claim is necessary.

**.1** Time extensions will be considered for excusable delays only. That is, delays that are beyond the control and/or contractual responsibility of the contractor.

**4.7.2** If weather days are the basis for a Claim for additional time, such Claim shall be documented by the Contractor by data acceptable to the Owner's Representative substantiating that weather conditions for the period of time in question, had an adverse effect on the critical path of the scheduled construction. Weather days shall be defined as days on which critical path work cannot proceed due to weather conditions (including but not limited to rain, snow, etc.), in excess of the number of days shown on the Anticipated Weather Day schedule in the Special Conditions. To be considered a weather day, at least four hours must be lost due to the weather conditions on a critical path scope item for that day. Weather days and Anticipated weather days listed in the Special Conditions shall only apply to Monday through Friday. A weather day claim cannot be made for Saturdays, Sundays, New Year's Day, Martin Luther King Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the day after Thanksgiving Day and Christmas Day, unless that specific day was approved in writing for work by the Owner's Representative.

**.1** The Contractor must have fulfilled its contract obligations with respect to temporary facilities and protection of its work; and worker protection for hot and cold weather per OSHA guidelines.

**.2** If the contract obligations have been satisfied, the Owner will review requests for non-compensable time extensions for critical path activities as follows:

**.2.1** If the Contractor cannot work on a critical path activity due to adverse weather, after implementing all reasonable temporary weather

protection, the Contractor will so notify the Owner's Representative. Each week, the Contractor will notify the Owner's Representative of the number of adverse weather days that it believes it has experienced in the previous week. As provided in the contract, until such time as the weather days acknowledged by the Owner's Representative exceed the number of days of adverse weather contemplated in the Special Conditions, no request for extension of the contract completion time will be considered.

**.2.2** If the Contractor has accumulated in excess of the number of adverse weather days contemplated in the Special Conditions due to the stoppage of work on critical path activities due to adverse weather, the Owner will consider a time extension request from the Contractor that is submitted in accordance with the contract requirements. The Owner will provide a change order extending the time for contract completion or direct an acceleration of the work in accordance with the contract terms and conditions to recover the time lost due to adverse weather in excess of the number of adverse weather working days contemplated in the Special Conditions.

**4.7.3** A Force Majeure event or circumstance shall not be the basis of a claim by the Contractor seeking an adjustment in the Contract amount for costs or expenses of any type. With the exception of weather delays which are administered under this Article 4, and notwithstanding other requirements of the Contract, all Force Majeure events resulting in a delay to the critical path of the project shall be administered as provided in Article 8.

**4.7.4** The Owner will consider and evaluate requests for time extensions due to changes or other events beyond the control of the Contractor on a monthly basis only, with the submission of the Contractor's updated schedule, in conjunction with the monthly application for payment.

#### **4.8 Resolution of Claims and Disputes**

**4.8.1** The Owner's Representative will review Claims and take one or more of the following preliminary actions within ten days of receipt of a Claim: (1) request additional supporting data from the Contractor, (2) reject the Claim in whole or in part, (3) approve the Claim, or (4) suggest a compromise.

**4.8.2** If a Claim has not been resolved, the Contractor shall, within ten days after the Owner's Representative's preliminary response, take one or more of the following actions: (1) submit additional supporting data requested, (2)



modify the initial Claim, or (3) notify the Owner's Representative that the initial Claim stands.

**4.8.3** If a Claim has not been resolved after consideration of the foregoing and of further information presented by the Contractor, the Contractor has the right to seek administrative review as set forth in Section 4.9. However, Owner's Representative's decisions on matters relating to aesthetics will be final.

#### **4.9 Administrative Review**

**4.9.1** Claims not resolved pursuant to the procedures set forth in the Contract Documents except with respect to Owner's Representative's decision on matters relating to aesthetic effect, and except for claims which have been waived by the making or acceptance of final payment, or the Contractor's acceptance of payments in full for changes in work may be submitted to administrative review as provided in this section. All requests for administrative review shall be made in writing.

**4.9.2** Upon written request from the Contractor, the Owner's Review Administrator authorized by the Campus Contracting Officer will convene a review meeting between the Contractor and Owner's Representative's within fifteen (15) days of receipt of such written request. The Contractor and Owner's Representative will be allowed to present written documentation with respect to the claim(s) before or during the meeting. The Contractor and Owner's Representative will be allowed to present the testimony of any knowledgeable person regarding the claim at the review meeting. The Owner's Review Administrator will issue a written summary of the review meeting and decision to resolve the Claim within fifteen (15) days. If the Contractor is in agreement with the decision the Contractor shall notify the Owner's Review Administrator in writing within five (5) days, and appropriate documentation will be signed by the parties to resolve the Claim.

**4.9.3** If the Contractor is not in agreement with the proposal of the Owner's Review Administrator as to the resolution of the claim, the Contractor may file a written appeal with the UM System Contracting Officer, [in care of the Director of Facilities Planning and Development, University of Missouri, 109 Old Alumni Centers, University of Missouri, Columbia, Missouri 65211] within fifteen (15) days after receipt of the Owner's Review Administrator's proposal. The UM System Contracting Officer will call a meeting of the Contractor, the Owner's Representative, and the Owner's Review Administrator by written notice, within thirty (30) days after receipt of the Contractor's written appeal. The Owner's Review Administrator shall provide the UM System Contracting Officer with a copy of the written decision and summary of the review meeting, the Contractor's corrections or comments regarding the summary of the review meeting, and any written documentation presented by the Contractor and the

Owner's Representative at the initial review meeting. The parties may present further documentation and/or present the testimony of any knowledgeable person regarding the claim at the meeting called by the UM System Contracting Officer.

**4.9.4** The UM System Contracting Officer will issue a written decision to resolve the claim within fifteen (15) days after the meeting. If the Contractor is in agreement with the UM System Contracting Officer's proposal, the Contractor shall notify the UM System Contracting Officer in writing within five (5) days, and the Contractor and the Owner shall sign appropriate documents. The issuance of the UM System Contracting Officer's written proposal shall conclude the administrative review process even if the Contractor is not in agreement. However, proposals and any opinions expressed in such proposals issued under this section will not be binding on the Contractor nor will the decisions or any opinions expressed be admissible in any legal actions arising from the Claim and will not be deemed to remove any right or remedy of the Contractor as may otherwise exist by virtue of Contract Documents or law. Contractor and Owner agree that the Missouri Circuit Court for the County where the Work is located shall have exclusive jurisdiction to determine all issues between them. Contractor agrees not to file any complaint, petition, lawsuit or legal proceeding against Owner except with such Missouri Circuit Court.

## **ARTICLE 5 SUBCONTRACTORS**

### **5.1 Award of Subcontracts**

**5.1.1** Pursuant to Article 9, the Contractor shall furnish the Owner and the Architect, in writing, with the name, and trade for each Subcontractor and the names of all persons or entities proposed as manufacturers of products, materials and equipment identified in the Contract Documents and where applicable, the name of the installing contractor. The Owner's Representative will reply to the Contractor in writing if the Owner has reasonable objection to any such proposed person or entity. The Contractor shall not contract with a proposed person or entity to whom the Owner has made reasonable and timely objection.

**5.1.2** The Contractor may request to change a subcontractor. Any such request shall be made in writing to the Owner's Representative. The Contractor shall not change a Subcontractor, person, or entity previously disclosed if the Owner makes reasonable objection to such change.

**5.1.3** The Contractor shall be responsible to the Owner for acts, defaults, and omissions of its Subcontractors of any tier.

### **5.2 Subcontractual Relations**

**5.2.1** By appropriate agreement, written where legally required for validity, the Contractor shall require each Subcontractor of any tier, to the extent of the Work to be performed by the Subcontractor of any tier, to be bound to



the Contractor by terms of the Contract Documents and to assume toward the Contractor all the obligations and responsibilities which the Contractor, by these Documents, assumes toward the Owner and the Architect. Each subcontract agreement of any tier shall preserve and protect the rights of the Owner and the Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor of any tier so that subcontracting thereof will not prejudice such rights and shall allow to the Subcontractor of any tier, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with its sub-subcontractors. The Contractor shall make available to each proposed Subcontractor of any tier, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor of any tier shall be bound. Subcontractors of any tier shall similarly make copies of applicable portions of such documents available to their respective proposed Subcontractors of any tier.

**5.2.2** All agreements between the Contractor and a Subcontractor or supplier shall contain provisions whereby Subcontractor or supplier waives all rights against the Owner, contractor, Owner's representative, Architect and all other additional insureds for all losses and damages caused by, arising out of, or resulting from any of the perils covered by property or builders risk insurance coverage required of the Contractor in the Contract Documents. If Contractor fails to include said provisions in all subcontracts, Contractor shall indemnify, defend and hold all the above entities harmless in the event of any legal action by Subcontractor or supplier. If insureds on any such policies require separate waiver forms to be signed by any Subcontractors of any tier or suppliers, Contractor shall obtain the same.

### **5.3 Contingent Assignment of Subcontract**

**5.3.1** No assignment by the Contractor of any amount or any part of the Contract or of the funds to be received thereunder will be recognized unless such assignment has had the written approval of the Owner, and the surety has been given due notice of such assignment and has furnished written consent hereto. In addition to the usual recitals in assignment Contracts, the following language must be set forth: "it is agreed that the funds to be paid to the assignee under this assignment are subject to performance by the Contractor of the contract and to claims and to liens for services rendered or materials supplied for the performance of the Work called for in said contract in favor of all persons, firms or corporations rendering such services or supplying such materials.

## **ARTICLE 6 SEPARATE CONTRACTS AND COOPERATION**

**6.1** The Owner reserves the right to let other contracts in connection with the Work.

**6.2** It shall be the duty of each Contractor to whom Work may be awarded, as well as all Subcontractors of any tier employed by them, to communicate immediately with each other in order to schedule Work, locate storage facilities, etc., in a manner that will permit all Contractors to work in harmony in order that Work may be completed in the manner and within the time specified in the Contract Documents.

**6.3** No Contractor shall delay another Contractor by neglecting to perform his work at the proper time. Each Contractor shall be required to coordinate his work with other Contractors to afford others reasonable opportunity for execution of their work. Any costs caused by defective or ill-timed work, including actual damages and liquidated damages for delay, if applicable, shall be borne by the Contractor responsible therefor.

**6.4** Each Contractor shall be responsible for damage to Owner's or other Contractor's property done by him or persons in his employ, through his or their fault or negligence. If any Contractor shall cause damage to any other Contractor, the Contractor causing such damage shall upon notice of any claim, settle with such Contractor.

**6.5** The Contractor shall not claim from the Owner money damages or extra compensation under this Contract when delayed in initiating or completing his performance hereunder, when the delay is caused by labor disputes, acts of God, or the failure of any other Contractor to complete his performance under any Contract with the Owner, where any such cause is beyond the Owner's reasonable control.

**6.6** Progress schedule of the Contractor for the Work shall be submitted to other Contractors as necessary to permit coordinating their progress schedules.

**6.7** If Contractors or Subcontractors of any tier refuse to cooperate with the instructions and reasonable requests of other contractors performing work for the Owner under separate contract, in the overall coordinating of the Work, the Owner's Representative may take such appropriate action and issue such instructions as in his judgement may be required to avoid unnecessary and unwarranted delay.

## **ARTICLE 7 CHANGES IN THE WORK**

### **7.1 CHANGE ORDERS**

**7.1.1** A change order is a written instrument prepared by the Owner and signed by the Owner and Contractor formalizing their agreement on the following:

- .1** a change in the Work
- .2** the amount of an adjustment, if any, in the Contract amount

.3 an adjustment, if any, in the Contract time

**7.1.2** The Owner may at any time, order additions, deletions, or revisions in the Work by a Change Order or a Construction Change Directive. Such Change Order or Construction Change Directive shall not invalidate the Contract and requires no notice to the surety. Upon receipt of any such document, or written authorization from the Owner's Representative directing the Contractor to proceed pending receipt of the document, Contractor shall promptly proceed with the Work involved in accordance with the terms set forth therein.

**7.1.3** Until such time as the change order is formalized and signed by both the Owner and the Contractor it shall be considered a Change Order Request.

**7.1.4** The amount of adjustment in the contract price for authorized Change Orders will be agreed upon before such Change Orders becomes effective and will be determined as follows:

- .1 By a lump sum proposal from the Contractor and the Subcontractors of any tier, including overhead and profit.
- .2 By a time and material basis with or without a specified maximum. The Contractor shall submit to the Owner's Representative itemized time and material sheets depicting labor, materials, equipment utilized in completing the Work on a daily basis for the Owner's Representative approval. If this pricing option is utilized, the Contractor may be required to submit weekly reports summarizing costs to date on time and material change orders not yet finalized.
- .3 By unit prices contained in the Contractor's original bid and incorporated in the Construction Contract or subsequently agreed upon. Such unit prices contained in the Contractor's original proposal are understood to include the Contractor's overhead and profit. 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 that application of such unit prices to quantities of the Work proposed will cause substantial inequity to the Owner or to the Contractor, the applicable unit prices shall be equitably adjusted.

**7.1.5** The Contractor shall submit all fully documented change order requests with corresponding back-up documentation within the time requested by the Owner but no later than fourteen (14) working days following 1.) the Owner's request for change order pricing in the case of a lump sum; or 2.) the completion of unit price or time and material work.

**7.1.6** The Contractor shall submit change order requests in sufficient detail to allow evaluation by the Owner. Such requests shall be fully itemized by units of labor, material and equipment and overhead and profit. Such breakdowns shall be itemized as follows:

- .1 Labor: The Contractor's proposal shall include breakdowns by labor, by trade, indicating number of hours and cost per hour for each Subcontractor as applicable. Such breakdowns shall only include employees in the direct employ of Contractor or Subcontractors in the performance of the Work. Such employees shall only include laborers at the site, mechanics, craftsmen and foremen. Payroll cost shall include base rate salaries and wages plus the cost of fringe benefits required by agreement or custom and social security contributions, unemployment, payroll taxes and workers' or workmen's compensation insurance and other customary and legally required taxes paid by the Contractor or Subcontractors. Any item or expense outside of these categories is not allowed. The expense of performing Work after regular working hours, on Saturdays, Sundays or legal holidays shall not be included in the above, unless approved in writing and in advance by Owner.
- .2 Material, supplies, consumables and equipment to be incorporated into the Work at actual invoice cost to the Contractor or Subcontractors; breakdowns showing all material, installed equipment and consumables fully itemized with number of units installed and cost per unit extended. Any singular item or items in aggregate greater than one thousand dollars (\$1,000) in cost shall be supported with supplier invoices at the request of the Owner's Representative. Normal hand tools are not compensable.
- .3 Equipment: Breakdown for required equipment shall itemize (at a minimum) delivery / pick-up charge, hourly rate and hours used. Operator hours and rate shall not be included in the equipment breakdown. Contractor must use the most cost effective equipment available in the area and should not exceed the rates listed in the Rental Rate Blue Book for Construction Equipment (Blue Book). Contractor shall submit documentation for the Blue Book to support the rate being requested.

## **7.2 Construction Change Directive**

**7.2.1** A construction change directive is a written order prepared and signed by the Owner, issued with supporting documents prepared by the Architect (if applicable), directing a change in the Work prior to agreement on adjustment of the Contract amount or Contract time, or both. A Construction Change Directive shall be used in the absence of complete agreement between the Owner and Contractor on the terms of a change order. If the Construction Change Directive allows an adjustment of the contract amount or time, such adjustment amount shall be based on one of the following methods:

- .1 A lump sum agreement, properly itemized and supported by substantiating documents of sufficient detail to allow evaluation.

- .2 By unit prices contained in the Contractor's original proposal and incorporated in the Construction Contract or subsequently agreed upon.
- .3 A method agreed to by both the Owner and the contractor with a mutually agreeable fee for overhead and profit.
- .4 In the absence of an agreement between the Owner and the Contractor on the method of establishing an adjustment of the contract amount, the Owner, with the assistance of the architect, shall determine the adjustment amount on the basis of expenditures by the Contractor for labor, materials, equipment and other costs consistent with other provisions of the Contract. The contractor shall keep and submit to the Owner an itemized accounting of all cost components, either expended or saved, while performing the Work covered under the Construction Change Directive.

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

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

**7.3 Overhead and Profit**

**7.3.1** Overhead and Profit on Change Orders shall be applied as follows:

- .1 The overhead and profit charged by the Contractor and Subcontractors shall be considered to include, but not limited to, job site office and clerical expense, normal hand tools, incidental job supervision, field supervision, payroll costs and other compensation for project manager, officers, executives, principals, general managers, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expeditors, time-keepers, and other personnel employed whether at the site or in principal or a branch office for general superintendent and administration of the Work.
- .2 The percentages for overhead and profit charged on Change Orders shall be negotiated and may vary according to the nature, extent, and complexity of the Work involved but in no case shall exceed the following:

15% To the Contractor or the Subcontractor of any tier for Work performed with their respective forces or materials purchased

5% To the Contractor on Work performed by other than his forces

5% To first tier Subcontractor on Work performed by his Subcontractor

- .3 The Contractor will be allowed to add 2% for the cost of bonding and insurance to their cost of work. This 2% shall be allowed on the total cost of the added work, including overhead and profit.
- .4 Not more than three mark-ups, not to exceed individual maximums shown above, shall be allowed regardless of the number of tier subcontractors. Overhead and profit shall be shown separately for each subcontractor of any tier and the Contractor.
- .5 On proposals covering both increases and decreases in the amount of the Contract, the application of overhead and profit shall be on the net change in direct cost for the Contractor or Subcontractor of any tier performing the Work.
- .6 The percentages for overhead and profit credit to the Owner on Change Orders that are strictly decreases in the quantity of work or materials shall be negotiated and may vary according to the nature, extent, and complexity of the Work involved, but shall not be less than the following:  
Overhead and Profit  
7.5% Credit to the Owner from the Contractor or Subcontractor of any tier for Work performed with their respective forces or materials purchased  
2.5% Credit to the Owner from the Contractor on Work performed by other than his forces  
2.5% Credit to the Owner from the first tier Subcontractor on Work performed by his Subcontractor of any tier

**7.4 Extended General Conditions**

**7.4.1** The Contractor acknowledges that the percentage mark-up allowed on change orders for overhead and profit cover the Contractor's cost of administering and executing the Work, inclusive of change orders that increase the contract time. Contractor further acknowledges that no compensation beyond the specified mark-up percentages for extended overhead shall be due or payable as a result of an increase in the Contract Time.

**7.4.2** The Owner may reimburse the Contractor for extended overhead if an extension of the Contract Time is granted by the Owner, in accordance with Article 4.7.1 and the Owner determines that the extension of the Contract Time creates an inequitable condition for the Contractor. If these conditions are determined by the Owner to exist the Contractor may be reimbursed by unit prices contained in the Contractor's original bid and incorporated in the Construction Contract or by unit prices subsequently agreed upon.

**7.4.3** If unit prices are subsequently agreed upon, the Contractor's compensation shall be limited as follows:

- .1** For the portion of the direct payroll cost of the Contractor's project manager expended in completing the Work and the direct payroll cost of other onsite administrative staff not included in Article 7.3.1. Direct payroll cost shall include base rate salaries and wages plus the cost of fringe benefits required by agreement or custom and social security contributions, unemployment, payroll taxes and workers' or workmen's compensation insurance and other customary and legally required taxes paid by the Contractor;
- .2** Cost of Contractor's temporary office, including temporary office utilities expense;
- .3** Cost of temporary utilities required in the performance of the work;
- .4** Profit not to exceed 5% of the total extended overhead direct costs;

**7.4.4** All costs not falling into one of these categories and costs of the Contractors staff not employed onsite are not allowed.

### **7.5 Emergency Work**

**7.5.1** If, during the course of the Work, the Owner has need to engage the Contractor in emergency work, whether related to the Work or not, the Contractor shall immediately proceed with the emergency work as directed by the Owner under the applicable provisions of the contract. In so doing, Contractor agrees that all provisions of the contract remain in full force and effect and the schedule for the Work is not impacted in any way unless explicitly agreed to in writing by the Owner.

## **ARTICLE 8 TIME**

### **8.1 Progress and Completion**

**8.1.1** Contractor acknowledges and agrees that time is of the essence of this Contract

**8.1.2** Contract Time is the period of time set forth in the Contract for Construction required for Substantial Completion and Final Completion of the entire Work or portions of the Work as defined in the Contract Documents. Time limits stated in the Contract Documents are of the essence of the Contract. The Contract Time may only be changed by a Change Order. By executing the Contract, the Contractor confirms that the Contract Time is a sufficient period for performing the Work in its entirety.

**8.1.3** The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, prematurely commence operations on the site or elsewhere prior to the effective date of insurance and

bonds required by Article 11 to be furnished by the Contractor.

**8.1.4** The Contractor shall proceed expeditiously and diligently with adequate forces and shall achieve Substantial Completion and Final Completion within the time specified in the Contract Documents.

### **8.2 Delay in Completion**

**8.2.1** The Contractor shall be liable for all of the Owner's damages for delay in achieving Substantial Completion and/or Final Completion of the entire Work or portions of Work as set forth in the Contract Documents within the Contract Time unless liquidated damages are specifically provided for in the Contract Documents. If liquidated damages are specifically provided for in the Contract for Construction, Contractor shall be liable for such liquidated damages as set forth in Paragraph 8.3

**8.2.2** All time limits stated in the Contract are of the essence of the Contract. However, if the Contractor is delayed at any time in the progress of the Work by any act or neglect of the Owner or by the Owner's Representative, by changes ordered in the Work, Force Majeure including but not limited to war, armed conflict, riot, civil commotion or disorder, act of terrorism or sabotage; epidemic, pandemic, outbreaks of infectious disease or any other public health crisis, including quarantine or other employee restrictions, compliance with any law or governmental order, rule, regulation or direction, curfew restriction, act of God or natural disaster such as earthquake, volcanic activity, landslide, tidal wave, tsunami, flood, damage or destruction by lightning, drought; explosion, fire, destruction of machines, equipment, prolonged break-down of transport, telecommunication or electric current; general labor disturbance such as but not limited to boycott, strike and lock-out, occupation of factories and premises, or any other causes beyond the Contractor's reasonable control which the Owner's Representative determines may justify delay then, upon submission of the Time Impact Schedule Analysis (TIA) justifying the delay called out in Section 4.7 of these General Conditions, the Contract Time may be extended for a reasonable time to the extent such delay will prevent Contractor from achieving Substantial Completion and/or Final Completion within the Contract Time and if performance of the Work is not, was not or would not have been delayed by any other cause for which the Contractor is not entitled to an extension of the Contract Time under the Contract Documents. It shall be a condition precedent to any adjustment of the Contract Time that Contractor provide the Owner's Representative with written notice of the cause of delay within seven (7) days from the occurrence of the event or condition which caused the claimed delay. If a Force Majeure is approved by the Owner as the basis for a delay claim, an adjustment in the contract time to the extent the Force Majeure impacts the schedule is the only remedy. No increase in the contract sum for any reason shall be allowed due to a Force Majeure.

**8.2.3** The Contractor further acknowledges and agrees that adjustments in the Contract Time will be permitted for a delay only to the extent such delay (1) is not caused, or could not have been anticipated, by the Contractor, (2) could not be limited or avoided by the Contractor's timely notice to the Owner of the delay, (3) prevents Contractor from completing its Work by the Contract Time, and (4) is of a duration not less than one (1) day. Delays attributable to and within the control of a Subcontractor or supplier shall not justify an extension of the Contract Time.

**8.2.4** Notwithstanding anything to the contrary in the Contract Documents, except as otherwise noted in these General Conditions, an extension in the Contract Time, to the extent permitted under this Article, shall be the sole remedy of the Contractor for any (1) delay in the commencement, prosecution or completion of the Work, (2) hindrance or obstruction in the performance of the Work, (3) loss of productivity, or (4) other claims due to or caused by any events beyond the control of both the Owner and Contractor defined herein as Force Majeure. In no event shall the Contractor be entitled to any compensation or recovery of any damages or any portion of damages resulting from delays caused by or within the control of Contractor or by acts or omissions of Contractor or its Subcontractors of any tier or delays beyond the control of both Owner and Contractor. If the Contractor contends that delay, hindrance, obstruction or other adverse condition results from acts or omissions of the Owner, the Owner's Representative or the Architect, Contractor shall provide written notice to the Owner within seven (7) calendar days of the event giving rise to such claim. Contractor shall only be entitled to an adjustment in the Contract Sum to the extent that such acts or omissions continue after the Contractor's written notice to the Owner of such acts or omissions, but in no case shall Force Majeure be the basis of an increase in the Contract sum. The Owner's exercise of any of its rights or remedies under the Contract Documents (including, without limitation, ordering changes in the Work, or directing suspension, rescheduling or correction of the Work) regardless of the extent or frequency of the Owner's exercise of such rights or remedies, shall not be the basis of any Claim for an increase in the Contract Sum or Contract Time. In the event Contractor is entitled to an adjustment in the Contract Sum for any delay, hindrance, obstruction or other adverse condition caused by the acts or omissions of the Owner, the Owner's Representative or the Architect, Contractor shall only be entitled to its actual direct costs caused thereby and Contractor shall not be entitled to and waives any right to special, indirect, or consequential damages including loss of profits, loss of savings or revenues, loss of anticipated profits, labor inefficiencies, idle equipment, home office overhead, and similar type of damages.

**8.2.5** If the Contractor submits a progress report or any construction schedule indicating, or otherwise expressing an intention to achieve completion of the Work prior to any completion date required by the Contract Documents or

expiration of the Contract Time, no liability of the Owner to the Contractor for any failure of the Contractor to so complete the Work shall be created or implied. Further, the Contractor acknowledges and agrees that even if Contractor intends or is able to complete the Work prior to the Contract Time, it shall assert no Claim and the Owner shall not be liable to Contractor for any failure of the Contractor, regardless of the cause of the failure, to complete the Work prior to the Contract Time.

### **8.3 Liquidated Damages**

**8.3.1** If Liquidated Damages are prescribed on the Bid Form and Special Conditions in the Contract Documents, the Owner may deduct from the Contract Sum and retain as Liquidated Damages, and not as penalty or forfeiture, the sum stipulated in the Contract Documents for each calendar day after the date specified for completion of the Work that the entire Work is not substantially complete and/or finally complete.

**8.3.2** The Owner's Representative shall establish the date of Substantial completion and the date of Final Completion of the Work which shall be conclusive and binding on the Owner and Contractor for the purpose of determining whether or not Liquidated Damages shall be assessed under terms hereof and the sum total amount due.

**8.3.3** Liquidated Damages or any matter related thereto shall not relieve the Contractor or his surety of any responsibility or obligation under this Contract.

## **ARTICLE 9 PAYMENTS AND COMPLETION**

### **9.1 Commencement, Prosecution, and Completion**

**9.1.1** The Contractor shall commence Work within five (5) days upon the date of a "Notice to Proceed" from the Owner or the date fixed in the Notice to Proceed. Contractor shall prosecute the Work with faithfulness and diligence, and the Contractor shall complete the Work within the Contract Time set forth in the Contract Documents.

**9.1.2** The Owner will prepare and forward three (3) copies of the Contract and Performance Bond to the bidder to whom the contract for the Work is awarded and such bidder shall return two (2) properly executed prescribed copies of the Contract and Bond to the Owner.

**9.1.3** The construction period, when specified in consecutive calendar days, shall begin when the Contractor receives notice requesting the instruments listed in below. Before the Owner will issue Notice to Proceed to permit the Contractor to begin Work, the Owner shall have received the following instruments, properly executed as described in the Contract Documents. The documents below shall have been received by the Owner within fifteen (15) days after receipt of request for documents:

- .1** Contract
- .2** Bond (See Article 11)

- .3 Insurance (See Article 11)
- .4 List of Subcontractors of any tier
- .5 Affirmative Action Plan (see Article 13.4)

**9.1.4** In the event Contractor fails to provide Owner such documents, Contractor may not enter upon the site of the Work until such documents are provided. The date the Contractor is required to commence and complete the Work shall not be affected by the Owner denying Contractor access to the site as a result of Contractor's failure to provide such documents and Contractor shall not be entitled to an adjustment of the Contract Time or Contract sum as a result of its failure to comply with the provisions of this Paragraph

**9.1.5** Contracts executed by partnerships shall be signed by all general partners of the partnership. Contracts signed by corporations shall be signed by the President or Vice President and the Secretary or Assistant Secretary. In case the Assistant Secretary or Vice President signs, it shall be so indicated by writing the word "Asst." or "Vice" in front of the words "Secretary" and "President". The corporate seal of the corporation shall be affixed. For all other types of entities, the Contractor and the person signing the Contract on behalf of Contractor represent and warrant that the person signing the Contract has the legal authority to bind Contractor to the Contract.

**9.1.6** Any successful bidder which is a corporation organized in a state other than Missouri or any bidder doing business in the State of Missouri under a fictitious name shall furnish, at no cost to the Owner, no later than the time at which the executed Contract for Construction, the Payment Bond, and the Performance Bond are returned, a properly certified copy of its current Certificate of Authority and License to do business in the State of Missouri. No contract will be executed by the Owner until such certificate is furnished by the bidder, unless there already is on file with the Owner a current certificate, in which event, no additional certificate will be required during the period of time for which such current certificate remains in effect.

**9.1.7** Within fifteen (15) calendar days of the issuance of a Notice to Proceed, the Contractor shall submit one (1) signed copy of the following instruments. No payment will be processed until all of these instruments are received and approved by the Owner's Representative.

- .1 Reproducible progress and payment schedule
- .2 Contractor's Schedule of Values
- .3 List of material suppliers
- .4 Itemized breakdown of all labor rates for each classification. Overhead and profit shall not be included. Payroll cost shall include base rate salaries and wages plus the cost of fringe benefits required by agreement or custom and social security contributions, unemployment, payroll taxes and workers' or workmen's compensation

insurance and other customary and legally required taxes paid by the Contractor or Subcontractors. Any item or expense outside of these categories is not allowed. The expense of performing Work after regular working hours, on Saturdays, Sundays or legal holidays shall not be included in the above, unless approved in writing and in advance by Owner.

- .5 Itemized breakdown of anticipated equipment rates (breakout operator rate). Overhead and profit shall not be included. Breakdown for required equipment shall itemize (at a minimum) delivery/ pick-up charge, hourly rate and hours used. Operator hours and rate shall not be included in the equipment breakdown. Contractor must use the most cost effective equipment available in the area and should not exceed the rates listed in the Rental Rate Blue Book for Construction Equipment (Blue Book). Contractor shall submit documentation for the Blue Book to support the rate being requested.

**9.1.8** The Contractor shall be paid electronically using the Owner's web-based payment program with a direct electronic transfer from the Owner's account into the Contractor's account. The Contractor must submit the following information to the Owner's Representative:

- .1 Bank Transit Number for the Contractor's bank into which the electronic deposit will be made.
- .2 Bank Account Number for the Contractor's account into which the electronic deposit will be made.
- .3 Contractor's E-Mail address so that formal notification of the deposit by the Owner can be provided.

**9.2 Contract Sum**

**9.2.1** The Owner shall compensate Contractor for all Work described herein and in the Contract Documents the Contract Sum set forth in the Contract for Construction, subject to additions and deletions as provided hereunder.

**9.3 Schedule of Values**

**9.3.1** Within fifteen (15) days after receipt of the Notice to Proceed, the Contractor shall submit to the Owner's Representative a schedule of values allocated to various portions of the Work, prepared in such form and supported by such data to substantiate its accuracy as the Owner's Representative may require. This schedule, unless objected to by the Owner's Representative, shall be used as a basis for reviewing the Contractor's Applications for Payment. The values set forth in such schedule may, at the Owner's option be used in any manner as fixing a basis for additions to or deletions from the Contract Sum.

**9.3.2** The progress and payment schedule of values shall show the following:

- .1 Enough detail as necessary to adequately evaluate the actual percent complete of any line item on a

monthly basis, as determined by the Owner's Representative.

.2 Line items, when being performed by a subcontractor or material supplier, shall correlate directly back to the subcontract or purchase order amount if requested by the Owner's Representative.

#### 9.4 Applications for Payment

9.4.1 The Contractor shall submit monthly to the Owner's Representative and the Architect an itemized Application for Payment for operations completed in accordance with the Schedule of Values. Such application shall be supported by such data substantiating the Contractor's right to payment as the Owner's Representative or Architect may require, such as copies of requisitions from Subcontractors and material suppliers, and reflecting retainage as provided for herein.

9.4.2 Such applications shall not include requests for payment of amounts the Contractor does not intend to pay to a Subcontractor or material supplier

9.4.3 Progress payments shall be made on account of materials and equipment delivered to the site and incorporated in the Work. No payments will be made for materials and equipment stored at the Project site but not yet incorporated into the Work except as provided in Paragraph 9.4.4.

9.4.4 If approved in writing and in advance by Owner, progress payments may be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. Owner may in its sole discretion refuse to grant approval for payments for materials and equipment stored at the Project site but not yet incorporated in the Work. Any approval by Owner for payment for materials and equipment delivered and suitably stored at the site, or stored offsite as noted below, for subsequent incorporation in the Work shall be conditioned upon Contractor's demonstrating that such materials and equipment are adequately protected from weather, damage, vandalism and theft and that such materials and equipment have been inventoried and stored in accordance with procedures established by or approved by the Owner. Nothing in this clause shall imply or create any liability on the part of the Owner for the Contractor's inventory and storage procedures or for any loss or damage to material, equipment or supplies stored on the site, whether incorporated into the work or not. In the event any such loss or damage occurs, the Contractor remains solely responsible for all costs associated with replacement of the affected materials, supplies and equipment including labor and incidental costs, and shall have no claim against the Owner for such loss.

No allowance shall be made in the project pay requests for materials not delivered to the site of the work and incorporated into the work, except as noted below. For

the purposes of this Article, Offsite is defined as any location not owned or leased by the Owner. Contractor shall submit a list of materials that they are requesting payment for offsite storage within 60 days of Notice Proceed.

.1 Items considered to be major items of considerable magnitude, if suitably stored, may be allowed in project pay requests on the basis of ninety percent (90%) of invoices

.2 Determination of acceptable "major items of considerable magnitude" and "suitably stored" shall be made by the Owner's Representative.

.3 Aggregate quantities of materials not considered unique to this project will not be considered for offsite storage payment.

.4 Contractor shall submit to the Owner's Representative a list of the material for which application for payment for offsite storage is anticipated no less than forty-five days prior to the submission of the applicable pay request. The list shall include a material description, applicable division, quantity and discounts offered to the Owner for early payment. Contractor shall also submit the location the material will be stored and the method of protection

.5 The storage facility shall be subject to approval by the Owner's representative, shall be located within an acceptable distance of the project sites as established by the Owner's Representative and all materials for the Owner's project must be stored separately from all other items within the storage facility and shall be labeled and stored in the name of the Curators of the University of Missouri.

.6 The Owner's representative shall be provided a minimum of two weeks time to visit the storage facility and inspect the stored material prior to submission of the pay request.

.7 Upon favorable inspection by the Owner's Representative, the Contractor shall, at the Owner's option, submit the appropriate UCC filing, transferring title of the material or equipment to The Curators of the University of Missouri.

.8 An invoice provided by the supplier shall be included with the applicable pay request.

.9 The contractor shall remain fully responsible for all items, until acceptance of the project by the Owner.

10. The contractor shall reimburse all costs incurred by the Owner in inspecting and verifying all material stored offsite, including mileage, airfare, meals, lodging and time, charged at a reasonable hourly rate.

9.4.5 The Application for Payment shall constitute a representation by the Contractor to the Owner that the Work has progressed to the point indicated; the quality of the Work covered by the Application for Payment is in accordance with the Contract Documents; and the Contractor is entitled to payment in the amount requested.

9.4.6 The Contractor will be reimbursed for ninety-five percent (95%) of the value of all labor furnished and

material installed and computed in the same manner, less all previous payments made. On projects where a bond is not required, the contractor will be reimbursed for ninety percent (90%) of the value of all labor furnished and material installed and computed in the same manner, less all previous payments made

## **9.5 Approval for Payment**

**9.5.1** The Owner's Representative will, within fifteen (15) days after receipt of the Contractor's Application for Payment, either approve Contractor's Application for Payment for such amount as the Owner's Representative determines is properly due, or notify the Contractor of the Owner's Representative's reasons for withholding certification in whole or in part as provided in Section 9.6.

## **9.6 Decisions to Withhold Approval**

**9.6.1** The Owner's Representative may decide not to certify payment and may withhold approval in whole or in part, to the extent reasonably necessary to protect the Owner. If the Owner's Representative is unable to approve payment in the amount of the Application, the Owner's Representative will notify the Contractor as provided in Paragraph 9.5.1. If the Contractor and Owner's Representative cannot agree on a revised amount, the Owner's Representative will promptly issue approval for payment for the amount for which the Owner's Representative is able to determine is due Contractor. The Owner's Representative may also decide not to approve payment or, because of subsequently discovered evidence or subsequent observations, may nullify the whole or a part of approval for payment previously issued, to such extent as may be necessary in the Owner's Representative opinion to protect the Owner from loss because of:

- .1** defective Work not remedied or damage to completed Work;
- .2** failure to supply sufficient skilled workers or suitable materials;
- .3** third party claims filed or reasonable evidence indicating probable filing of such claims;
- .4** failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment, Owner may, at its sole option issue joint checks to subcontractors who have presented evidence that it has not been paid in accordance with the Contract;
- .5** reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- .6** damage to the Owner or another contractor;
- .7** reasonable evidence that the Work will not be completed within the Contract Time or an unsatisfactory rate of progress made by Contractor;
- .8** Contractor's failure to comply with applicable Laws;
- .9** Contractor's or Subcontractor's failure to comply with contract Prevailing Wage requirements; or

**.10** Contractor's failure to carry out the Work in strict accordance with the Contract Documents.

**9.6.2** When the above reasons for withholding approval are removed, approval will be made for amounts previously withheld.

## **9.7 Progress Payments**

**9.7.1** Based upon Applications for Payment submitted to the Owner by the Contractor and approvals issued by the Owner's Representative, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

**9.7.2** The period covered by each Application for Payment shall be one (1) calendar month.

**9.7.3** The Owner shall make payment to Contractor for amounts due and approved by Owner's Representative not later than thirty (30) days after the Owner approves a properly detailed Application for Payment which is in compliance with the Contract Documents. The Owner shall not have the obligation to process or pay such Application for Payment until it receives an Application for Payment satisfying such requirements.

**9.7.4** Based on the Schedule of Values submitted by Contractor, Applications for Payment submitted by Contractor shall indicate the actual percentage of completion of each portion of Contractor's Work as of the end of the period covered by the Application for Payment.

**9.7.5** The Contractor shall promptly pay each Subcontractor and Supplier, upon receipt of payment from the Owner, out of the amount paid to the Contractor on account of such Subcontractor's or supplier's portion of the Work, the amount to which said Subcontractor or supplier is entitled, reflecting percentages actually retained from payments to the Contractor on account of each Subcontractor's or supplier's portion of the Work, in full compliance with state statute. The Contractor shall, by appropriate agreement with each Subcontractor or supplier, require each Subcontractor or supplier to make payments to Sub-subcontractors in similar manner.

**9.7.6** Neither the Owner nor Architect shall have an obligation to pay or to see to the payment of money to a Subcontractor of any tier nor a laborer or employee of Contractor except to the extent required by law. Retainage provided for by the Contract Documents are to be retained and held for the sole protection of Owner, and no other person, firm or corporation shall have any claim or right whatsoever thereto.

**9.7.7** An approval for payment by Owner's Representative, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.



## **9.8 Failure of Payment**

**9.8.1** If the Owner is entitled to reimbursement or payment from the Contractor under or pursuant to the Contract Documents, such payment by Contractor shall be made promptly upon demand by the Owner. Notwithstanding anything contained in the Contract Documents to the contrary, if the Contractor fails to promptly make any payment due the Owner, or the Owner incurs any costs and expenses to cure any default of the Contractor or to correct defective Work, the Owner shall have an absolute right to offset such amount against the Contract Sum and may, in the Owner's sole discretion, elect either to: (1) deduct an amount equal to that to which the Owner is entitled from any payment then or thereafter due the Contractor from the Owner, or (2) issue a written notice to the Contractor reducing the Contract Sum by an amount equal to that to which the Owner is entitled.

## **9.9 Substantial Completion**

**9.9.1** Substantial Completion is the stage in the progress of the Work as defined in Paragraph 1.1.9 as certified by the Owner.

**9.9.2** When the Contractor considers the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall notify the Owner and the Architect. The Owner's Representative will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Owner's Representative's inspection discloses any item which is not in accordance with the requirements of the Contract Documents, the Contractor shall complete or correct such item upon notification by the Owner's Representative. The Contractor shall then submit a request for another inspection by the Owner's Representative to determine Substantial Completion. When the Work or designated portion thereof is substantially complete, the Owner will issue a Certificate of Substantial Completion. Substantial Completion shall transfer from the Contractor to the Owner responsibilities for security, maintenance, heat, utilities, damage to the Work and insurance. In no event shall Contractor have more than thirty (30) days to complete all items on the Punch List and achieve Final Completion. Warranties required by the Contract Documents shall commence on the date of Substantial Completion or as agreed otherwise.

**9.9.3** At the date of Substantial Completion, the Contractor may apply for, and if approved by Owner's Representative, the Owner, subject to the provisions herein, shall increase total payments to one hundred percent (100%) of the Contract Sum less one hundred fifty percent (150%) of the value of any incomplete Work and unsettled claims, as determined by the Owner's Representative.

## **9.10 Partial Occupancy or Use**

**9.10.1** The Owner may occupy or use any completed or partially completed portion of the Work at any stage when

such portion is designated by separate agreement with the Contractor. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, security, maintenance, heat, utilities, damage to the Work and insurance. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by the Owner's Representative.

**9.10.2** Immediately before such partial occupancy or use, the Owner, and Contractor 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. Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

## **9.11 Final Completion and Final Payment**

**9.11.1** Upon receipt of written notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Owner's Representative and the Architect will promptly make such inspection and, when the Owner's Representative and Architect find the Work acceptable under the Contract Documents and the Contract fully performed, the Owner's Representative will promptly issue a final approval for payment; otherwise, Owner's Representative will return Contractor's Final Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application. Submission of a Final Application for Payment shall constitute a further representation that conditions listed in Paragraph 9.11.2 as precedent to the Contractor's being entitled to final payment have been fulfilled. All warranties and guarantees required under or pursuant to the Contract Documents shall be assembled and delivered by the Contractor to the Owner's Representative as part of the final Application for Payment. The final approval for payment will not be issued by the Owner's Representative until all warranties and guarantees have been received and accepted by the Owner.

**9.11.2** The Owner will request the Contractor to submit the application for final payment along with a manually signed notarized letter on the Contractor's letterhead certifying that:

- .1** Labor costs, prevailing wage rates, fringe benefits and material costs have been paid.
- .2** Subcontractors of any tier and manufacturers furnishing materials and labor for the project have fully completed their Work and have been paid in full.
- .3** The project has been fully completed in accordance with the Contract Documents as modified by Change Orders.
- .4** The acceptance by Contractor of its Final Payment, by check or electronic transfer, shall be and operate

as a release of all claims of Contractor against Owner for all things done or furnished or relating to the Work and for every act or alleged neglect of Owner arising out of the Work.

**9.11.3** Final Payment constituting the entire unpaid balance due shall be paid by the Owner to the Contractor within thirty (30) days after Owner's receipt of Contractor's Final Application for Payment which satisfies all the requirements of the Contract Documents and Owner's receipt of all information and documents set forth in Section 9.11.

**9.11.4** No payment under this Contract, including but not limited to final payment, shall constitute acceptance by Owner of any Work or act not in accordance with the requirements of the Contract Documents.

**9.11.5** No recourse shall be had against any member of the Board of Curators, or officer thereof, for any payment under the Contract or any claim based thereon.

## **ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY**

### **10.1 Safety Precautions and Programs**

**10.1.1** The Contractor shall at all times conduct operations under this Contract in a manner to avoid the risk of bodily harm to persons or risk of damage to any property. The Contractor shall promptly take precautions which are necessary and adequate against conditions created during the progress of the Contractor's activities hereunder which involve a risk of bodily harm to persons or a risk of damage to property. The Contractor shall continuously inspect Work, materials, and equipment to discover and determine any such conditions and shall be solely responsible for discovery, determination, and correction of any such conditions. The Contractor shall comply with applicable safety laws, standards, codes, and regulations in the jurisdiction where the Work is being performed, specifically, but without limiting the generality of the foregoing, with rules regulations, and standards adopted pursuant to the Williams-Steiger Occupational Safety and Health Act of 1970 and applicable amendments.

**10.1.2** All contractors, subcontractors and workers on this project are subject to the Construction Safety Training provisions 292.675 RSMo.

**10.1.3** In the event the Contractor encounters on the site, material reasonably believed to be asbestos, polychlorinated biphenyl (PCB), lead, mercury, or other material known to be hazardous, which has not been rendered harmless, the Contractor shall immediately stop Work in the area affected and report the condition to the Owner's Representative and the Architect in writing. The Work in the affected area shall not thereafter be resumed

except by written agreement of the Owner's Representative and Contractor if in fact the material is asbestos or polychlorinated biphenyl (PCB) and has not been rendered harmless. The Work in the affected area shall be resumed in the absence of asbestos or polychlorinated biphenyl (PCB), or when it has been rendered harmless by written agreement of the Owner's Representative and the Contractor. "Rendered Harmless" shall mean that levels of such materials are less than any applicable exposure standards, including but limited to OSHA regulations.

### **10.2 Safety Of Persons And Property**

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

- .1** students, faculty, staff, the public, construction personnel, 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 the Contractor's Subcontractors of any tier; and
- .3** other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

**10.2.2** The Contractor shall 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.

**10.2.3** The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, safeguards for safety and protection, including, but not limited to, posting danger signs and other warnings against hazards, promulgating safety regulations, and notifying owners and users of adjacent sites and utilities.

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

**10.2.5** The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Article 10 caused in whole or in part by the Contractor, a Subcontractor of any tier, 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 Article 10, except damage or loss attributable solely to acts or omissions of Owner or the Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are

in addition to the Contractor's other obligations stated elsewhere in the Contract.

**10.2.6** The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents, and the maintaining, enforcing and supervising of safety precautions and programs. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner's Representative and Architect. The Contractor shall hold regularly scheduled safety meetings to instruct Contractor personnel on safety practices, accident avoidance and prevention, and the Project Safety Program. The Contractor shall furnish safety equipment, and enforce the use of such equipment by its employees and its subcontractors of any tier.

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

**10.2.8** The Contractor shall promptly report in writing to the Owner all accidents arising out of or in connection with the Work which cause death, lost time injury, personal injury, or property damage, giving full details and statements of any witnesses. In addition, if death, serious personal injuries, or serious property damages are caused, the accident shall be reported immediately by telephone or messenger to the Owner

**10.2.9** The Contractor shall promptly notify in writing to the Owner of any claims for injury or damage to personal property related to the work, either by or against the Contractor.

## **ARTICLE 11 INSURANCE & BONDS**

### **11.1 Insurance**

**11.1.1** Contractor shall secure from the date of the Contract for Construction and maintain for such periods of time as set forth below, insurance of such types and in such amounts specified below, to protect Contractor, Owner and others against all hazards or risks of loss described below. The form of such insurance together with carriers thereof, in each case, shall be approved by Owner, but, regardless of such approval, it shall be the responsibility of Contractor to maintain the insurance coverages set forth herein.

**11.1.2** The contractor shall not be allowed on the Owners property without proof of the insurance coverages set forth herein

### **11.2 Commercial General Liability**

**11.2.1** Contractor shall secure and maintain from the date of the Contract and for a period of at least five (5)

years from the date of Final Completion of the entire Work Commercial General Liability insurance ("CGL") with a combined single limit of not less than \$2,000,000 per occurrence, \$5,000,000 general aggregate, \$5,000,000 products and completed operations aggregate and \$1,000,000 personal injury and advertising injury. General Aggregate should apply per project. An umbrella policy may be used to satisfy these limits. If the General Aggregate is not on a per project basis, the contractor shall provide an additional \$2,000,000 general aggregate.

**11.2.2** CGL insurance shall be written on a comprehensive form and shall cover claims and liability in connection with or resulting from the Contractor's operations and activities under the Contract, for personal injuries, occupational sickness, disease, death or damage to property of others, including loss of use resulting therefrom, arising out of any operations or activities of the Contractor, its agents, or any Subcontractors of any tier or by anyone directly or indirectly employed by either of them.

**11.2.3** CGL insurance shall include premises, operations, independent contractors, products-completed operations, personal injury and advertising injury and liability assumed under an insured contract (including the tort liability of another assumed in a business contract) coverages. In particular, and not by way of any limitation, the CGL insurance shall cover the Contractor's indemnity obligations contained in the Contract Documents.

**11.2.4** There shall be no endorsement or modification of the CGL policy limiting the scope of coverage for liability arising from blasting, explosion, collapse, or underground property damage.

**11.2.5** "The Curators of the University of Missouri" shall be endorsed as an "additional insured" under the CGL policy. The additional insured status must be conveyed by using the ISO CG 2 10 (2004) edition or equivalent and the ISO CG 20 37 (2004) edition. The policy shall be endorsed to be primary coverage and any other insurance carried by the Owner shall be excess only and will not contribute with Contractors' insurance. To confirm, the Endorsement should accompany the insurance certificate.

**11.2.6** Contractor waives all rights against Owner and its agents, officers, representatives and employees for recovery of damages to the extent those damages are covered by the CGL policy required hereunder.

### **11.3 Licensed for Use Vehicle Liability**

**11.3.1** Contractor shall secure and maintain from the date of the Contract for Construction until the date of Final Completion of the entire Work, insurance, to be on comprehensive form, which shall protect Contractor against any and all claims for all injuries and all damage to property arising from the use of automobiles, trucks and motorized vehicles, in connection with the performance of Work under this Contract, and shall cover the operation on or off the site of

the Work of all motor vehicles licensed for highway use whether they are owned, non-owned or hired. Such insurance shall include contractual liability coverage and shall provide coverage on the basis of the date of any accident. The liability limits under such policy shall not be less than \$2,000,000 combined single limit for bodily injury and property damage per accident.

**11.3.2** Contractor waives all rights against Owner and its agents, officers, directors and employees for recovery of damages to the extent such damages are covered by the automobile liability insurance required hereunder.

#### **11.4 Workers' Compensation Insurance**

**11.4.1** Contractor shall purchase and maintain workers' compensation insurance and employers' liability insurance which shall protect Contractor from claims for injury, sickness, disease or death of Contractor's employees or statutory employees. The insurance policies required hereunder shall include an "all states" or "other states" endorsement. In case any Work is sublet, Contractor shall require any Subcontractor of any tier to provide the insurance coverages required under this Section 11.4.

**11.4.2** Contractor's workers' compensation insurance coverage shall be in compliance with all applicable Laws, including the statutes of the State of Missouri. Contractor's employers' liability coverage limits shall not be less than \$1,000,000 each accident for bodily injury by accident or \$1,000,000 each employee for bodily injury by disease.

#### **11.5 Liability Insurance General Requirements**

**11.5.1** All insurance coverages procured by Contractor shall be provided by agencies and insurance companies acceptable to and approved by Owner. Any insurance coverage shall be provided by insurance companies that are duly licensed to conduct business in the State of Missouri as an admitted carrier. The form and content of all insurance coverage provided by Contractor are subject to the approval of Owner. All required insurance coverages shall be obtained and paid for by Contractor. Any approval of the form, content or insurance company by Owner shall not relieve the Contractor from the obligation to provide the coverages required herein.

**11.5.2** All insurance coverage procured by the Contractor shall be provided by insurance companies having policyholder ratings no lower than "A-" and financial ratings not lower than "XI" in the Best's Insurance Guide, latest edition in effect as of the date of the Contract, and subsequently in effect at the time of renewal of any policies required by the Contract Documents. Insurance coverages required hereunder shall not be subject to a deductible amount on a per-claim basis of more than \$10,000.00 and shall not be subject to a per-occurrence deductible of more than \$25,000.00. Insurance procured by Contractor covering the additional insureds shall be primary insurance

and any insurance maintained by Owner shall be excess insurance.

**11.5.3** All insurance required hereunder shall provide that the insurer's cost of providing the insureds a defense and appeal, including attorneys' fees, shall be supplementary and shall not be included as part of the policy limits but shall remain the insurer's separate responsibility. Contractor shall cause its insurance carriers to waive all rights of subrogation, except for Workers' Compensation, against the Owner and its officers, employees and agents.

**11.5.4** The Contractor shall furnish the Owner with certificates, Additional Insured endorsements, policies, or binders which indicate the Contractor and/or the Owner and other Contractors (where required) are covered by the required insurance showing type, amount, class of operations covered, effective dates and dates of expiration of policies prior to commencement of the work. Contractor is required to maintain coverages as stated and required to notify the University of a Carrier Change or cancellation within 2 business days. The University reserves the right to request a copy of the policy. Contractor fails to provide, procure and deliver acceptable policies of insurance or satisfactory certificates or other evidence thereof, the Owner may obtain such insurance at the cost and expense of the Contractor without notice to the Contractor.

**11.5.5** With respect to all insurance coverages required to remain in force and affect after final payment, Contractor shall provide Owner additional certificates, policies and binders evidencing continuation of such insurance coverages along with Contractor's application for final payment and shall provide certificates, policies and binders thereafter as requested by Owner.

**11.5.6** The maintenance in full current force and effect of such forms and amounts of insurance and bonds required by the Contract Documents shall be a condition precedent to Contractor's exercise or enforcement of any rights under the Contract Documents.

**11.5.7** Failure of Owner to demand certificates, policies and binders evidencing insurance coverages required by the Contract Documents, approval by Owner of such certificates, policies and binders or failure of Owner to identify a deficiency from evidence that is provided by Contractor shall not be construed as a waiver of Contractor's obligations to maintain the insurance required by the Contract Documents.

**11.5.8** The Owner shall have the right to terminate the Contract if Contractor fails to maintain the insurance required by the Contract Documents.

**11.5.9** If Contractor fails to maintain the insurance required by the Contract Document, Owner shall have the right, but not the obligation, to purchase said insurance at Contractor's expense. If Owner is damaged by Contractor's failure to maintain the insurance required by the Contract Documents,

Contractor shall bear all reasonable costs properly attributable to such failure.

**11.5.10** By requiring the insurance set forth herein and in the Contract Documents, Owner does not represent or warrant that coverage and limits will necessarily be adequate to protect Contractor, and such coverages and limits shall not be deemed as a limitation on Contractor's liability under the indemnities granted to Owner in the Contract Documents.

**11.5.11** If Contractor's liability policies do not contain a standard separation of insureds provision, such policies shall be endorsed to provide cross-liability coverage.

**11.5.12** If a part of the Work hereunder is to be subcontracted, the Contractor shall: (1) cover any and all Subcontractors in its insurance policies; (2) require each Subcontractor to secure insurance which will protect said Subcontractor and supplier against all applicable hazards or risks of loss designated in accordance with Article 11 hereunder; and (3) require each Subcontractor or supplier to assist in every manner possible in the reporting and investigation of any accident, and upon request, to cooperate with any insurance carrier in the handling of any claim by securing and giving evidence and obtaining the attendance of witnesses as required by any claim or suit.

**11.5.13** It is understood and agreed that the insurance coverages required by the provisions of this Article 11 are required in the public interest and that the Owner does not assume any liability for acts of Contractor or Subcontractors of any tier or their employees in the performance of the Contract or Work.

## **11.6 Builder's Risk Insurance**

**11.6.1** The Contractor shall purchase and maintain, in a company or companies lawfully authorized to do business in the State of Missouri, as an admitted carrier, builder's risk insurance on the entire Work. Such insurance shall be written on a completed value form for the entire Work. The insurance shall apply on a replacement cost basis.

**11.6.2** The insurance as required herein shall name as insureds the Owner, Contractor and all Subcontractors of any tier. The insurance policy shall contain a provision that the insurance will not be canceled, allowed to expire or materially changed until at least thirty (30) days prior written notice has been given to Owner.

**11.6.3** The insurance as required herein shall cover the entire Work, including reasonable compensation for Architect's services and expenses made necessary by an insured loss. Insured property shall include portions of the Work located away from the site (including all offsite stored materials) but intended for use at the site, and shall also cover portions of the Work in transit, including ocean transit. The policy shall include as insured property scaffolding, falsework, and temporary buildings located at

the site. The policy shall cover the cost of removing debris, including demolition as may be made legally necessary by the operation of any law, ordinance or regulation.

**11.6.4** The insurance required herein shall be on an all risk form and shall be written to cover all risks of physical loss or damage to the insured party and shall insure at least against the perils of fire and extended coverage, theft, vandalism, malicious mischief, collapse, lightening, earthquake, flood, frost, water damage, windstorm and freezing.

**11.6.5** If there are any deductibles applicable to the insurance required herein, Contractor shall pay any part of any loss not covered because of the operation of such deductibles.

**11.6.6** The insurance as required herein shall be maintained in effect until the earliest of the following dates:

- .1** the date which all persons and organization who are insureds under the policy agree in writing that it shall be terminated;
- .2** the date on which final payment of this Contract has been made by Owner to Contractor; or
- .3** the date on which the insurable interests in the property of all insureds other than the Owner have ceased.

**11.6.7** The Owner and Contractor waive all rights against (1) each other and any of their subcontractors of any tier, suppliers, agents and employees, each of the other, (2) the Architect and Architect's consultants, and (3) separate contractors described in Article 6, if any, and any of their subcontractors of any tier, suppliers, agents and employees, for damages caused by fire or other perils to the extent covered by property insurance obtained pursuant to this Section 11.7 or other insurance applicable to the Work, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require of the Architect, Architect's consultants, separate contractors described in Article 6, if any, and the subcontractors of any tier, suppliers, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, was at fault or was negligent in causing the loss and whether or not the person or entity had an interest in the property damaged.

**11.6.8** A loss insured under Contractor's property insurance shall be adjusted by the Owner in good faith and made payable to the Owner for the insureds, subject to requirements of the Contract Documents. The Contractor shall pay Subcontractors of any tier their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors of

any tier to make payments to their Sub-subcontractors in similar manner.

### **11.7 Bonds**

**11.7.1** When the Contract sum exceeds Fifty Thousand Dollars (\$50,000), the Contractor shall procure and furnish a Performance Bond and a Payment Bond in the form prepared by the Owner, each in an amount equal to one hundred percent (100%) of the Contract Sum, as well as adjustments to the Contract Sum. The Performance Bond shall secure and guarantee Contractor's faithful performance of this Contract, including but not limited to Contractor's obligation to correct defects after final payment has been made as required by the Contract Documents. The Payment Bond shall secure and guarantee payment of all persons performing labor on the Project under this Contract and furnishing materials in connection with this Contract. These Bonds shall be in effect through the duration of the Contract plus the Guaranty Period as required by the Contract Documents.

**11.7.2** The bonds required hereunder shall be executed by a responsible surety licensed in the State of Missouri, with a Best's rating of no less than A-/XI. The Contractor shall require the attorney in fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of this power of attorney indicating the monetary limit of such power.

**11.7.3** If the surety of any bond furnished by Contractor is declared bankrupt or becomes insolvent or its right to conduct business in the State of Missouri is terminated, or it ceases to meet the requirements of this paragraph, Contractor shall within ten (10) days substitute another bond and surety, both of which must be acceptable to Owner. If Contractor fails to make such substitution, Owner may procure such required bonds on behalf of Contractor at Contractor's expense.

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

**11.7.5** The Contractor shall keep the surety informed of the progress of the Work, and, where necessary, obtain the surety's consent to or waiver of: (1) notice of changes in the Work; (2) request for reduction or release of retention; (3) request for final payment; and (4) any other material required by the surety. The Owner shall be notified by the Contractor, in writing, of all communications with the surety, as it relates to items one through four. The Owner may, in the Owner's sole discretion, inform surety of the progress of the Work, any defects in the Work, or any defaults of Contractor under the Contract Documents and obtain consents as necessary to protect the Owner's rights, interest, privileges and benefits under and pursuant to any bond issued in connection with the Work.

**11.7.6** Contractor shall indemnify and hold harmless the Owner and any agents, employees, representative or member of the Board of Curators from and against any claims, expenses, losses, costs, including reasonable attorneys' fees, as a result of any failure of Contractor to procure the bonds required herein.

## **ARTICLE 12**

### **UNCOVERING AND CORRECTION OF THE WORK**

#### **12.1 Uncovering of the Work**

**12.1.1** If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it shall, if required in writing by the Architect or the Owner's Representative, be uncovered for the Architect's observation and be replaced at the Contractor's expense without change in the Contract Time.

**12.1.2** If a portion of the Work has been covered which the Architect or the Owner's Representative has not specifically requested to observe, prior to its being covered, the Architect or the Owner's Representative 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 the Owner. If such Work is not in accordance with the Contract Documents, the Contractor shall pay such costs unless the condition was caused by the Owner or a separate contractor in which event the Owner will be responsible for payment of such costs.

#### **12.2 Correction of the Work**

**12.2.1** The Architect or Owner's Representative shall have the right to reject Work not in strict compliance with the requirements of the Contract Documents. The Contractor shall promptly correct Work rejected by the Architect or the Owner's Representative for failing to conform to the requirements of the Contract Documents, whether observed before or after final completion and whether or not fabricated, installed, or completed. If Work has been rejected by Architect or Owner's Representative, the Architect or Owner's Representative shall have the right to require the Contractor to remove it from the Project site and replace it with Work that strictly conforms to the requirements of the Contract Documents regardless if such removal and replacement results in "economic waste." Contractor shall pay all claims, costs, losses and damages caused by or resulting from the correction, removal or replacement of defective Work, including but not limited to, all costs of repair or replacement of Work of others. The Contractor shall bear costs of correcting, removing and replacing such rejected Work, including additional testing and inspections and compensation for the Architect's services and expenses made necessary thereby. If prior to the date of final payment, the Contractor, a Subcontractor or anyone for whom either is responsible uses or damages any portion of the Work, including, without limitation, mechanical, electrical,

plumbing and other building systems, machinery, equipment or other mechanical device, the Contractor shall cause such item to be restored to "like new" condition at no expense to the Owner.

**12.2.2** If, within twelve (12) months after the date of Final Completion of the Work or designated portion thereof, or after the date for commencement of warranties, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found not to be in strict accordance with the requirements of the Contract Documents, the Contractor shall correct or remove and replace such defective Work, at the Owner's discretion. Such twelve (12) month period is referred to as the "Guarantee Period." The obligations under this Paragraph 12.2.2 shall cover any repairs, removal and replacement to any part of the Work or other property caused by the defective Work.

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

**12.2.4** If the Contractor fails to correct nonconforming Work within a reasonable time, the Owner may correct or remove it and replace such nonconforming Work. If the Contractor does not proceed with correction of such nonconforming Work within a reasonable time fixed by written notice from the Owner, the Owner may take action to correct or remove the nonconforming work at the contractor's expense.

**12.2.5** The Contractor shall bear the cost of correcting destroyed or damaged Work or property, whether completed or partially completed, of the Owner or of others caused by the Contractor's correction or removal of Work which is not in accordance with the requirements of the Contract Documents.

**12.2.6** Nothing contained in Article 12 shall be construed to establish a period of limitation with respect to other obligations that the Contractor might have under the Contract Documents. Establishment of the twelve (12) month Guarantee Period as described in Article 12 relates only to the specific obligation of the Contractor to correct, remove or replace 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 under the Contract Documents. The requirements of Article 12 are in addition to and not in limitation of any of the other requirements of the Contract for warranties or conformance of the Work to the requirements of the Contract Documents.

### **12.3 Acceptance of Nonconforming Work**

**12.3.1** The Owner may accept Work which is not in accordance with the Contract Documents, instead of requiring its removal and correction, in its sole discretion. In Such case the Contract Sum will be adjusted as appropriate and equitable. Such adjustment shall be made whether or not final payment has been made. Nothing contained herein shall impose any obligation upon the Owner to accept nonconforming or defective Work.

## **ARTICLE 13 MISCELLANEOUS PROVISIONS**

### **13.1 Written Notice**

**13.1.1** All notices required to be given by the contractor under the terms of this Contract shall be made in writing. Written notice when served by the Owner will be deemed to have been duly served if delivered in person to the individual or a member of the firm or entity or to an office of the corporation for which it was intended, or if delivered at or sent to the last business address known to the party giving notice.

### **13.2 Rights and Remedies**

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

**13.2.2** No action or failure to act by the Owner, the Architect, or the Owner's Representative will constitute a waiver of a right or duty afforded to the Owner under the Contract Documents, nor will such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed in writing.

**13.2.3** The terms of this Contract and all representations, indemnifications, warranties and guarantees made in, required by or given in accordance with the Contract Documents, as well as all continuing obligations indicated in the Contract Documents, will survive final payment, completion and acceptance of the Work and termination or completion of the Work and shall remain in effect so long as the Owner is entitled to protection of its rights under applicable law.

**13.2.4** Contractor shall carry out the Work and adhere to the current construction schedule during all disputes or disagreements with the Owner. No Work shall be delayed or postponed pending resolution of any disputes or disagreements except as the Owner and Contractor may otherwise agree to in writing.

### **13.3 Tests and Inspections**

**13.3.1** Tests, inspections, and approvals of portions of the Work required by the Contract Documents or by laws, ordinances, rules or regulations shall be made at an appropriate time. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections and

approvals with an independent testing laboratory or entity acceptable to the Owner, and shall bear related costs of tests, inspections, and approvals. The Contractor shall give the Architect and the Owner's Representative timely notice of when and where tests and inspections are to be made so the Architect and/or the Owner's Representative may observe procedures.

**13.3.2** If the Architect or the Owner's Representative determine that portions of the Work require additional testing, inspection or approval not included in the Contract Documents, or required by law, the Architect, or the Owner's Representative will instruct the Contractor to make arrangements for such additional testing, inspection, or approval by an entity acceptable to the Owner's Representative and the Contractor shall give timely notice to the Architect, and the Owner's Representative, of when and where tests and inspections are to be made so the Architect and/or the Owner's Representative may observe such procedures. The Owner will bear such costs except as provided elsewhere in Article 13.

**13.3.3** If such procedures for testing, inspection, or approval under Article 13 reveal failure of the portions of the Work to comply with 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 the Architect's services and expenses.

**13.3.4** Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Owner's Representative and Architect.

**13.3.5** Contractor shall take all necessary actions to ensure that all tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

**13.3.6** Contractor shall arrange for and pay for all costs of all testing required by the Contract Documents or any applicable Laws for materials to be tested or certified at or on the place or premises of the source of the material to be supplied. The Owner shall have the right to require testing of all materials at the place of the source of the material to be supplied if not required by the Contract Documents or any applicable Laws. The Owner shall bear the costs of such tests and inspections not required by the Contract Documents or by applicable Laws unless prior defective Work provides Architect or Owner with a reasonable belief that additional defective Work may be found, in which case Contractor shall be responsible for all costs of tests and inspections ordered by the Owner or Architect, whether or not such tests or inspection reveals that Work is in compliance with the Contract Documents.

### **13.4 Nondiscrimination in Employment Equal Opportunity**

**13.4.1** The University serves from time to time as a contractor for the United States government. Accordingly, the provider of goods and/or services shall comply with federal laws, rules and regulations applicable to subcontractors of government contracts including those relating to equal employment opportunity and affirmative action in the employment of minorities (Executive Order 11246), women (Executive Order 11375), persons with disabilities (29 USC 706) and Executive Order 11758, and certain veterans (38 USC 4212 formerly [2012]) contracting with business concerns with small disadvantaged business concerns (Publication L. 95-507). Contract clauses required by the Government in such circumstances are incorporated herein by reference.

### **13.5 Supplier Diversity Goal Program**

**13.5.1** The Contractor shall subcontract with diverse firms no less than the amount pledged in the Contractor's Bid and/or the amount accepted by the Owner.

**13.5.2** If the Contractor must remove any diverse subcontractor of any tier, the Contractor shall replace the diverse subcontractor of any tier with another diverse subcontractor(s) of equal dollar value to the diverse supplier removed. The Contractor shall immediately notify the Owner's Representative in writing of the Contractor's intent to remove any, and the Contractor's plan to maintain subcontracts with diverse firms of no less than amount pledged in the Contractor's Bid and/or the amount accepted by the Owner. All changes of diverse subcontractor of any tier shall be approved by the Director of Facilities Planning & Development.

**13.5.3** If the Contractor fails to meet or maintain the contractor's Supplier Diversity subcontracting pledge, the Contractor shall immediately notify in writing the Owner's Representative, and the Director of Facilities Planning & Development. Such notice shall include a description of the Contractor's good faith effort to comply with their Supplier Diversity subcontracting pledge.

**13.5.4** If the Director of Facilities Planning & Development finds the Contractor has failed to comply in good faith with the Owner's Supplier Diversity goal program, the Director may take appropriate action, including but not limited to, declaring the Contractor ineligible to participate in any contracts with the Owner for a period not to exceed six (6) months, and/or directing that the Contractor's actions be declared a material breach of the Contract and that the Contract be terminated.

**13.5.5** The Contractor and his subcontractors shall develop, implement, maintain, and submit in writing to the Director of Facilities Planning & Development, an affirmative action program if at least fifty (50) persons in the aggregate are employed under this contract. If less than fifty (50) persons in the aggregate are to be employed under this contract, the Contractor shall submit, in lieu of the written affirmative action program, a properly executed "Affidavit for



Affirmative Action" in the form as included in the Contract Documents. For the purpose of this section, an "Affirmative Action Program" means positive actions to influence all employment practices (including, but not limited to, recruiting, hiring, promoting, and training) in providing equal employment opportunity regardless of race, color, sex, national origin, religion, age (where the person affected is between 40 and 70), disabled and Vietnam-era veteran status, and handicapped otherwise qualified status. Such affirmative action program shall include:

- .1 A written policy statement committing the total organization to affirmative action and assigning management responsibilities and procedures for evaluation and dissemination.
- .2 The identification of a person designated to handle affirmative action.
- .3 The establishment of non-discriminatory selection standards, objective measures to analyze recruitment, an upward mobility system, a wage and salary structure, and standards applicable to lay-off, recall, discharge, demotion, and discipline.
- .4 The exclusion of discrimination from collective bargaining agreements.
- .5 Performance of an internal audit of the reporting system to monitor execution and to provide for future planning.

**13.5.6** In the enforcement of this non-discrimination requirement, the Owner may use any reasonable procedures available, including but not limited to: requests, reports, site visits, and inspection of relevant documents of Contractors and Subcontractors of any tier. The contractor shall submit a final Affidavit of Supplier Diversity Participation for each diverse firm at the end of the project stating the actual amount paid to the diverse firm.

**13.6 Wage Rates (If the contract amount is less than \$75,000, the requirements of this section will not apply. Any contract adjustments that increase the contract above \$75,000 will be subject to this section.)**

**13.6.1** The Contractor shall pay workers employed in the execution of this contract in full each week and not less than the predetermined wage rates and overtime for work of a similar character that have been made a part of this Contract. These rates are determined by the University of Missouri Director of Facilities Planning and Development. The rates are based on wage rates published in the Annual Wage Orders of the Missouri Department of Labor and Industrial Relations (MDLIR). The Contractor is to use MDLIR 8 CSR 30-3.020; .030; .040, .060 in determining the appropriate occupational titles and rates for workers used in the execution of this contract. All determinations and/or interpretations regarding wage rates and classification of workers will be made by the office of the University of Missouri Director

of Facilities Planning and Development. The Contractor is responsible for the payment of the aggregate of the Basic Hourly Rate and the Total Fringe Benefits to the workers on the project. Fringe benefit payments may be made to the worker in cash, or irrevocably made by a Contractor or Subcontractor to a trustee or to a third person pursuant to a fund, plan or program, or pursuant to an enforceable commitment, or any combination thereof, to carry out a financially responsible plan or program which was communicated in writing to the workmen affected, for medical or hospital care, pensions on retirement or death, compensation for injuries or illness resulting from occupational activity, or insurance to provide any of the foregoing, for unemployment benefits, life insurance, disability and sickness insurance, accident insurance, for vacation and holiday pay, for defraying costs of apprenticeship or other similar programs, or for other bona fide fringe benefits, but only where the Contractor or Subcontractor is not required by other federal or state law to provide any of the benefits as referenced in §290.210(5) RSMo 1994. Pay for travel, mileage, meals, bonuses, or other expenses are not fringe benefits and cannot be considered part of the workers wage rate. The Contractor shall not make any deductions for food, sleeping accommodations, transportation, use of small tools, uniforms, or anything of any kind or description, unless the Contractor and employee enter into an agreement in writing at the beginning of the worker's term of employment, and such agreement is approved by the Owner. In the event the contract contains more than one wage determination the Contractor shall comply with both.

**13.6.2** The Contractor shall submit to the Owner with the Contractor's periodic pay request, certified payroll records for labor performed by the Contractor and Subcontractors of any tier. The Contractor shall submit all required certified payroll information records electronically in pdf format using the Owner's web-based payment program. The certified payroll forms shall contain the name, address, personal identification number, and occupational title of the workers as well as the hours they work each day. The Owner's acceptance of certified payroll records does not in any way relieve the Contractor of any responsibility for the payment of prevailing wages to workers on the project. The Contractor shall also maintain copies of the certified payroll records. The Owner may, at any time, request copies of, and/or inspect all of the Contractor's payroll records for the Work to verify compliance. The Contractor shall furnish the Owner copies of payroll records within 10 days of the Owner's written request. The Contractor shall provide copies of workers I-9 forms within 24 hours of written notice. (If applicable, and required by Owner, the Contractor will demonstrate that the Contractor is enrolled and participating in a federal work authorization program with respect to the employees working in connection with this project.) Such payroll records shall be maintained in accordance with Article 13.7.1 and shall be available for inspection for two (2) years after final completion of the Work. The contractor further agrees, in the event the records are not presented as

requested, he will abide by any decision made by the Owner regarding underpayment of wages to workers and amounts owed them as well as liquidated damages for underpayment of wages. Falsification of the certified payroll records may result in the debarment of the contractor or subcontractor from future work with the University.

**13.6.3** The acquisition of products or services is subject to the supplier's conformance to the rules and regulations of the President's Committee on Equal Employment Opportunity (41 CFR, Ch. 60).

**13.6.4** The Contractor shall comply with the Copeland Regulations of the Secretary of Labor (29 CFR, Part 3), which are incorporated herein by reference. In addition, the Weekly Statement of Compliance required by these Regulations shall also contain a statement that the applicable fringe benefits paid are equal to or greater than those set forth in the minimum wage decision.

**13.6.5** Contractor acknowledges that violation of the requirements of Article 13.6 result in additional costs to Owner, including, but not limited to, cost of construction delays, of additional work for Owner's staff and legal expense. The cost of Contractor's violation of the provisions of Article 13.6 would be and is difficult to determine and establish. In the event that Contractor fails to comply with the provisions of this Article 13.6, Owner shall be entitled to retain or recover from the Contractor, as liquidated damages and not as a penalty, the sum of Fifty Dollars (\$50.00) per day per individual who is paid less than the applicable prevailing wage, to approximate the investigative cost resulting to the Owner for such violations. To approximate the delay costs, Owner shall be entitled to retain or recover from the Contractor, as liquidated damages and not as a penalty, the sum of One Hundred Dollars (\$100.00) per day for each day the Contract cannot be closed out and final payment made because of Contractor's failure to comply with the provisions of this Article 13.6. Such liquidated damages shall be collected regardless of whether the Work has been completed. The liquidated damages and other amounts set forth in this Article 13.6 shall be in addition to all other liquidated damages the Owner may be entitled to as set forth in the Contract Documents.

**13.6.6** The Owner may deduct liquidated damages described Article 13 and the amounts set forth in Article 13 from any unpaid amounts then or thereafter due the Contractor under the Contract. Any liquidated damages not so deducted from any unpaid amounts due the Contractor shall be payable to the Owner at the demand of the Owner.

**13.6.7** The Contractor shall specifically incorporate the obligations of Article 13 into the subcontracts, supply agreements and purchase orders for the Work and require the same of any Subcontractors of any tier.

**13.6.8** Contractor acknowledges and recognizes that a material factor in its selection by the Owner is the Contractor's willingness to undertake and comply with the requirements of this Article 13.6. If Contractor fails to comply with the provisions of this Article 13.6, Owner may, in its sole discretion, immediately terminate the Contract upon written notice. The rights and remedies of Owner provided herein shall not be exclusive and are in addition to other rights and remedies provided by law or under this Contract.

**13.6.9** Only such workers who are individually registered in a bona fide apprenticeship program approved by the U.S. Department of Labor, Office of Apprenticeship can be paid less than the journeyman rate of pay. "Entry Level Workers; must be registered apprentices. The apprenticeship ratio will be one to one with a journeyman of the same classification. Any worker not registered as an apprentice per this section will be paid as a journeyman.

**13.6.10** The Contractor shall post the wage rates for the contract in a conspicuous place at the field office on the project. On projects where there is no field office the Contractor may post the wage rates at their local office, as long as they provide a copy of the wage rates to a worker upon request. The wage rates shall be kept in a clearly legible condition for the duration of the project.

**13.6.11** Neither the Contractor, nor any Subcontractor of any tier, nor any person hired by them or acting on their behalf, shall request or demand that workers pay back, return, donate, contribute or give any part, or all, of said workers wages, salary, or any thing of value, upon the statement, representation or understanding that failure to comply with such request or demand will prevent such worker from procuring or retaining employment. The exception being to an agent or representative of a duly constituted labor organization acting in the collection of dues or assessments of such organization.

**13.6.12** No contractor or subcontractor may directly or indirectly receive a wage subsidy, bid supplement, or rebate for employment on this project if such wage subsidy, bid supplement, or rebate has the effect of reducing the wage rate paid by the employer on a given occupational title below the prevailing wage rate as provided in contract. In the event a wage subsidy, bid supplement, or rebate is provided or received, the entity receiving such subsidy, supplement, or rebate shall report the date and amount of such subsidy, supplement, or rebate to the University within thirty days of receipt of payment. This disclosure report shall be a matter of public record. Any employer not in compliance with this Article shall owe to the University double the dollar amount per hour that the wage subsidy, bid supplement, or rebate has reduced the wage rate paid by the employer below the prevailing wage rate for each hour that work was performed.

**13.6.13** Time and one half overtime will be paid on all hours over 10 hours per day or 40 hours per week. The wage rate is the total of the “Basic Hourly Rate” plus “Total Fringe Benefits” or the “public works contracting minimum wage”. For all work performed on a Sunday or Holiday, not less than twice the prevailing hourly rate of pay or public works contracting minimum wage will apply. Holidays are as follows: January first, the last Monday in May, July fourth, the first Monday in September, November 11, the fourth Thursday in November, December twenty-fifth. If any holiday falls on a Sunday, the following Monday shall be considered a holiday.

### **13.7 Records**

**13.7.1** The Owner, or any parties it deems necessary, shall have access to and the right to examine any accounting or other records of the Contractor involving transactions and Work related to this Contract for five (5) years after final payment or five (5) years after the final resolution of any on going disputes at the time of final payment. All records shall be maintained in accordance with generally accepted accounting procedures, consistently applied. Subcontractors of any tier shall be required by Contractor to maintain records and to permit audits as required of Contractor herein.

### **13.8 Codes and Standards**

**13.8.1** The Work shall be performed to comply with the International Code Council (ICC) Codes, and the codes and standards noted below. The latest editions and supplements of these Codes and Standards in effect on the date of the execution of the Contract for Construction shall be applicable unless otherwise designated in the Contract Documents. Codes and standards required by accreditation agencies will also be used unless the ICC requirements are more stringent. In the event that special design features and/or construction systems are not covered in the ICC codes, the applicable edition of the National Fire Protection Association (NFPA) family of standards and/or the NFPA 101 Life Safety Code shall be used.

- .1** ICC International Building Code and reference standards
- .2** ICC International Plumbing Code
- .3** ICC International Mechanical Code
- .4** NFPA 70 National Electric Code (NEC)
- .5** Americans with Disabilities Act – Standards for Accessible Design.
- .6** American National Standard Safety Code for Elevators, Dumbwaiters, Escalators, and Moving Walks as published by the American Society of Mechanical Engineers (ASME), American National Standards Institute (ANSI) A17.1
- .7** NFPA 101 Life Safety Code (as noted above)
- .8** American Concrete Institute (ACI)
- .9** American National Standards Institute (ANSI)
- .10** American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

- .11** American Refrigeration Institute (ARI)
- .12** American Society for Testing and Materials (ASTM)
- .13** Missouri Standard Specification for Highway Construction, Missouri State Highway Commission
- .14** National Electrical Manufacturers Association (NEMA)
- .15** Underwriter's Laboratories, Inc. (UL), Federal Specifications
- .16** Williams Steiger Occupational Safety and Health Act of 1970 (OSHA)

### **13.9 General Provisions**

**13.9.1** Any specific requirement in this Contract that the responsibilities or obligations of the Contractor also apply to a Subcontractor is added for emphasis and are also hereby deemed to include a Subcontractor of any tier. The omission of a reference to a Subcontractor in connection with any of the Contractor's responsibilities or obligations shall not be construed to diminish, abrogate or limit any responsibilities or obligations of a Subcontractor of any tier under the Contract Documents or the applicable subcontract.

**13.9.2** This Contract shall be interpreted, construed, enforced and regulated under and by the laws of the State of Missouri. Whenever possible, each provision of this Contract shall be interpreted in a manner as to be effective and valid under applicable law. If, however, any provision of this Contract, or a portion thereof, is prohibited by law or found invalid under any law, only such provision or portion thereof shall be ineffective, without invalidating or affecting the remaining provisions of this Contract or valid portions of such provision, which are hereby deemed severable. Contractor and Owner further agree that in the event any provision of this Contract, or a portion thereof, is prohibited by law or found invalid under any law, this Contract shall be reformed to replace such prohibited or invalid provision or portion thereof with a valid and enforceable provision which comes as close as possible to expressing the intention of the prohibited or invalid provision.

**13.9.3** Contractor and Owner each agree that the State of Missouri Circuit Court for the County where the Project is located shall have exclusive jurisdiction to resolve all Claims and any issue and disputes between Contractor and Owner. Contractor agrees that it shall not file any petition, complaint, lawsuit or legal proceeding against Owner in any other court other than the State of Missouri Circuit Court for the County where the Project is located.

**13.9.4** Owner's total liability to Contractor and anyone claiming by, through, or under Contractor for any Claim, cost, loss, expense or damage caused in part by the fault of Owner and in part by the fault of Contractor or any other entity or individual shall not exceed the percentage share that Owner's fault bears to the total fault of Owner, Contractor and all other entities and individuals as determined on the basis of comparative fault principles.

**13.9.5** Contractor agrees that Owner shall not be liable to Contractor for any special, indirect, incidental, or consequential damage whatsoever, whether caused by Owner's negligence, fault, errors or omissions, strict liability, breach of contract, breach of warranty or other cause or causes whatsoever. Such special, indirect, incidental or consequential damages include, but are not limited to loss of profits, loss of savings or revenue, loss of anticipated profits, labor inefficiencies, idle equipment, home office overhead, and similar types of damages.

**13.9.6** Nothing contained in this Contract or the Contract Documents shall create any contractual relationship with or cause of action in favor of a third party against the Owner.

**13.9.7** No member or officer of the Board of Curators of the University incurs or assumes any individual or personal liability under the Contract or by reason of the default of the Owner in the performance of any terms thereof. Contractor releases and discharges all members or officers of the Board of Curators of the University from any liability as a condition of and as consideration for the award of the Contract to Contractor.

**13.9.8** The Contractor hereby binds itself, its partners, successors, assigns and legal representatives to the Owner in respect to covenants, agreements and obligations contained in the Contract Documents. Contractor shall not assign the Contract or proceeds hereof without written consent of the Owner. If Contractor attempts to make such an assignment without such consent, it shall be void and confer no rights on third parties, and Contractor shall nevertheless remain legally responsible for all obligations under the Contract. The Owner's consent to any assignment is conditioned upon Contractor entering into a written assignment which contains the following language: "it is agreed that the funds to be paid to the assignee under this assignment are subject to performance by the Contractor and to claims and to liens for services rendered or materials supplied for the performance of the Work required in said Contract in favor of all persons, firms, corporations rendering such services or supplying such materials."

### **13.10 Certification**

**13.10.1** The contractor certifies to the best of its knowledge and belief that it and its principals are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency in accordance with Executive Order 12549 (2/18/86).

**13.10.2** If this contract is for \$100,000 or more, and if the Contractor is a company with ten (10) or more employees, then Contractor certifies that it, and any company affiliated with it, does not boycott Israel and will not boycott Israel during the term of this Contract. In this paragraph, the terms

"company" and "boycott Israel" shall have the meanings described in Section 34.600 of the Missouri Revised Statutes.

## **ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT**

### **14.1 Termination by Owner for Cause**

**14.1.1** In addition to other rights and remedies granted to Owner under the Contract Documents and by law, the Owner may terminate the Contract if the Contractor:

- .1** refuses or fails to supply enough properly skilled workers, superintendents, foremen, or managers;
- .2** refuses or fails to supply sufficient or proper materials;
- .3** fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;
- .4** disregards laws, ordinances, rules, or regulations or orders of a public authority having jurisdiction;
- .5** disregards the authority of the Owner's Representative or Architect;
- .6** breaches any warranty or representations made by the Contractor under or pursuant to the Contract Documents;
- .7** fails to furnish the Owner with assurances satisfactory to the Owner evidencing the Contractor's ability to complete the Work in compliance with all the requirements of the Contract Documents;
- .8** fails after commencement of the Work to proceed continuously with the construction and completion of the Work for more than ten (10) days, except as permitted under the Contract Documents;
- .9** fails to maintain a satisfactory rate of progress with the Work or fails to comply with approved progress schedules; or
- .10** violates in any substantial way any provisions of the Contract Documents.

**14.1.2** When any of the above reasons exist, the Owner may, without prejudice to any other rights or remedies of the Owner, terminate this Contract by delivering a written notice of termination to Contractor and Contractor's surety, and may:

- .1** take possession of the site and of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- .2** accept assignment of subcontracts pursuant to Paragraph 5.3; and
- .3** finish the Work by whatever reasonable method the Owner may deem expedient, including turning the Work over to the surety.

**14.1.3** The Contractor, in the event of a termination under Section 14.1, shall not be entitled to receive any further payments under the Contract until the Work is completed in its entirety. Then, if the unpaid balance under the Contract shall exceed all expenses of the Owner in finishing the Work,

including additional compensation for the Architects services and expenses made necessary thereby, such excess will be paid to the Contractor; but, if such expenses of Owner to finish the Work shall exceed the unpaid balance, the Contractor and its surety shall be liable for, and shall pay the difference and any damages to the Owner. The obligation of the Contractor and its surety for payment of said amounts shall survive termination of the Contract.

**14.1.4** In exercising the Owner's right to secure completion of the Work under any of the provisions hereof, the Owner shall have the right to exercise the Owner's sole discretion as to the manner, methods, and reasonableness of costs of completing the Work.

**14.1.5** The rights of the Owner to terminate pursuant to Article 14.1 will be cumulative and not exclusive and shall be in addition to any other remedy provided by law or the Contract Documents.

**14.1.6** Should the Contractor fail to achieve Final Completion of the Work within thirty (30) calendar days following the date of Substantial Completion, the Owner may exercise its rights under Article 14.1.

#### **14.2 Suspension by the Owner for Convenience**

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

**14.2.2** An adjustment will be made to the Contract Sum for increases in the cost of performance of the Contract caused by suspension, delay or interruption. However, in the event of a suspension under this Article 14.2, Contractor hereby waives and forfeits any claims for payment of any special, indirect, incidental or consequential damages such as lost profits, loss of savings or revenue, loss of anticipated profits, idle labor or equipment, home office overhead, and similar type damages. No adjustment will be made to the extent:

- .1 that performance is, was, or would have been so suspended, delayed or interrupted by another cause for which the Contractor in whole or in part is responsible, or
- .2 that an equitable adjustment is made or denied under another provision of this Contract.

#### **14.3 Owner's Termination for Convenience**

**14.3.1** The Owner may, at any time, terminate the Contract in whole or in part for the Owner's convenience and without cause. Termination by the Owner under this Paragraph shall be by a notice of termination delivered to the Contractor specifying the extent of termination and the effective date.

**14.3.2** Upon receipt of a notice of termination for convenience, the Contractor shall immediately, in

accordance with instructions from the Owner, proceed with performance of the following duties regardless of delay in determining or adjusting amounts due under this Paragraph:

- .1 cease operation as specified in the notice;
- .2 place no further orders and enter into no further subcontracts for materials, labor, services or facilities except as necessary to complete Work not terminated;
- .3 terminate all subcontracts and orders to the extent they relate to the Work terminated;
- .4 proceed to complete the performance of Work not terminated; and
- .5 take actions that may be necessary, or that the Owner may direct, for the protection and preservation of the terminated Work.

**14.3.3** Upon such termination, the Contractor shall recover as its sole remedy payment for Work properly performed in connection with the terminated portion of the Work prior to the effective date of termination and for items properly and timely fabricated off the Project site, delivered and stored in accordance with the Owner's instructions and for all Owner approved claims, costs, losses and damages incurred in settlement of terminated contracts with Subcontractors and suppliers. The Contractor hereby waives and forfeits all other claims for payment and damages, including, without limitation, anticipated profits, consequential damages and other economic losses.

**14.3.4** The Owner shall be credited for (1) payments previously made to the Contractor for the terminated portion of the Work, (2) claims which the Owner has against the Contractor under the Contract and (3) the value of the materials, supplies, equipment or other items that are to be disposed of by the Contractor that are part of the Contract Sum.

**14.3.5** Upon determination by a court that termination of Contractor or its successor in interest pursuant to Paragraph 14.1 was wrongful, such termination will be deemed converted to a termination for convenience pursuant to Paragraph 14.3, and Contractor's sole and exclusive remedy for wrongful termination is limited to recovery of the payments permitted for termination for convenience as set forth in Paragraph 14.3.

SECTION 1.E  
SPECIAL CONDITIONS

1. DEFINITIONS

a. "Drawings"

Drawings referred to in and accompanying Project Manual consist of Drawings prepared by and bearing name of below defined Architect, bearing 08.29.2022 and University Physicians Building – Ground Floor CHCC Clinic Renovation

b. Architect  
bcDesignGroup  
12101 W. 110<sup>th</sup> Street  
Suite 100  
Overland Park, KS 66210  
(913) 232-2123

c. Mechanical & Electrical Engineer  
Ross & Baruzzini  
6 South Old Orchard  
St. Louis, MO 63119  
(314) 918-8383

2. SPECIAL SCHEDULING REQUIREMENTS

a. Special scheduling requirements supplemental to the bid form; Section 1.A.: Refer to the Bid Form

3. SCOPE OF WORK

a. The Contractor shall furnish all labor, materials, tools, equipment necessary for, and incidental to, construction of this project as indicated on Drawings and specified herein.

b. Work shall include everything requisite and necessary to finish work properly, notwithstanding that every item of labor or materials or accessories required to make project complete may not be specifically mentioned.

c. General Description of Work:

(1) Project consists of the selective demolition and build back of a new Children's Cardiology Clinic on the ground floor of the

University Physicians Medical Building.

- (2) Demolition shall consist of selective removal of walls, ceilings, doors, flooring, casework and selective removal of MEP infrastructure.
- (3) Architectural work shall consist of new metal stud and gypsum board partitions, doors, frames and hardware, lay-in ceilings, casework and finishes.
- (4) Mechanical work shall consist of removing ductwork and air devices. Relocating an air terminal unit and its controls. Adding new air devices to serve the various spaces within scope and adding new air terminal units, piping, and controls.
- (5) Plumbing demolition work shall consist of removing select existing plumbing fixtures. Plumbing fit out of the project scope consists of providing new exam room sinks, restroom fixtures, all associated domestic water and sanitary/vent piping, and sawcutting of the existing slab for underfloor pipe installation.
- (6) Fire Protection work shall consist of removing existing sprinkler heads and arm-over piping, and providing new concealed sprinkler heads and arm-over piping coordinated with the new ceiling grid and other ceiling mounted devices.
- (7) Electrical work shall consist of removing and replacing receptacles, data devices, fire alarm devices, PA speakers, Antennas, and lighting.

#### 4. LOCATION

Work shall be performed under this Contract on campus of the University of Missouri – Columbia, at University Physicians Building.

#### 5. NUMBER OF CONSTRUCTION DOCUMENTS

- a. The Owner will provide electronic data files to the Contractor for their convenience and use in progressing the Work and the preparation of shop drawings or other submittal requirements required for construction of the referenced project. The electronic data files shall reflect Construction Documents and Bid Addenda only. These files will be transmitted subject to the following terms and conditions:
  - (1) The Owner makes no representation as to the compatibility of these files with the Contractor's hardware or software.

- (2) Data contained on these electronic files shall not be used by the Contractor or anyone else for any purpose other than as a convenience in progressing the Work or in the preparation of shop drawings or other required submittals for the referenced project. Any other use or reuse by the Contractor or by others will be at their own sole risk and without liability or legal exposure to Owner. The Contractor agrees to make no claim and hereby waive, to the fullest extent permitted by law, any claim or cause of action of any nature against the Owner and its consultants, contractors, agents, employees, and representatives that may arise out of or in connection with the use of the electronic files transmitted.
- (3) Furthermore, the Contractor shall, to the fullest extent permitted by law, indemnify and hold harmless the Owner and its consultants, contractors, agents, employees, and representatives, against all damages, liabilities or costs, including reasonable attorney's fees and defense costs, arising out of or resulting from the use of these electronic files.
- (4) These electronic files are not contract documents. Differences may exist between these electronic files and corresponding hard-copy construction documents. The Owner makes no representation regarding the accuracy or completeness of the electronic files you receive. In the event that a conflict arises between the signed or sealed hard-copy construction documents prepared by the Consultant and the electronic files, the signed and sealed hard-copy construction documents shall govern. The Contractor is responsible for determining if any conflict exists. By use of these electronic files, the Contractor is not relieved of their duty to fully comply with the contract documents.
- (5) Because information presented on the electronic files can be modified, unintentionally or otherwise, the Owner reserves the right to remove all indications of ownership and/or involvement from each electronic display.
- (6) Under no circumstances shall delivery of the electronic files be deemed a sale by the Owner and no warranties are made, either expressed or implied, of merchantability and fitness for any particular purpose. In no event shall the Owner be liable for any loss of profit, or any consequential damages as a result of use or reuse of these electronic files.

## 6. SUBMITTALS

- a. The Contractor shall submit for approval to the Architect, equipment lists and Shop Drawings, as expediently as possible. Failure of the Contractor to submit Shop Drawings in a timely manner will result in the Owner holding back Contractor payments. (See General



Conditions)

- b. The material and equipment lists shall be submitted and approved before any material or equipment is purchased and shall be corrected to as-built conditions before the completion of the project.
- c. The Contractor shall submit electronic versions of all required Shop Drawings, material and equipment lists. The Contractor shall upload all Shop Drawings to a secure information sharing website determined by the Owner notifying the Owner and Consultant that these shop drawings are available for review. Each submittal shall have the General Contractors digital stamp affixed to the first page signifying their review and acceptance. Review comments, approvals, and rejections will be posted on this same site with notification to the contractor. Submittals requiring a professional seal shall be submitted hard copy with a manual seal affixed.
  - (1) The Contractor shall identify each submittal item with the following:
    - (a) Project Title and Location
    - (b) Project Number
    - (c) Supplier's Name
    - (d) Manufacturer's Name
    - (e) Contract Specification Section and Article Number
    - (f) Contract Drawing Number
    - (g) Acrobat file name: Spec Section\_Times Submitted-Spec Title: 033000\_01-Cast In Place Concrete.pdf
  - (2) Reference the accompanying Shop Drawing and Submittal Log at the end of this section (1.E.3) for required submittal information.
- d. The Contractor shall submit to the Architect one (1) bound copy and one (1) electronic copy of all required Operating Instructions and Service Manuals for the Architect's and the Owner's sole use prior to completing 50% of the adjusted contract. Payments beyond 50% of the contract amount may be withheld until all Operating Instructions and Service Manuals are received as referenced in the accompanying Operating Instructions and Service Manual Log at the end of this section (1.E.4).
- e. The Contractor shall submit to the Owner's Representative all items referenced in the accompanying Closeout Log (1.E.5) within 30 days following substantial completion of the work. The Owner's Representative will maintain the closeout log and include as an

agenda item at all coordination meetings.

7. NOTIFICATION

Before beginning Demolition Work or service outages, the Contractor shall provide, at minimum, seventy-two (72) hours advance notice to Owner's Representative for purpose of verifying utility locations including, but not limited to, gas, telecommunications, electric, water, steam, sewer, and nitrogen. Contractor shall minimize the number of outages, minimize the length of outages and related work shall be continuous until the utility is restored.

8. USE OF PREMISES

a. Access: Access to construction site shall be as indicated on Drawings and as directed by the Owner's Representative.

b. Parking:

- (1) The Owner will issue Contractor Two (2) service vehicle parking permits for use in University Parking lot Lot CG1-NE, that is currently utilized for the MU Health Care – Children's Hospital Facility Construction Manager at Risk (Paric-Barton Malow). The permits will be issued at no cost to the contractor up to the contract completion date. After the contract completion date, the permits will be re-issued on an as available basis at the contractors expense. These permits are to be used for general contractor or subcontractor owned and labeled vehicles only. Personal vehicles are prohibited from use of these permits. Violation of this requirement may result in ticketing and/or towing at the vehicle owner's expense and suspension of progress payments.
- (2) Parking of personal vehicles within project access/lay down/staging areas is prohibited. Violation of this requirement may result in ticketing and/or towing at the vehicle owner's expense and suspension of progress payments.
- (3) Parking or driving on sidewalks, landscaped areas, within fire and service lanes or generally in areas not designated for vehicular traffic is prohibited except as allowed in the contract documents. Violation of this requirement may result in ticketing and/or towing at the vehicle owner's expense and suspension of progress payments.

- (4) Free parking for contractor employees is available in the Ashland Road Contractor lot on an as available basis. This space is for use by contractor employees for parking their personal vehicles only and is not to be used for staging or storage.
  - (5) Vendor Permits may be purchased by contractor management personnel on an as available basis by contacting the Parking and Transportation office in the Turner Avenue Parking Structure. These permits will allow contractor management personnel to park in various University lots while conducting business on University construction projects.
  - (6) Temporary University parking permits may be purchased by contractor employees for use with their personal vehicles on an as available basis by contacting the Parking and Transportation office in the Turner Avenue Parking Structure.
  - (7) Conley Avenue between Missouri Avenue and University Avenue and Hitt Street between University Avenue and the Memorial Union are designated for pedestrian use only during the work week between the hours of 8:15 AM and 3:45 PM. Unless otherwise indicated in the contract documents, this area is strictly off limits to vehicular traffic without authorization from the Owner's Representative.
- c. Storage of materials: The Contractor shall store all materials within project limits. The Contractor shall confine apparatus, materials, and operation of workers to location established by the Owner's Representative. The Contractor shall not unreasonably encumber premises with materials. **In addition, storage trailer locations may be available within 1-1/2 miles of project site as directed by the Owner's Representative.** Storage trailer locations shall be subject to approval by the Owner's Representative and are available to the Contractor without cost.
- d. Utilities: Drinking water, water required to carry on work, and 120 volt electrical power required for small tool operation may be obtained without cost to the Contractor from existing utilities at locations designated by the Owner's Representative. Provisions for obtaining power, including temporary extensions, shall be furnished and maintained by the Contractor. Upon completion of work such extensions shall be removed and any damage caused by use of such extensions shall be repaired to satisfaction of the Owner's Representative, at no cost to the Owner.

- e. Restroom: Existing toilet facilities within Project Limits or Restrooms designated by the Owner's Representative for use by the Contractor will be available. Failure of the Contractor to maintain restrooms in a clean condition will be cause for the Contractor's discontinued use of the restroom.
- f. Smoking is prohibited at the University of Missouri and all properties owned, operated, leased or controlled by the University of Missouri. Violation of the policy is defined as smoking any tobacco products, including e-cigarettes.
- g. Landfill: The Contractor shall not use the Owner's landfill. Dumping or disposal of excavated or demolition materials on Owner's property shall not be permitted. The Contractor shall remove and legally dispose of excavated or demolished materials off the Owner's property.
- h. Care of Project Work Site: The contractor shall be responsible for maintaining the construction site in a reasonably neat and orderly condition by regular cleaning and mowing of the premises as determined by the Owner's Representative.
- i. Discharge to Sewer Request: The University of Missouri's MS4 permit and NPDES Storm Water Discharge Permits along with the City of Columbia's POTW Operating Permit as well as local ordinances, and state and federal environmental regulations prohibit hazardous materials from being disposed into either the storm water or sanitary sewer systems. Unless specifically approved, all chemical products such as paints, dyes, lawn care products, maintenance products, and oil is are prohibited from drain disposal. Any product, including contaminated water, being discarded into the storm water or sanitary sewer systems requires written approval from the Owner through a formal "Discharge to Sewer Request" form obtained at [Discharge to Sewer Request Form](#). The contractor should submit the form to the Owner's Representative, not to the Department of Environmental Health and Safety as the form indicates.
- j. All concrete waste material including washout water shall be totally contained and removed from the Owner's property.
- k. Artifacts Found During Construction: Contractor shall immediately notify the Owner's Representative when artifacts are uncovered or found during the demolition or construction process. Artifacts include, but are not limited to, tools, drawings (construction or other), photographs, books and other objects/devices which may hold historical importance/significance. Do not remove or disturb the

object(s) in question. Artifacts are not considered part of demolished materials and shall remain the property of the University of Missouri.

1. **“Permit Required Confined Space” Entry Communication and Coordination**

(See OSHA 1926 subpart aa – Construction Confined Space for the definition of “permit required confined spaces” - Note: OSHA does not apply to the University. However, the University will provide a list of all known “permit required confined spaces”)

There are no known “permit required confined spaces” within the project limits. Each contractor shall conduct a survey to confirm whether or not any confined spaces exist within the project limits. It is incumbent upon each contractor to list all “permit required spaces”.

The Contractor shall notify the Owner’s Representative if 1) conditions change resulting in a non-permit required confined space being reclassified to a “permit required confined space” after evaluation of the space by a competent person; 2) a space previously thought to be non-permit required space is classified as a “permit required confined space”; or 3) during the course of construction a “permit required confined space” is created after evaluation by a competent person.

The Contractor shall submit to the Owner’s Representative a copy of the cancelled confined space entry permit and a written report summarizing the permit space program followed and all hazards confronted or created during entry operations. This information shall be submitted within one week of cancelling the permit.

9. PROTECTION OF OWNER'S PROPERTY

- a. The Contractor shall be responsible for repair of damage to building exterior and interior, drives, curbs, streets, walks, grass, shrubbery and trees, which was caused by workmen or equipment employed during progress of work. All such repairs shall be made to satisfaction of the Owner's Representative, at no cost to the Owner, or reimburse the Owner if the Owner elects to make repairs. For landscape damage, the Owner shall make such repairs. Compensation for these repairs shall be determined by the Owner's Representative using the "Valuation of Landscape Trees, Shrubs, and other Plants" as published by the International Society of Arboriculture, as last revised.
- b. Construction Project Fencing:

- (1) Fencing will not be required as a part of work.
- c. Preserving and Protecting Existing Vegetation:
- (1) Plants within work area designated for removal shall be removed by Contractor.
  - (2) To prevent compaction of soil over tree roots, vehicles or equipment shall not at any time park or travel over, nor shall any materials be stored within drip line of trees designated to remain.
  - (3) Area within drip line of trees and shrubs shall be protected from work area by use of a standard 60" high woven plastic or woven wire fence mounted on standard steel posts set not more than 10' apart. Tree protection shall be removed during work in area of protection only when necessary to perform grading and other work required by Drawings and only as authorized by Owner's Representative.
  - (4) Pruning of limbs necessary to repair damage or provide clearance for work shall be done by the MU Landscape Services Department done by approved, trained tree maintenance personnel at the direction of the Owner's Representative. Limbs shall be cut off cleanly and cut surfaces treated according to established horticultural standards.

#### 10. SUBSTITUTIONS and EQUALS

**[Choose one of the following sections and allow a minimum of 4 weeks if limiting substitutions to the bid phase only.]**

- a. Substitutions are defined in General Conditions article 3.11.8 for and Equals are defined General Conditions Article 3.12 .
- b. Use of materials, products or equipment other than those named and described in the Contract Documents are substitutions and/or equal. Substitutions and/or equals submitted during the bidding period shall be received by both the Architect and the Owner at least ten calendar days prior to the date for receipt of bids. To be considered, bidder's proposal shall include a complete description of the proposed substitution and/or equal and a comparison of significant qualities of the proposed substitution and/or equal with those specified including drawings, performance and test data, and other information necessary for an evaluation. The Architect's decision on

the approval or disapproval of a proposed substitution and/or equal shall be final.

- c. If the Architect and Owner approve a proposed substitution prior to receipt of Bids, such approval will be set forth in an Addendum. Bidders shall not rely upon approval made in any other manner.
- d. No substitutions and/or equal will be allowed for the following items:

<u>Item</u>	<u>Specification Section</u>
Lock Cylinders [Best]	08710

## 11. CODES AND STANDARDS

The Contractor shall comply with applicable codes and standards as listed in General Conditions. The following codes and standards shall also apply:

- a. City of Columbia - Sewer Line Installation Standards - Department of Public Works

“All sanitary sewer construction shall be in accordance with the City of Columbia Specifications and Standards and in conformance with the rules and regulations of the Missouri Clean Water Commission.”

## 12. PERMITS

- a. The owner has hired a third party Code Inspection Agency, George Butler & Associates (GBA) for this project. The owner will secure a building permit and furnish to the contractor prior to construction commencing on site. A temporary Certificate of Occupancy and Certificate of Occupancy process will be incorporated into this project.
- b. The contractor shall be responsible for coordinating inspections with GBA.
- c. Before commencement of Boilers, Water Heaters or Pressure Vessels the Contractor must obtain an installation permit from the State of Missouri, Division of Fire Safety, Boiler and Pressure Unit as required by 11 CSR 40-2.010 through 11 CSR 40-2.065. The permit applications are available at <http://www.dfs.dps.mo.gov/programs/bpv/> .

## 13. SPECIALTIES: NOT USED

## 14. PRE-BID INSPECTION

All pre-bid inspections of work areas shall be scheduled with pre-bid

inspection guide, telephone: (573) 882-2228].

- 15. ROOF WARRANTY REQUIREMENT: NOT USED
- 16. MODIFICATIONS TO INFORMATION TO BIDDERS
  - a. Information to Bidders:

- (1) Referenced Information to Bidders, Page IFB/6.  
Add new Article 15.9.2 as follows:

**15.9.2.1** Within 48 hours of the receipt of bids, the apparent low bidder shall submit to the Director of Facilities Planning and Development an “Affidavit of Supplier Diversity Participation” for every diverse subcontractor or supplier the bidder intends to award work to on the contract. The affidavit will be signed by both the bidder and the diverse firm.

- 17. MODIFICATION TO INFORMATION FOR BIDDERS: BIDDERS STATEMENT OF QUALIFICATIONS: NOT USED
- 18. MODIFICATIONS TO GENERAL CONDITIONS: NOT USED
- 19. PROJECT SCHEDULING

The project scheduling specification for the project are included immediately after the Special Conditions. For this project the Contractor shall meet the following scheduling requirements.

Option 3: Contractor Schedule – Contractor is responsible for the schedule and he may provide with in-house personnel or hire a third party scheduling consultant. See Contractor Schedule Specification included in these documents.

- 20. PROJECT COORDINATION
  - a. Coordinate construction operations included in various Sections of these Specifications to assure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different Sections that depend on each other for proper installation, connection, and operation.
    - (1) Schedule construction operations in the 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 to assure maximum accessibility for required maintenance, service, and repair.
    - (3) Make provisions to accommodate items scheduled for later installation.
  - b. Coordination Drawings: Within 45 days of Notice to Proceed provide coordination drawings for the integration of the Work, including work first shown in detail on shop drawings or product data. Show sequencing and relationship of separate units of work which must interface in a restricted manner to fit in the space provided, or function as indicated.
    - (1) Show the interrelationship of components shown on separate shop drawings.
    - (2) Indicate required installation sequences.
    - (3) Call attention in advance to Architect of any dimensional or detail information needed to complete the coordination drawings.
21. PROJECT PARTNERING: NOT USED
  22. VALUE ENGINEERING: NOT USED
  23. BUILDING SYSTEM COMMISSIONING: NOT USED
  24. MECHANICAL, ELECTRICAL, PLUMBING (MEP) PRE-INSTALLATION MEETING(S)
    - a. Before the start of MEP installation, the Owner's Representative will convene an MEP pre-installation meeting. Meeting participants to include contractor (including MEP subcontractors), Owner's Representative and additional contractor and University operational staff invited by the Owner's Representative. Topics will include underground rough-ins, steam piping, chilled water piping, sprinkler piping, hot water piping, electrical system, duct, telephone/data wiring, control wiring. Additional meetings will be conducted as required for the review of coordination drawings and scope specific installations. Cross section drawings of corridor ceilings and other congested areas will be of highest priority and will be reviewed prior to the start of installations in the affected areas. Meeting minutes and sign-up sheet will be transcribed by contractor and distributed

to attendees.

25. COST BREAKOUT FOR OWNER'S ACCOUNTING PURPOSES: NOT USED

26. PROJECT MANAGEMENT/COMMUNICATION REQUIREMENTS

- a. The Contractor shall be represented at the site by a full-time, competent superintendent with no other assigned duties or responsibilities from the beginning of the work until its final acceptance, unless otherwise permitted by the Owner's Representative. The superintendent for the Contractor for the general building work shall exercise general supervision over all subcontractors of any tier engaged on the work with decision-making authority of the Contractor.
- b. The Contractor shall use a current industry standard (Primavera, Microsoft Project, etc.) project scheduling software which provides as a minimum: Critical paths, milestones, estimated and actual start and completion dates, scheduled vs. actual progress, and detailed task and subtask breakdown. The following schedules shall be provided as a minimum and kept current: Overall project schedule, four- (4-) week look-ahead, and two- (2-) week look-ahead.
- c. The Contractor shall furnish on-site Internet access for use by his Project Manager and superintendent. . The contractor shall utilize the Owner's secure information sharing system for submittals, construction payment process, change orders, RFI's/ASI's, O&M manuals and all other project manual requirements as directed by the Owner's Representative. Field staff are also required to utilize this software as directed by the Owner's Representative.
- d. The Contractor shall provide his on-site superintendent with a handheld cellular telephone.

27. SAFETY PRECAUTIONS AND PROGRAMS

- a. The Bidder's Statement of Qualifications includes a requirement that the Bidder provide its Worker's Compensation Experience Modification Rates (EMR) and Incidence Rates for the three recent years. The Bidder shall also include the EMR and Incidence Rates of listed major subcontractors on the Bid for Lump Sum Contract. If the EMR exceeds 1 or the Incidence Rate exceeds 13, the Contractor or major subcontractor shall take additional safety measures including, but not limited to, developing a site specific safety plan and

assigning a Safety Manager to the Project to perform inspections on a schedule as determined acceptable by the Owner with written reports to be submitted to the Owner. The Owner reserves the right to reject a Bidder or major subcontractor whose rates exceed these stated rates.

- b. The contractor shall provide Emergency Contact Information for the Contractor's on-site staff and home office management as well as contact information for all major subcontractor personnel. This information shall contain business and personal phone numbers for each individual for contact during or after hours in case of an emergency. This information shall be submitted within 15 days of the Notice to Proceed.

## 28. HOT WORK PERMITTING AND GENERAL REQUIREMENTS

Hot work Requirements: The contractor shall comply with the following hot work requirements and the requirements of the International Fire Code and 2014 NFPA 51B.

- a. Hot work shall be defined as any work involving burning, welding, grinding, cutting, or similar operations that are capable of initiating fires or explosions.
- a. The Contractor shall utilize the hot work permit decision tree and permit provided by MUHC (based upon the 2014 NFPA 51B) for all Hot Work operations.
- b. A hot work permit shall be used on all hot work performed outside a designated hot work area. The hot work permit shall be posted and clearly visible within proximity of the hot work area. The hot work permit authorizing individual (PAI) shall be as designated by the Contractor.
- c. Notify the MUHC Engineering Services 24 hours prior to starting hot work in buildings with operational fire alarm or fire suppression systems.
- d. MUHC will collect and file Hot Work Permits.

## 29. GENERAL REQUIREMENTS FOR CRANE AND HOISTING OPERATIONS: NOT USED

## 30. CONSTRUCTION WASTE MANAGEMENT: NOT USED

## 31. WARRANTY WALKTHROUGH

Contractor shall attend a walk-thru with the Owner at 11 months after acceptance to review and document any warranty items to be addressed as part of the 12 month warranty stated in article 3.1 of the General Conditions.

**END OF SECTION**

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## Option #3 – Contractor Schedule

### 1. GENERAL

a) Time is of the essence for this contract.

The time frames spelled out in this contract are essential to the success of this project. The University understands that effective schedule management, in accordance with the General Conditions and these Special Conditions is necessary to insure that the critical milestone and end dates spelled out in the contract are achieved.

b) Related Documents

Drawings and general provisions of the Contract, including General Conditions' Article 3.17 shall apply to this Section.

c) Stakeholders

A Stakeholder is anyone with a stake in the outcome of the Project, including the University, the University Department utilizing the facility, the Design Professionals, the Contractor and subcontractors.

d) Weather

(1) Contractor acknowledges that there will be days in which work cannot be completed due to the weather, and that a certain number of these lost days are to be expected under normal weather conditions in Missouri.

(2) Rather than speculate as to what comprises "normal" weather at the location of the project, Contractor agrees that it will assume a total of 44 lost days due to weather over the course of a calendar year, and include same in its as planned schedule. For projects of less than a calendar year, lost weather days should be prorated for the months of construction in accordance with the following schedule.

(3) Anticipated weather days for allocation/proration only. For projects lasting 12 months or longer, the 44 days per year plus whatever additional months are included will constitute normal weather.

Jan – 5 days	Feb – 5 days	Mar – 4 days	Apr – 4 days
May – 3 days	Jun – 3 days	Jul – 2 days	Aug – 2 days
Sep – 3 days	Oct – 4 days	Nov – 4 days	Dec – 5 days

### 2. SCHEDULING PROCESS

a) The intent of this section is to insure that a well-conceived plan, that addresses the milestone and completion dates spelled out in these documents, is developed with input from all stakeholders in the project. Input is limited to all reasonable requests that are consistent with the requirements of the contract documents, and do not prejudice the Contractor's ability to perform its work consistent with the contract documents.

Further, the plan must be documented in an understandable format that allows for each stakeholder in the project to understand the plan for the construction

and/or renovation contained in the Project.

b) Contractor Requirements

(1) Schedule Development

Contractor shall prepare the Project Schedule using Primavera P3 or Oracle P6.

(2) Schedule Development

Within 4 weeks of the NTP, contractor shall prepare a schedule, in CPM format, that reflects the contractor's and each subcontractors plan for performing the contract work.

Contractor shall review each major subcontractor's schedule with the sub and obtain the subcontractor's concurrence with the schedule, prior to submitting to the University.

(3) Schedule Updates.

(a) Schedule Updates will be conducted once a month, at a minimum.

Actual Start and Finish dates should be recorded regularly during the month. Percent Complete, or Remaining Duration shall be updated as of the data date, just prior to Contractor's submittal of the update data.

(b) Contractor will copy the previous months schedule and will input update information into the new monthly update version.

(c) Contractor will meet with the Owner's Representative to review the draft of the updated schedule. At this meeting, Owner's Representative and Contractor will:

- (i) Review out of sequence progress, making adjustments as necessary,
- (ii) Add any fragnets necessary to describe changes or other impacts to the project schedule and
- (iii) Review the resultant critical and near critical paths to determine any impact of the occurrences encountered over the last month.

(4) Schedule Narrative

After finalization of the update, the Contractor will prepare a Narrative that describes progress for the month, impacts to the schedule and an assessment as to the Contractor's entitlement to a time extension for occurrences beyond its control during the month and submit in accordance with this Section.

(5) Progress Meetings

(a) Review the updated schedule at each monthly progress meeting.

Payments to the Contractor may be suspended if the progress schedule is not adequately updated to reflect actual conditions.

(b) Submit progress schedules to subcontractors to permit coordinating their progress schedules to the general construction work. Include 4 week look ahead schedules to allow subs to focus on critical upcoming work.

3. CRITICAL PATH METHOD (CPM)

- a) This Section includes administrative and procedural requirements for the critical path method (CPM) of scheduling and reporting progress of the Work.
- b) Refer to the General and Special Conditions and the Agreement for definitions and specific dates of Contract Time.
- c) Critical Path Method (CPM): A method of planning and scheduling a construction project where activities are arranged based on activity relationships and network calculations determine when activities can be performed and the critical path of the Project.
- d) Critical Path: The longest continuous chain of activities through the network schedule that establishes the minimum overall project duration.
- e) Network Diagram: A graphic diagram of a network schedule, showing the activities and activity relationships.
- f) Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling, the construction project. Activities included in a construction schedule consume time and resources.
- g) Critical activities are activities on the critical path.
- h) Predecessor activity is an activity that must be completed before a given activity can be started.
- i) Milestone: A key or critical point in time for reference or measurement.
- j) Float or Slack Time: The measure of leeway in activity performance. Accumulative float time is not for the exclusive use or benefit of the Owner or Contractor, but is a project resource available to both parties as needed to meet contract milestones and the completion date.
- k) Total float is herein defined as the measure of leeway in starting or completing an activity without adversely affecting the planned project completion date.
- l) Weather: Adverse weather that is normal for the area must be taken into account in the Contractor's Project Schedule. See 1.d.3, above.
- m) Force Majeure Event: Any event that delays the project but is beyond the control and/or contractual responsibility of either party.
- n) Schedule shall including the following, in addition to Contractor's work.
  - (1) Phasing: Provide notations on the schedule to show how the sequence of the Work is affected by the following:
    - (a) Requirements for phased completion and milestone dates.
    - (b) Work by separate contractors.
    - (c) Work by the Owner.
    - (d) Coordination with existing construction.
    - (e) Limitations of continued occupancies.
    - (f) Uninterruptible services.
    - (g) Partial occupancy prior to Substantial Completion.
    - (h) Area Separations: Use Activity Codes to identify each major area of construction for each major portion of the Work. For the purposes of this Article, a "major area" is a story of construction, a separate building, or a similar significant construction element.

#### 4. TIME EXTENSION REQUESTS

- a) Refer to General Conditions of the Contract for Construction, Article 4.7 Claims for Additional Time.



b) Changes or Other Impacts to the Contractor's Work Plan

The Owner will consider and evaluate requests for time extensions due to changes or other events beyond the control of the Contractor on a monthly basis only, with the submission of the Contractor's updated schedule, in conjunction with the monthly application for payment. The Update must include:

- (1) An activity depicting the event(s) impacting the Contractor's work plan shall be added to the CPM schedule, using the actual start date of the impact, along with actually required predecessors and successors.
- (2) After the addition of the impact activity(ies), the Contractor will identify subsequent activities on the critical path, with finish to start relationships that can be realistically adjusted to overlap using good, standard construction practice.
  - (a) If the adjustments above result in the completion date being brought back within the contract time period, no adjustment will be made in the contract time.
  - (b) If the adjustments above still result in a completion date beyond the contract completion date, the delay shall be deemed excusable and the contract completion date shall be extended by the number of days indicated by the analysis.
  - (c) Contractor agrees to continue to utilize its best efforts to make up the time caused by the delays. However the Contractor is not expected to expend costs not contemplated in its contract, in making those efforts.

Questions of compensability of any delays shall be held until the actual completion of the project. If the actual substantial completion date of the project based on excusable delays, excluding weather delays, exceeds the original contract completion date, AND there are no delays that are the responsibility of the contractor to consider, the delays days shall be considered compensable. The actual costs, if any, of the Contractor's time sensitive jobsite supervision and general conditions costs, shall be quantified and a change order issued for these costs.

### SHOP DRAWING AND SUBMITTAL LOG

Project: University Physicians Medical Building – Ground Floor CHCC Clinic Renovation

Project Number: CP221951

Contractor:

Section	Description	Contractor	Date Rec'd	#	Date Sent to Cons.	Date Ret'd	Remarks	Date ret'd	Cont'r	Copies To Owner	File
02 4119	Proposed Dust-Control and Noise-Control Measures										
	Schedule of Selective Demolition Activities										
	Inventory										
	Predemolition Photographs and Videotape										
06 4023	Product Data										
	Shop Drawings										
	Samples for Verification										
	Product Certificates										
07 8413	Product Data										
	Shop Drawings										
	Qualification Data										

	Product Certificates							
	Product Test Reports							
07 8446	Product Data							
	Shop Drawings							
	Product Certificates							
	Qualification Data							
	Compatibility and Adhesion Test Reports							
	Evaluation Reports							
	Research/Evaluation Reports							
07 9200	Product Data							
	Samples for Initial Selection							
	Product Certificates							
	Product Test Reports							
08 1113	Product Data							

	Shop Drawings							
	Door Schedule							
08 1416	Product Data							
	Shop Drawings							
	Samples for Verification							
08 7111	Product Data							
	Hardware Schedule							
08 8000	Product Data							
	Samples							
	Glazing Schedule							
	Product Certificates							
	Qualification Data							
09 2116	Product Data							
	Shop Drawings							

09 5113	Product Data							
	Maintenance Data							
09 6513	Product Data							
	Samples							
09 6516	Product Data							
	Samples for Verification							
	Heat-Welded Seam Samples							
	Qualification Data							
	Maintenance Data							
09 6519	Product Data							
	Samples for Verification							
	Maintenance Data							
09 6813	Product Data							
	Shop Drawings							

	Samples									
	Product Schedule									
	Maintenance Data									
09 9100	Product Data									
	Samples for Verification									
	Qualification Data									
10 2813	Product Data									
	Setting Drawings									
	Product Schedule									
	Maintenance Data									
200800	SEISMIC PROTECTION									
	PRODUCT DATA									
230500	BASIC MECHANICAL MATERIALS AND METHODS									
	PRODUCT DATA									
	COORDINATION DRAWINGS									
230513	MOTORS									
	PRODUCT DATA									

230519	METERS AND GAGES										
	PRODUCT DATA										
	PRODUCT CERTIFICATES										
230523	VALVES										
	PRODUCT DATA										
230593	TEST-ADJUST-BALANCE										
	TAB REPORT										
230700	MECHANICAL INSULATION										
	PRODUCT DATA										

Section	Description	Contractor	Date Rec'd	#	Date Sent to Cons.	Date Ret'd	Remarks	Date ret'd	Cont'r	Copies To Owner	File
	MATERIAL SAFETY DATA SHEET										
230900	CONTROL SYSTEMS										
	SHOP DRAWINGS										
232113	HYDRONIC PIPING										
	PRODUCT DATA										
	QUALIFICATION DATA										
	FIELD QUALITY CONTROL TEST REPORTS										
233113	METAL DUCTS										
	PRODUCT DATA										
	COORDINATION DRAWINGS										
	FIELD QUALITY-CONTROL TEST REPORTS										

	RECORD DOCUMENTS										
233300	DUCT ACCESSORIES										
	PRODUCT DATA										
233600	AIR TERMINAL UNITS										
	PRODUCT DATA										
	SHOP DRAWINGS										
	COORDINATION DRAWINGS										
	FIELD QUALITY-CONTROL REPORTS										
233713	DIFFUSERS, REGISTERS, AND GRILLES										
	PRODUCT DATA										
262726	WIRING DEVICES										
	SHOP DRAWINGS										
260293	LIGHTING CONTROL DEVICES										
	SHOP DRAWINGS										
265100	LIGHTING FIXTURES										
	SHOP DRAWINGS										
211100	WATER BASED FIRE SUPPRESSION SYSTEMS										
	PRODUCT DATA										
	CALCULATIONS										
	RECORD DOCUMENTS										
	STATE SUBMITTAL										
	AS-BUILT DRAWINGS										
220523	GENERAL DUTY VALVES FOR PLUMBING PIPING										



	PRODUCT DATA										
220529	HANGERS AND SUPPORTS FOR PLUMBING PIPING										
	PRODUCT DATA										
220553	IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT										
	PRODUCT DATA										
220719	PLUMBING PIPING INSULATION										
	PRODUCT DATA										
221116	DOMESTIC WATER PIPING										
	PRODUCT DATA										
	AS-BUILT DRAWINGS										
221316	SANITARY WASTE AND VENT AND STORM PIPING										
	PRODUCT DATA										
221319	SANITARY WASTE AND VENT AND STORM PIPING SPECIALTIES										
	PRODUCT DATA										
224000	PLUMBING FIXTURES										
	PRODUCT DATA										

OPERATING INSTRUCTIONS AND SERVICE MANUAL LOG

Project: University Physicians Medical Building – Ground Floor CHCC Clinic Renovation

Project Number: CP221951

Contractor:

Section	Description	Catalog Data	Wiring Diagrams	Installation Instructions	Service & Maintenance Instructions	Parts List & Availability	Performance Curves	Startup & Operating Instructions
230519	METERS AND GAGES							
	OPERATION AND MAINTENANCE DATA				X			
230523	VALVES							
	MAINTENANCE DATA			X	X			
232113	HYDRONIC PIPING							
	OPERATION AND MAINTENANCE DATA				X			
233300	DUCT ACCESSORIES							
	OPERATION AND MAINTENANCE DATA				X			
233600	AIR TERMINAL UNITS							
	OPERATION AND MAINTENANCE DATA			X	X			
233300	DUCT ACCESSORIES							
	EXTRA MATERIALS							
233300	DUCT ACCESSORIES							
	EXTRA MATERIALS							
262726	WIRING DEVICES							
	OPERATION AND MAINTENANCE DATA							
260293	LIGHTING CONTROL DEVICES							

	OPERATION AND MAINTENANCE DATA							
265100	LIGHTING FIXTURES							
	OPERATION AND MAINTENANCE DATA							
211100	WATER BASED FIRE SUPPRESSION SYSTEMS							
	OPERATION AND MAINTENANCE DATA							
221116	DOMESTIC WATER PIPING							
	OPERATION AND MAINTENANCE							
224000	PLUMBING FIXTURES							
	OPERATION AND MAINTENANCE							
220523	GENERAL DUTY VALVES FOR PLUMBING PIPING							
	OPERATION AND MAINTENANCE							
221316	SANITARY WASTE AND VENT AND STORM PIPING							
	OPERATION AND MAINTENANCE							
221319	SANITARY WASTE AND VENT AND STORM PIPING SPECIALTIES							
	OPERATION AND MAINTENANCE							

CLOSEOUT LOG

Project: University Physicians Medical Building – Ground Floor CHCC Clinic Renovation

Project Number: CP221951

Contractor:

Section	Description	Contractor/Subcontractor	Date Rec'd	# of Copies	CPM Initials	Remarks
GC/3.11	As-Built Drawings					
GC/13.5.6	Final Affidavit of Supplier Diversity Participation for each Diverse Firm					
SC/20	Executed commissioning plan w/ required documentation					
	List special warranties and guarantees for each section					
	List any required maintenance stock, spare parts, etc.					
	List any special tools, keys, etc.					
08 1416	Special Warranties					
262726	WIRING DEVICES					
	RECORD DOCUMENTS					
260293	LIGHTING CONTROL DEVICES					
	RECORD DOCUMENTS					
265100	LIGHTING FIXTURES					
	RECORD DOCUMENTS					
	OPERATION AND MAINTENANCE					
DIV 21	FIRE PROTECTION					
	AS-BUILT DRAWINGS					
DIV 22	PLUMBING					
	AS-BUILT DRAWINGS					

DIV 23	MECHANICAL					
	AS-BUILT DRAWINGS					

# CP221951 UPMB Grnd Flr CHCC Clinic Renovation Quality Assurance Log

	Verified by:		Date compl	Coord Initial	Documentation Required	Owner Witness Required
Commissioning Items by CSI Division	Name	Firm				
<i>1</i>						
<b>Building System Commissioning</b>						
Commissioning Agent - Conduct pre-installation meetings per specifications.					Meeting Minutes	<input checked="" type="checkbox"/>
<i>24119</i>						
<b>Selective Demolition</b>						
Do not start demolition until utility disconnect and sealing has been verified in writing						<input checked="" type="checkbox"/>
<i>78413</i>						
<b>Through-Penetration Firestop Systems</b>						
Build mockup as specified					Inspection Report	<input checked="" type="checkbox"/>
Conduct a preinstallation conference at project site per specifications					Meeting Minutes	<input checked="" type="checkbox"/>
Perform Field Quality Control section of specifications					Test Report	<input checked="" type="checkbox"/>
<i>78446</i>						
<b>Fire-Resistive Smoke Joint Systems</b>						
Perform Field Quality Control section of specifications					field report	<input checked="" type="checkbox"/>
<i>79200</i>						
<b>Joint Sealants</b>						
Clean out joints immediately before installing joint sealant						<input checked="" type="checkbox"/>

Commissioning Items by CSI Division		Verified by: Name	Firm	Date compl	Coord Initial	Documentation Required	Owner Witness Required
<b>81113</b>							
<b>Hollow Metal Doors and Frames</b>							
Inspect label for fire rated doors and frames						itemized list of doors	<input checked="" type="checkbox"/>
<b>81416</b>							
<b>Flush Wood Doors</b>							
Inspect label for fire rated doors and frames						Door List	<input checked="" type="checkbox"/>
Perform Field Quality Control section of specifications						field report	<input checked="" type="checkbox"/>
<b>87111</b>							
<b>Door Hardware</b>							
Perform Demonstration and Training section of specifications						Sign-in Sheet	<input checked="" type="checkbox"/>
Perform Field Quality Control section of specifications						Test Report	<input checked="" type="checkbox"/>
Verify that all fire doors close and latch positively						test report	<input type="checkbox"/>
<b>88000</b>							
<b>Glazing</b>							
Wash clear glass on both faces not more than 4 days prior to punch list inspection							<input type="checkbox"/>
<b>92116</b>							
<b>Gypsum Board Assemblies</b>							
Verify fire rating compliance is maintained, including all wall penetrations. Ensure walls stenciled as specified						inspection report	<input checked="" type="checkbox"/>

Commissioning Items by CSI Division	Verified by:		Date compl	Coord Initial	Documentation Required	Owner Witness Required
	Name	Firm				
<b>95113</b>						
<b>Acoustical Panel Ceilings</b>						
Provide Extra Material as specified					Transmittal	<input checked="" type="checkbox"/>
<b>Acoustical Panel Ceilings</b>						
Complete all above ceiling inspections prior to installation of tiles						<input checked="" type="checkbox"/>
<b>96513</b>						
<b>Resilient Base</b>						
Provide Extra Material as specified					Transmittal	<input checked="" type="checkbox"/>
<b>96519</b>						
<b>Luxury Resilient Tile Flooring</b>						
Perform pH, Chloride (moisture) and bond tests per manufacturer. Do not proceed until all manufacturing requirements are met.					test reports	<input checked="" type="checkbox"/>
Provide Extra Material as specified					Transmittal	<input checked="" type="checkbox"/>
<b>96813</b>						
<b>Tile Carpeting</b>						
Provide Extra Material as specified					Transmittal	<input checked="" type="checkbox"/>
<b>99100</b>						
<b>Painting</b>						
Periodically Check Wet Film Thickness To Assure Conformance With Manufacturer's Requirements To Achieve Dry Film Thickness					field report	<input checked="" type="checkbox"/>
Provide Extra Material as specified					Transmittal	<input checked="" type="checkbox"/>



Commissioning Items by CSI Division		Verified by:	Date compl	Coord Initial	Documentation Required	Owner Witness Required
		Name	Firm			
<b>200800</b>						
<b>Seismic Protection</b>						
Perform Field Quality Control section of specifications					Test Report	<input checked="" type="checkbox"/>
Provide Extra Materials as specified					Transmittal	<input checked="" type="checkbox"/>
Submit Welders Certificates					Welders Certificates	<input checked="" type="checkbox"/>
<b>211100</b>						
<b>Water Based Fire Suppression Systems</b>						
Perform Field Quality Control section of specifications					NFPA 13 Certification	<input checked="" type="checkbox"/>
Provide Extra Material as specified					Transmittal	<input checked="" type="checkbox"/>
Provide system operation & maintenance training Per Demonstration section of specifications					Sign In Sheet	<input checked="" type="checkbox"/>
Verify all labeling						<input type="checkbox"/>
<b>220500</b>						
<b>Common Work Results For Plumbing</b>						
Hold MEP pre-installation meeting(s).					Meeting Minutes and Sign-up Sheet	<input checked="" type="checkbox"/>
Verify fire rating compliance at all wall, ceiling and floor penetrations						<input type="checkbox"/>

Commissioning Items by CSI Division		Verified by:	Date compl	Coord Initial	Documentation Required	Owner Witness Required
		Name	Firm			
<b>220523</b>						
<b>General Duty Valves for Plumbing Piping</b>						
Check valves for leaks and replace in necessary						<input type="checkbox"/>
<b>220553</b>						
<b>Identification for Plumbing Piping and Equipment</b>						
Install valve tags on valves and control devices per specifications					Valve Schedule framed/posted	<input type="checkbox"/>
<b>220719</b>						
<b>Plumbing Piping Insulation</b>						
Verify all valve stems are extended and accessible						<input type="checkbox"/>
<b>221116</b>						
<b>Domestic Water Piping</b>						
Fill and flush each system						<input type="checkbox"/>
Perform Disinfection of Domestic Water Piping System section of specifications					Bacteria test results	<input checked="" type="checkbox"/>
Provide pressure testing per Field Quality Control section of specifications					test report	<input checked="" type="checkbox"/>
<b>221316</b>						
<b>Sanitary Waste and Vent and Storm Piping</b>						
Perform leak test per Field Quality Control section of specifications					test report	<input checked="" type="checkbox"/>

Commissioning Items by CSI Division		Verified by: Name	Firm	Date compl	Coord Initial	Documentation Required	Owner Witness Required
<b>221319</b>							
<b>Sanitary Waste and Storm Piping Specialties</b>							
Perform Field Quality Control section of specifications						Test Reports	<input checked="" type="checkbox"/>
<b>224000</b>							
<b>Plumbing Fixtures</b>							
Adjust and Test All Fixtures Per "Field Quality Control" section of spec. Clean and flush all floor drains and verify positive drainage, free of blockage						test report	<input checked="" type="checkbox"/>
<b>230100</b>							
<b>Basic Mechanical Requirements</b>							
Conduct start-up and tests per specifications						Startup Report	<input checked="" type="checkbox"/>
Hold MEP pre-installation meeting(s).						Meeting Minutes	<input checked="" type="checkbox"/>
<b>230513</b>							
<b>Motors</b>							
Check each motor for alignment, lubrication, rotation, voltage and current and Efficiency						List of motors	<input checked="" type="checkbox"/>
<b>230519</b>							
<b>Meters and Gages</b>							
Install test plugs where specified and at owner representative directive							<input type="checkbox"/>
<b>230593</b>							
<b>Test-Adjust-Balance</b>							
Hold Prebalancing conference as specified						Meeting Minutes	<input checked="" type="checkbox"/>

Commissioning Items by CSI Division	Verified by:		Date compl	Coord Initial	Documentation Required	Owner Witness Required
	Name	Firm				
Perform Section 1.2 C 4 of spec before TAB commences						<input type="checkbox"/>
Place outlet dampers in full open position						<input type="checkbox"/>
Provide a complete set of as-builts prior to testing						<input type="checkbox"/>
Supply control diagram					control diagram	<input type="checkbox"/>
Verify TAB Engineer notified of differences between design and installed equipment						<input type="checkbox"/>
<b>230700</b>						
<b>Mechanical Insulation</b>						
Verify all piping unions are accessible for maintenance						<input type="checkbox"/>
Verify fire rating at fire dampers,walls, floors, ceilings and roof						<input type="checkbox"/>
<b>230900</b>						
<b>Control Systems</b>						
Check and record amp draw on supply transformers of I/O panels					Test Report	<input checked="" type="checkbox"/>
Ensure shipping material has been removed from thermostats and other control devices						<input type="checkbox"/>
Perform commissioning section of specifications					Commissioning Report	<input checked="" type="checkbox"/>
Post laminated control diagram in mechanical room						<input type="checkbox"/>

Verified by:						
Commissioning Items by CSI Division	Name	Firm	Date compl	Coord Initial	Documentation Required	Owner Witness Required
Provide factory authorized training for maintenance personnel					training report summary	<input checked="" type="checkbox"/>
<b>232113</b>						
<b>Hydronic Piping</b>						
Pressure test piping per Field Quality Control section of specifications					test report	<input checked="" type="checkbox"/>
Remove and clean all strainers after flushing system					Flush Report	<input checked="" type="checkbox"/>
<b>233113</b>						
<b>Metal Ducts</b>						
test for duct leakage per "Field Quality Control" section of spec. Ducts shall meet leakage requirement prior to testing and balancing					test report	<input checked="" type="checkbox"/>
<b>233300</b>						
<b>Duct Accessories</b>						
Demonstrate Proper Operation of All Fire Dampers per NFPA-90A.					Inspection report	<input checked="" type="checkbox"/>
Perform Field Quality Control section of specifications					Test Report	<input checked="" type="checkbox"/>
Provide Extra Materials as specified					Transmittal	<input checked="" type="checkbox"/>
<b>233600</b>						
<b>Air Terminal Units</b>						
Notify owner's rep after fully installing a representative unit (in-place mockup) for approval. Coordinate and cooperate with owner's commissioning of the boxes.						<input type="checkbox"/>
Perform Field Quality Control section of specifications					Test Report	<input checked="" type="checkbox"/>

Commissioning Items by CSI Division	Verified by:		Date compl	Coord Initial	Documentation Required	Owner Witness Required
	Name	Firm				
<b>260500</b>						
<b>Common Work Results for Electrical</b>						
Perform Field Quality Control Section of specifications					Test Report	<input checked="" type="checkbox"/>
Train all End Users on the equipment they will use on a periodic basis per Demonstration section of specifications					Sign-in Sheet	<input checked="" type="checkbox"/>
Verify that every penetration through fire walls (re: life safety plans) has been properly firestopped					certification	<input type="checkbox"/>
<b>260519</b>						
<b>Conductors and Cables</b>						
Ensure wires are color coded per specifications						<input type="checkbox"/>
Perform independent tests per "Field Quality Control" section of spec, including megohm/high pot tests					test report	<input type="checkbox"/>
<b>260526</b>						
<b>Grounding and Bonding</b>						
Perform resistance test as described in "Field Quality Control" section of spec					test report	<input checked="" type="checkbox"/>
<b>260553</b>						
<b>Identification for Electrical Systems</b>						
Ensure identification devices are applied per specifications						<input type="checkbox"/>
Verify all equipment, panels, conduits and conductors are correctly labeled.						<input type="checkbox"/>

Commissioning Items by CSI Division	Verified by:		Date compl	Coord Initial	Documentation Required	Owner Witness Required
	Name	Firm				
<b>262726</b>						
<b>Wiring Devices</b>						
Operate All Devices to verify correct operation					Test Report	<input checked="" type="checkbox"/>
Perform checks per "Field Quality Control" section of spec					Test Report	<input checked="" type="checkbox"/>
<b>271513</b>						
<b>Communications Copper Horizontal Cabling</b>						
Perform checks per "Field Quality Control" section of spec					Test Report	<input checked="" type="checkbox"/>
<b>283111</b>						
<b>Digital, Addressable Fire-Alarm System</b>						
Perform checks per "Field Quality Control" section of spec					NFPA Certification	<input checked="" type="checkbox"/>
Perform Field Quality Control section of specifications					Test Report	<input checked="" type="checkbox"/>
Precheck all fire alarm devices					Precheck Checklist	<input type="checkbox"/>
Provide factory training per system training section of spec.					Sign in sheet	<input checked="" type="checkbox"/>
Test each system for continuity						<input type="checkbox"/>
Test system operation of pull stations horns/strobes by factory trained representative					Written certification of fire alarm system per NFP	<input checked="" type="checkbox"/>
Verify battery power available						<input type="checkbox"/>

Verified by:						
Commissioning Items by CSI Division	Name	Firm	Date compl	Coord Initial	Documentation Required	Owner Witness Required
Verify door hardware interlock						<input checked="" type="checkbox"/>



Please see following website for suggested commissioning forms:

<https://operations.missouri.edu/facilities/commissioning-forms>

## SECTION 1.F

### INDEX OF DRAWINGS

Drawings referred to in and accompanying Project Manual consist of following sheets dated **8.29.2022**

Cover	Project Information
G100	Code plan + Infection Control
G101	Contractor Access
A100	Noted Floor Plan + Demo Plan
A101	Dimensioned Floor Plan
A200	Reflected Ceiling Plan + Finish Plan
A600	Interior Elevations + Opening Schedule
A601	Casework Sections
M000	Mechanical Symbols & Abbreviations
MD100	Mechanical – Ground Floor – Demolition
M100	Mechanical – Ground Floor – New Work
M500	Details & Schedules
M700	Temperature Controls
P000	Plumbing Symbols and Abbreviations
PD100	Plumbing – Underfloor Demolition Plan
PD101	Plumbing – Ground Demolition Plan
P100	Plumbing – Underfloor Plan
P101	Plumbing – Ground Floor Plan
P400	Plumbing Isometrics
P401	Plumbing Isometrics
P500	Plumbing Details and Schedules
FP000	Fire Protection Symbols and Abbreviations
FPD101	Fire Protection – Ground Floor Demolition Plan
FP101	Fire Protection – Ground Floor Plan
E000	Electrical Symbols and Abbreviations
ED100	Electrical – Ground Floor – Demolition
ED101	Lighting – Ground Floor – Demolition
E100	Electrical – Ground Floor – New Work
E101	Lighting – Ground Floor – New Work
E500	Electrical Schedules
E501	Electrical Details

END OF SECTION

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SECTION 1.G

PREVAILING WAGE RATES

[The rates will be supplied to the Consultant in packet immediately before project is advertised.]

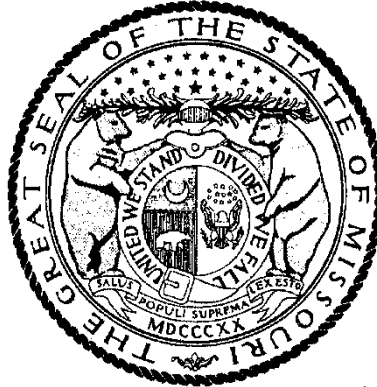
END OF SECTION

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# Missouri

## Division of Labor Standards

### WAGE AND HOUR SECTION



MICHAEL L. PARSON, Governor

## Annual Wage Order No. 27

Section 010  
**BOONE COUNTY**

In accordance with Section 290.262 RSMo 2000, within thirty (30) days after a certified copy of this Annual Wage Order has been filed with the Secretary of State as indicated below, any person who may be affected by this Annual Wage Order may object by filing an objection in triplicate with the Labor and Industrial Relations Commission, P.O. Box 599, Jefferson City, MO 65102-0599. Such objections must set forth in writing the specific grounds of objection. Each objection shall certify that a copy has been furnished to the Division of Labor Standards, P.O. Box 449, Jefferson City, MO 65102-0449 pursuant to 8 CSR 20-5.010(1). A certified copy of the Annual Wage Order has been filed with the Secretary of State of Missouri.

Original Signed by

Taylor Burks, Director  
Division of Labor Standards

Filed With Secretary of State: March 10, 2020

Last Date Objections May Be Filed: April 9, 2020

Prepared by Missouri Department of Labor and Industrial Relations

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Asbestos Worker	\$52.88
Boilermaker	*\$27.06
<b>Bricklayer</b>	<b>\$49.54</b>
<b>Carpenter</b>	<b>\$44.27</b>
Lather	
Linoleum Layer	
Millwright	
Pile Driver	
Cement Mason	\$41.89
Plasterer	
Communications Technician	\$51.30
Electrician (Inside Wireman)	\$51.37
Electrician Outside Lineman	\$73.26
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Elevator Constructor	*\$27.06
<b>Glazier</b>	<b>\$41.33</b>
Ironworker	\$58.10
Laborer	\$39.16
General Laborer	
First Semi-Skilled	
Second Semi-Skilled	
Mason	\$50.20
Marble Mason	
Marble Finisher	
Terrazzo Worker	
Terrazzo Finisher	
Tile Setter	
Tile Finisher	
Operating Engineer	*\$27.06
Group I	
Group II	
Group III	
Group III-A	
Group IV	
Group V	
Painter	\$39.03
<b>Plumber</b>	<b>\$56.87</b>
Pipe Fitter	
Roofer	\$49.42
<b>Sheet Metal Worker</b>	<b>\$52.30</b>
<b>Sprinkler Fitter</b>	<b>\$44.65</b>
Truck Driver	*\$27.06
Truck Control Service Driver	
Group I	
Group II	
Group III	
Group IV	

\*The Division of Labor Standards received less than 1,000 reportable hours for this occupational title. Public works contracting minimum wage is established for this occupational title using data provided by Missouri Economic Research and Information Center.

\*\*The Prevailing Hourly Rate includes any applicable fringe benefit amounts for each occupational title.

Heavy Construction Rates for  
BOONE County

Section 010

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Carpenter	\$49.56
Millwright	
Pile Driver	
Electrician (Outside Lineman)	\$73.26
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Laborer	\$43.60
General Laborer	
Skilled Laborer	
Operating Engineer	\$55.90
Group I	
Group II	
Group III	
Group IV	
Truck Driver	\$43.10
Truck Control Service Driver	
Group I	
Group II	
Group III	
Group IV	

Use Heavy Construction Rates on Highway and Heavy construction in accordance with the classifications of construction work established in 8 CSR 30-3.040(3).

Use Building Construction Rates on Building construction in accordance with the classifications of construction work established in 8 CSR 30-3.040(2).

If a worker is performing work on a heavy construction project within an occupational title that is not listed on the Heavy Construction Rate Sheet, use the rate for that occupational title as shown on the Building Construction Rate Sheet.

\*The Division of Labor Standards received less than 1,000 reportable hours for this occupational title. Public works contracting minimum wage is established for this occupational title using data provided by Missouri Economic Research and Information Center.

\*\*The Prevailing Hourly Rate includes any applicable fringe benefit amounts for each occupational title.



# OVERTIME and HOLIDAYS

## OVERTIME

For all work performed on a Sunday or a holiday, not less than twice (2x) the prevailing hourly rate of wages for work of a similar character in the locality in which the work is performed or the public works contracting minimum wage, whichever is applicable, shall be paid to all workers employed by or on behalf of any public body engaged in the construction of public works, exclusive of maintenance work.

For all overtime work performed, not less than one and one-half (1½) the prevailing hourly rate of wages for work of a similar character in the locality in which the work is performed or the public works contracting minimum wage, whichever is applicable, shall be paid to all workers employed by or on behalf of any public body engaged in the construction of public works, exclusive of maintenance work or contractual obligation. For purposes of this subdivision, "**overtime work**" shall include work that exceeds ten hours in one day and work in excess of forty hours in one calendar week; and

A thirty-minute lunch period on each calendar day shall be allowed for each worker on a public works project, provided that such time shall not be considered as time worked.

## HOLIDAYS

January First;  
The last Monday in May;  
July Fourth;  
The first Monday in September;  
November Eleventh;  
The fourth Thursday in November; and  
December Twenty-Fifth;

If any holiday falls on a Sunday, the following Monday shall be considered a holiday.

## SECTION 02 4119 - **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. Division 1 for use of the premises and phasing requirements.
  - 2. Division 1 for restrictions on use of the premises due to Owner occupancy.
  - 3. Division 1 for temporary construction and environmental-protection measures for selective demolition operations.
  - 4. Division 2 for cutting and patching procedures for selective demolition operations.
  - 5. Sections for demolishing, cutting, patching, or relocating mechanical items.
  - 6. Sections for demolishing, cutting, patching, or relocating electrical items.

#### 1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Detach items from existing construction and deliver them to Owner.
- C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- D. Existing to Remain: Existing items of construction that are not to be removed.

#### 1.4 MATERIALS OWNERSHIP

- A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, demolished materials shall become Contractor's property and shall be removed from Project site.

#### 1.5 SUBMITTALS

- A. Proposed Dust-Control and Noise-Control Measures: Submit statement or drawing that indicates the measures proposed for use, proposed locations, and proposed time frame for their operation. Identify options if proposed measures are later determined to be inadequate.

- B. 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. Use of elevator and stairs.
  5. Locations of temporary partitions and means of egress.
  6. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
- C. Inventory: After selective demolition is complete, submit a list of items that have been removed and salvaged.
- D. Predemolition Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by selective demolition operations. Submit before Work begins.

#### 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. Professional Engineer Qualifications: Where a professional engineer is required to determine the structural suitability of demolition and/or shoring, employ a Professional Engineer licensed by the State of Missouri.
- C. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- D. Standards: Comply with ANSI A10.6 and NFPA 241.
- E. Demolition in a Fire-Rated System: When any pipe, duct, louver, damper, accessory, equipment or other element is indicated (or required to permit the completion of the work) to be abandoned or removed from an existing fire rated floor, wall, ceiling or roof system, the ensuing opening shall be patched to match the surrounding in a manner to comply with code requirements and to match the required fire rating of the existing surrounding construction whether or not specifically detailed or noted on the Drawings. If the patching is in an exposed area, the patching shall match existing. If new equipment or construction fills the majority of the opening, the seal between the old and new construction shall be installed to comply with no less than the fire rating of the existing construction.

#### 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.
- 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:
1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Owner.
- 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.
- 1.8 WARRANTY
- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

## 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. 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. Utility Requirements: Refer to Divisions 22, 23, 26, 27 and 28 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.
- D. Terminate MEP utilities per UM System requirements.

### 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.
- 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. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
  - 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.

- 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. Airborne construction dust containment control from ceiling to deck:
    - a. If not feasible/possible to extend partition to deck, extend and seal tight 6-mil fire retardant polyethylene listed by Fire Underwriter's Laboratories, Griffolyn #T55R or Star-Tex of Lakeville, MN 550044 with Griffolyn Fire retardant tape, or approved equal, from ceiling to deck.
  - 2. Contamination Control Mats outside of dust enclosure:
    - a. Tacky Mat 800030 (High tack) by Liberty Industries, 133 Commerce Street, East Berlin, Connecticut, 06023, 1-800-828-5656, or approved equal.
- E. Temporary Shoring: Provide and maintain interior and exterior 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 SELECTIVE DEMOLITION

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Remove all abandoned and permanently disconnected items. Do not abandon in place. 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 without written permission of the Owner and 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 fire watch and portable fire-suppression devices during flame-cutting operations.
    - a. Maintain adequate ventilation when using cutting torches.
  - 5. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
  - 6. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
  - 7. Dispose of demolished items and materials promptly.
  - 8. Return elements of construction and surfaces that are to remain to condition existing before selective demolition operations began.

- B. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Owner, items may be removed to a suitable, protected storage location during selective and reinstalled in their original locations after selective demolition operations are complete.
- C. 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.
- D. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.
  - 1. Clean, salvage and bind one pallet of blended face brick salvaged during demolition. Cleaned and salvaged brick shall be suitable for future installation in other areas of the building. Contractor shall move pallet to location as directed by Owner's Representative.
- E. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI-WP and its Addendum.
  - 1. Remove residual adhesive and prepare substrate for new floor coverings by one of the methods recommended by RFCI.

### 3.5 PATCHING AND REPAIRS

- A. General: Promptly repair damage to adjacent construction caused by selective demolition operations.
- B. Patching: Comply with Division 2.
- C. 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.
- D. Finishes: Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.
- E. 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, if necessary, 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. 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.

- a. In areas where refinishing of existing surfaces is required as part of the selective demolition operation or called for as part of the overall finishing of a given area, the existing surfaces shall be properly prepared by patching, filling of indentations, sanding and smoothing of existing finish surfaces, and priming in preparation of finishing the surfaces.
- F. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

### 3.6 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 02 4119



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## SECTION 02 4126 - **CUTTING AND PATCHING**

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes procedural requirements for cutting and patching.
- B. Related Sections include:
  - 1. See Division 07 Section "Penetration Firestopping" for patching fire-rated construction.
  - 2. See Divisions 02 through 28 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

#### 1.2 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.
- C. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching, 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.

### 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.

### 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.
  - 1. Cut existing construction and subsequently patch to restore surfaces to their original condition.
- B. Cutting: Cut existing construction using methods least likely to damage elements retained or adjoining construction.
  - 1. In general, 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 and 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 in walls or partitions 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.
- C. Patching: Patch construction with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.
  - 1. 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.
  - 2. Floors and Walls: Where walls or partitions that are removed 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, if necessary, to achieve uniform color and appearance.
    - a. In areas where refinishing of existing surfaces is required as part of the selective demolition operation or called for as part of the overall finishing of a given area, the existing surfaces shall be properly prepared by patching,

filling of indentations, sanding and smoothing of existing finish surfaces, and priming in preparation of finishing the surfaces.

- b. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch – from corner to corner at the logical breaking point for the finish, unless specifically noted otherwise. Provide additional coats until patch blends with adjacent surfaces.
3. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.
4. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

END OF SECTION 02 4126

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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 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:

1. Interior standing and running trim, and miscellaneous trim units.
2. Plastic-laminate cabinets.
3. Plastic-laminate countertops.
4. Solid Surface countertops.

- B. Architectural woodwork specified in this Section and detailed on the Drawings shall be custom fabrications constructed and installed by a qualified woodwork fabricator for undivided responsibility. The use of "modular casework" in an attempt to achieve the same layout and design as indicated will not be allowed.

- C. Related Sections include the following:

1. Division 08 Section "Flush Wood Doors."
2. Division 09 Section "Painting" for field finishing of interior architectural wood trim.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated, including cabinet hardware and accessories.

- B. Shop Drawings: Show 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 reinforcement specified in other Sections.
3. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, and other items installed in architectural woodwork.
4. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.

- C. Samples for Verification: For the following:

1. Lumber with or for transparent finish, 50 sq. in. (300 sq. cm) for each species and cut, finished on 1 side and 1 edge.
2. Wood-veneer-faced panel products with or for transparent finish, 8 by 10 inches (200 by 250 mm), for each species and cut. Include at least one face-veneer seam and finish as specified.

- D. Product Certificates: Signed by manufacturers of woodwork certifying that products furnished comply with requirements.

#### 1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm experienced in producing architectural woodwork similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- B. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production and installation of interior architectural woodwork.
- C. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork, construction, finishes, and other requirements.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions".

#### 1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
  - 1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed and indicate measurements on Shop Drawings.
  - 2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

#### 1.7 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. General: Provide materials that comply with requirements of the AWI quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.
- B. Wood Products: Comply with the following:
  - 1. Hardboard: AHA A135.4.
  - 2. High Performance Particleboard Core:
    - a. Particleboard shall be of 47 lb. density, and balanced construction with moisture content not to exceed 8%. Three-ply particleboard shall exceed the requirements for its type and classification under Commercial Standard CS-236-66, Federal Specifications LLL-B-800A, and ASTM D 1037-78.
      - 1) Provide Extira™ Treated Exterior Composite as manufactured by CMI (1-866-382-8701) at all wet area countertops and backsplashes. Use only adhesives recommended by CMI. **Water based adhesives are not recommended.**
- C. Thermoset Decorative Overlay (Melamine): Particleboard complying with ANSI A208.1, Grade M-2, or medium-density fiberboard complying with ANSI A208.2, Grade MD, with surface of thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.
  - 1. Colors per Materials Legend & Finish Plan.
- D. High-Pressure Decorative Laminate: NEMA LD 3, grade, colors and patterns as indicated, or if not indicated, as required by woodwork quality standard.
- E. Adhesive for Bonding Plastic Laminate: Urea-formaldehyde.
- F. Cabinet Backs at Exposed Fixed or Adjustable Shelving (Base or Upper Cabinets): Unless noted otherwise on the Drawings, the exposed back and the inside vertical ends of the unit, any vertical standards or divisions in the shelving unit, and the shelves themselves shall be 3/4 inch thick particleboard (min.) covered with plastic laminate to match the face of the adjacent cabinets. No melamine shall be exposed.
- G. Shelving Fixed or Adjustable: Shelves shall be 3/4 inch thick particleboard (min.), unless noted or specified otherwise, covered with plastic laminate or Melamine – top, bottom and all edges.

## 2.2 SOLID SURFACE

- A. Solid Polymer Components:
  - 1. Cast, nonporous, filled polymer, not coated, laminated or of composite construction with through body colors meeting ANSI Z124.3 or ANSI Z124.6, having minimum physical and performance properties specified.
  - 2. Flat sheet products shall comply with material and performance requirements in ASSFA-2-01 (2002). ISSFA is the International Solid Surface Fabricators Association established to regulate the solid surface industry.
  - 3. Superficial damage to a depth of 0.010 inch (.25 mm) shall be repairable by sanding and/or polishing.



4. Products: Subject to compliance with requirements, provide one of the following:

- a. Avonite; Avonite, Inc.
- b. Corian; DuPont Polymers.
- c. Formica® Solid Surfacing; Formica Corporation.
- d. Swanstone; Swan Corporation (The).
- e. Gibraltar; Wilsonart International, Div. of Premark International, Inc.

B. Provide continuous countertop reinforcement at ALL SOLID SURFACE COUNTERTOPS. Reinforcement shall consist of a sub top made from 1" thick "Extira" composite panel material, adhered to underside of countertops using Polyseam seal.

C. All solid surface joints shall be glued with manufacturer's 2-part solid surface seaming adhesive.

D. All field applied backsplashes are to be glued to tops using manufacturer's 2-part solid surface seaming adhesive. **Any other sealant will be removed at the installer's expense.**

### 2.3 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 8 Section "Door Hardware. All exposed cabinet fasteners shall be tamper-resistant.

B. Hardware Standard: Comply with BHMA A156.9 for items indicated by referencing BHMA numbers or items referenced to this standard.

C. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.
2. Satin Stainless Steel: BHMA 630.

D. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

E. Butt Hinges: 2-3/4-inch (70-mm), 5-knuckle steel hinges made from 0.095-inch- (2.4-mm) thick metal.

F. Back-Mounted Pulls: BHMA A156.9, B02011.

G. Pulls:

1. Standard Wire Pulls: Back mounted, 4 inches (100 mm) long, 5/16 inches (8 mm) in diameter.

H. Catches: Magnetic catches, BHMA A156.9, B03141. At cabinets exceeding 36" in height, provide two per door located at the top and bottom.

I. Adjustable Shelf Standards and Supports: End of Shelf Supports, BHMA A156.9, B04071; with shelf rests, B04081. Furnish and install KV 85-185 double slot standards with brackets for shelving mounted to back of wall.

- J. Shelf Rests for Drilled Holes: BHMA A156.9, B04013.
1. Provide metal shelf rests, unless noted otherwise.
- K. Drawer Slides: bottom corner-mounted, full-extension, epoxy coated steel drawer slides with smooth and quiet nylon rollers, BHMA A156.9, B05091, and rated for the following loads:
1. Box Drawer Slides: 100 lbf (440 N).
  2. File Drawer Slides: 200 lbf (890 N).
  - 3. NO METABOX DRAWER SYSTEMS ALLOWED, NO EXCEPTIONS.**
- L. Undercounter Metal Support Brackets: Provide Work Station Brackets, in sizes required, as marketed by Rakks #EH1824FM (18x24) or #EH1818FM (18x18) or approved equal,(www.rakks.com) shall be spaced no farther apart than 3'-0" o.c. Refer to Drawings for suggested location of undercounter brackets and coordinate final location on shop drawings after reviewing jobsite conditions (outlet and communication boxes, etc.) with the Architect.
1. Maximum spacing for metal undercounter supports shall be 36"o.c. Coordinate spacing with elevations on the drawings and adjust location(s) of brackets so as to not interfere with wall outlets and undercounter devices. Also coordinate location of brackets with any webbing provided with the countertop for support of heavy appliances to be located on the countertop above. If location of undercounter support does not coordinate with the mentioned webbing or if the countertop does not require webbing, provide a 1x4 blocking member at the location of every support bracket.
  2. Factory-Primed and Field Painted: Color as selected by the Architect.
- M. Door Locks: BHMA A156.11, E07121. CompX National Stock Locks – Master Keyed to E041A
- N. Drawer Locks: BHMA A156.11, E07041. CompX National Stock Locks - Master Keyed to E041A
- O. Provide panels of 1/4-inch (6.4-mm) plywood or tempered hardboard above locked compartments and drawers (between locked and non-locked components), unless located directly under tops.
- P. Grommets for Cable Passage through Countertops: 2-inch (51-mm) OD, color selected by architect, molded-plastic grommets and matching plastic caps with slot for wire passage.
1. Product: Subject to compliance with requirements, provide grommets by Doug Mockett and Co., Inc.
- Q. File Hangers: 1/8-inch x 1-inch aluminum bars rabbeted in drawers for use with 'Pendaflex' hanging files at all drawers noted as 'file'.
1. Casework manufacturer to verify that files are deep enough to provide clear glide of hanging files with plastic insert tabs on top. Files are to hang in the drawer

without dragging on bottom of drawer and without plastic tab markers dragging on top of the drawer or impeding the closing of the drawer.

## 2.4 INSTALLATION MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Metal strap blocking shall be used at all locations where blocking is required for the installation of interior architectural woodwork. **No wood blocking will be allowed.**
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

## 2.5 FABRICATION, GENERAL

- A. Interior Woodwork Grade: Provide Custom grade interior woodwork complying with the referenced quality standard.
- B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.
- C. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- D. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
  - 1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 3/4 Inch (19 mm) Thick or Less: 1/16 inch (1.5 mm).
  - 2. Edges of Laminate counter tops and other fabrications: Bevel one of the laminate sheets at the edge as indicated AWI 400C-G-1, unless noted otherwise.
  - 3. Edges of Rails and Similar Members More Than 3/4 Inch (19 mm) Thick: 1/8 inch (3 mm).
  - 4. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members and Rails: 1/16 inch (1.5 mm).
- E. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
- F. NO LENGTH OF SHELVING, exposed to view or concealed, MAY EXCEED 30" IN LENGTH without support on three sides of the shelf or by compensating for the additional length by an increase in thickness of the shelf, or by additional edge support on the face and rear of the shelf.
- G. Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

1. Seal edges of openings in countertops with a coat of varnish.
- H. Install glass to comply with applicable requirements in Division 8 Section "Glazing" and in GANA's "Glazing Manual." For glass in wood frames, secure glass with removable stops.
- 2.6 PLASTIC-LAMINATE CABINETS
- A. Quality Standard: Comply with AWI Section 400 (400B) requirements for laminate cabinets.
  - B. Grade: Custom.
  - C. AWI Type of Cabinet Construction: Reveal overlay on face frame.
  - D. Reveal Dimension: 1/2 inch (13 mm), unless noted otherwise.
- 2.7 PLASTIC-LAMINATE COUNTERTOPS
- A. Quality Standard: Comply with AWI Section 400 requirements for high-pressure decorative laminate countertops. Fabricate using 2 layers of 3/4" plywood.
  - B. Grade: Custom.
  - C. High-Pressure Decorative Laminate Grade: HGS - 0.048 inch, 1.2 mm.
  - D. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
    1. Provide Architect's selections from manufacturer's full range of colors and finishes.
  - E. Edge Treatment:
    1. Countertops: 3 mm PVC edge – Color as shown on the finish schedule.
    2. Cabinet Doors & Drawers: 2 mm PVC edge
  - F. Core Material: Plywood
- 2.8 SOLID-SURFACING-MATERIAL COUNTERTOPS AND WINDOW SURROUNDS
- A. Quality Standard: Comply with AWI Section 400 requirements for countertops. Substrate 1/2" plywood covered with 1/2" thick solid surface.
  - B. Grade: Custom.
  - C. Solid-Surfacing-Material Thickness: 1/2 inch (13 mm).
  - D. Colors, Patterns, and Finishes: Provide materials and products that result in colors of solid-surfacing material complying with the following requirements:
    1. Match color, pattern, and finish as indicated by manufacturer's designations for these characteristics.
    2. Match Architect's sample.
    3. Provide Architect's selections from manufacturer's full range of colors and finishes.

- E. Fabricate tops in one piece with shop-applied backsplashes and edges, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.

## 2.9 SOLID SURFACE INTEGRAL BOWL SINKS

- A. Basis of Design: Corian, Glacier White

- B. Sink "S1": Corian 859

## 2.10 SHOP FINISHING

- A. Quality Standard: Comply with AWI Section 1500, unless otherwise indicated.
- B. General: Finish architectural woodwork at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.
- C. General: The entire finish of interior architectural woodwork is specified in this Section, regardless of whether shop applied or applied after installation. The extent to which the final finish is applied at fabrication shop is Contractor's option, except shop apply at least the prime coat before delivery.
- D. Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.
  - 1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling and to end-grain surfaces. Concealed surfaces of plastic-laminate-clad woodwork do not require backpriming when surfaced with plastic laminate, backing paper, or thermoset decorative overlay.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Condition woodwork to average prevailing humidity conditions in installation areas before installation.
- B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing.

### 3.2 INSTALLATION

- A. Quality Standard: Install woodwork to comply with AWI Section 1700 for the same grade specified in Part 2 of this Section for type of woodwork involved.
- B. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).

- C. Scribe and cut woodwork to fit adjoining work, and refinish cut surfaces and repair damaged finish at cuts.
- D. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed, tamper resistant fasteners and blind nailing as required for complete installation. Use fine finishing nails for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.
- E. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 60 inches (1500 mm) long, except where shorter single-length pieces are necessary. Scarf running joints and stagger in adjacent and related members.
  - 1. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches (3 mm in 2400 mm).
- F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
  - 1. Install cabinets with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
  - 2. Maintain veneer sequence matching of cabinets with transparent finish.
  - 3. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches (400 mm) o.c. with No. 10 wafer-head, tamper resistant sheet metal screws through metal backing or metal framing behind wall finish.
- G. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
  - 1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
  - 2. Install countertops with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
  - 3. Secure backsplashes to tops with concealed metal brackets at 16 inches (400 mm) o.c. and to walls with adhesive.
  - 4. Caulk space between backsplash and wall with sealant specified in Division 7 Section "Joint Sealants."
- H. Complete the finishing work specified in this Section to extent not completed at shop or before installation of woodwork. Fill nail holes with matching filler where exposed. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats were applied in shop.
- I. Refer to Division 9 Sections for final finishing of installed architectural 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.

END OF SECTION 06 4023

## SECTION 07 8413 - THROUGH-PENETRATION FIRESTOP SYSTEMS [PENETRATION FIRESTOPPING]

### 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 through-penetration firestop systems for penetrations through the following fire-resistance-rated assemblies, including both empty openings and openings containing penetrating items:
  - 1. Walls and partitions.
  - 2. Floors.
  - 3. Smoke Barriers.
- B. Related Sections include the following:
  - 1. Division 23 Sections specifying duct and piping penetrations.
  - 2. Division 26, 27, 28 Sections specifying cable and conduit penetrations, including but not limited to, EZ Path devices.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. General: For the following constructions, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly penetrated.
  - 1. Fire-resistance-rated non-load-bearing walls, including partitions, with fire-protection-rated openings.
  - 2. Fire-resistance-rated floor assemblies.
- B. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, as determined per UL 1479 or ASTM E 814, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
- C. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, as determined per ASTM E 814, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:
  - 1. Penetrations located outside wall cavities.
  - 2. Penetrations located outside fire-resistive shaft enclosures.
  - 3. Penetrations located in construction containing fire-protection-rated openings.
  - 4. Penetrating items larger than 4-inch- (100-mm-) diameter nominal pipe or 16 sq. in. (100 sq. cm) in overall cross-sectional area.



- D. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that after curing do not deteriorate when exposed to these conditions both during and after construction.
  - 1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
  - 2. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved either by installing floor plates or by other means.
  - 3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.
- E. For through-penetration firestop systems exposed to view, provide products with flame-spread ratings of less than 25 and smoke-developed ratings of less than 450, as determined per ASTM E 84.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of through-penetration firestop system product indicated.
- B. Shop Drawings: For each through-penetration firestop system, show each kind of construction condition penetrated, relationships to adjoining construction and kind of penetrating item. Include firestop design designation of testing and inspection agency acceptable to authorities having jurisdiction that evidences compliance with requirements for each condition indicated.
  - 1. For those firestop applications that exist for which no UL tested system is available, and engineering judgment derived from similar UL Systems designs or other tests shall be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineer Judgments drawings must follow requirements set forth by the International Firestop Council.
- C. 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.
- D. Product Certificates: Signed by manufacturers of through-penetration firestop system products certifying that products furnished comply with requirements.
- E. Product Test Reports: From a qualified testing agency indicating through-penetration firestop system complies with requirements, based on comprehensive testing of current products.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Must be a single installer and a firm experienced in installing penetration fire stopping similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Installer shall be certified, licensed, FM approved in accordance with PM 4991, certified by UL as a qualified contractor.
- B. Fire-Test-Response Characteristics: Penetration fire stopping shall comply with the following requirements:

1. Penetration fire stopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
  2. Penetration fire stopping is identical to those tested per testing standard referenced in "Penetration Fire stopping" Article.
  3. Provide rated systems complying with the following requirements:
    - a. Penetration fire stopping products bear classification marking of a qualified testing and inspecting agency.
    - b. Classification markings on penetration fire stopping correspond to designations listed by the following: 1) UL in its "Fire Resistance Directory."
    - c. Obtain fire stop systems for each type of penetration or joint opening and construction condition indicated from a single manufacturer.
    - d. Fire Stopping Contractor shall submit certificates and qualifications for approval prior to commencement of work.
  4. A manufacturer's willingness to sell its through-penetration firestop system products to Contractor or to an installer engaged by Contractor does not in itself confer qualification on buyer.
- C. Source Limitations: Obtain through-penetration firestop systems, for each kind of penetration and construction condition indicated, from a single manufacturer.
- D. Firestop system installation must meet requirements of UL 1479 or ASTM E-814 tested assemblies that provide a fire rating equal to that of construction being penetrated.
- E. Proposed firestop materials and methods shall conform to applicable governing codes having jurisdiction.
- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."
- G. Mock up Requirements: A mockup of each fire rated design fire resistant penetration, joint system, curtain wall to floor intersection, or head of wall configuration is required and must be reviewed for acceptance as a minimum standard for the Work. Mock ups may remain in place as part of the project Work.
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer; date of manufacture; lot number; shelf life, if applicable; qualified testing and inspecting agency's classification marking applicable to Project; curing time; and mixing instructions for multicomponent materials.
  - B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.
  - C. Do not use damaged or expired materials.
- 1.7 PROJECT CONDITIONS
- A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration

firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

- B. Ventilate through-penetration firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.
- C. Do not use materials that contain flammable solvents.
- D. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.

## 1.8 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.
- C. Notify Owner's inspecting agency at least seven days in advance of through-penetration firestop system installations; confirm dates and times on days preceding each series of installations.
- D. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until Owner's inspecting agency and building inspector, if required by authorities having jurisdiction, have examined each installation.

## PART 2 - PRODUCTS

### 2.1 PRODUCTS AND MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Hilti, Inc. (800) 879-8000
  - 2. 3M Fire Protection Products.
  - 3. Specified Technologies, Inc.
  - 4. It is the intent to have all firestopping materials (penetration and fire-resistive joint systems) installed in one color.

### 2.2 FIRESTOPPING, GENERAL

- A. Compatibility: Provide through-penetration firestop systems that are compatible with one another, with the substrates forming openings, and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.
- B. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with "Performance Requirements" Article. Use only components specified by through-penetration firestop system

manufacturer and approved by the qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to, the following items:

1. Permanent forming/damming/backing materials, including the following:
  - a. Slag-/rock-wool-fiber insulation.
  - b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
  - c. Fire-rated form board.
  - d. Fillers for sealants.
2. Temporary forming materials.
3. Substrate primers.
4. Collars.

### 2.3 FILL MATERIALS

- A. General: Provide through-penetration firestop systems containing the types of fill materials indicated in the Through-Penetration Firestop System Schedule at the end of Part 3 by reference to the types of materials described in this Article. Fill materials are those referred to in directories of the referenced testing and inspecting agencies as fill, void, or cavity materials.
- B. Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture. Product shall be equal to Hilti FS-One intumescent firestop sealant.
- C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant. Product shall be equal to Hilti CP 642 and CP 643 firestop collar.
- D. Materials used for large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways. Product shall be equal to Hilti FS 635 FIRE BLOCK and Hilti FS ;635 Trowelable Firestop Compound.
- E. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds. Product shall be equal to Hilti CP 618 Firestop Putty Stick.
- F. Intumescent Wrap Strips: Single-component intumescent elastomeric strips for plastic and insulated pipe penetrations. Product shall be equal to Hilti CP 645 Firestop Warp Strip.
- G. Mortars: Prepackaged, dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.
- H. Polyurethane Foams: Two part polyurethane foam for sealing ahrd to reach penetrations. Product shall be equal to Hilti CP 620.
- I. Silicone Sealants: Moisture-curing, 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 and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping, gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.
  2. Grade for Horizontal Surfaces: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces.
  3. Grade for Vertical Surfaces: Nonsag formulation for openings in vertical and other surfaces.
- J. Provide an "F"-rating as determined by UL 1479 or ASTM E814 which is equal to the time rating of construction being penetrated.

## 2.4 MIXING

- A. For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Surface Cleaning: Clean out openings immediately before installing through-penetration firestop systems to comply with written recommendations of firestop system manufacturer and the following requirements:
1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration firestop systems.
  2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestop systems. Remove loose particles remaining from cleaning operation.
  3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by through-penetration firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent through-penetration firestop systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop system's seal with substrates.

### 3.2 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

- A. Regulatory Requirements: Install firestop materials in accordance with UL Fire Resistance Directory.
- B. Manufacturer's Instructions: Comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
- C. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
  - 1. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
- D. Install fill materials for firestop systems by proven techniques to produce the following results:
  - 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
  - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
  - 3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.
- E. Install wall-mounted, self-adhesive labels at each penetration upon completion of installation.

### 3.3 FIELD QUALITY CONTROL

- A. All areas of work must be accessible until inspection by the applicable Code Authorities.
- B. Correct unacceptable firestops and provide additional inspection to verify compliance with this specification at no additional cost to the Owner.
  - 1. Identify damaged, improperly installed or re-entered seals for repair or modification.
  - 2. Modifications to penetrations shall be accomplished per the firestop material manufacturer's recommendations.
  - 3. Only materials used in the original seal and designated by the manufacturer as suitable for said repair shall be used for this purpose.
- C. Do not proceed to enclose through-penetration firestop with other construction until reports of approval by examinations are issued.

### 3.4 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce through-penetration firestop systems complying with specified requirements.

END OF SECTION 07 8413

## SECTION 07 8446 - FIRE-RESISTIVE SMOKE JOINT SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes fire-resistive joint systems for the following:
  - 1. Floor-to-wall joints.
  - 2. Head-of-wall joints.
  - 3. Wall-to-wall joints.
  - 4. Joints requiring restriction of smoke migration
- B. Related Sections include the following:
  - 1. Division 07 Section "Penetration Firestopping" for systems installed in openings in walls and floors with and without penetrating items.
  - 2. Division 07 Section "Joint Sealants" for non-fire-resistive joint sealants.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. General: For joints in the following constructions, provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly in which fire-resistive joint systems are installed:
  - 1. Fire-resistance-rated non-load-bearing walls, including partitions, with fire-protection-rated openings.
  - 2. Fire-resistance-rated floor assemblies.
- B. Fire Resistance of Joint Systems: Assembly ratings and movement capabilities indicated, but with assembly ratings not less than that equaling or exceeding fire-resistance rating of constructions in which joints are located, as determined by UL 2079.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each through-penetration firestop system, show each kind of construction condition penetrated, relationships to adjoining construction and kind of penetrating item. Include firestop design designation of testing and inspection agency acceptable to authorities having jurisdiction that evidences compliance with requirements for each condition indicated.
  - 1. For those firestop applications that exist for which no UL tested system is available, and engineering judgment derived from similar UL Systems designs or other tests shall be submitted to local authorities having jurisdiction for their review and



approval prior to installation. Engineer Judgments drawings must follow requirements set forth by the International Firestop Council.

- C. Product Certificates: For each type of fire-resistive joint system, signed by product manufacturer.
  - D. Qualification Data: For Installer.
  - E. Compatibility and Adhesion Test Reports: From fire-resistive joint system manufacturer indicating the following:
    - 1. Materials forming joint substrates have been tested for compatibility and adhesion with fill materials.
    - 2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
  - F. Evaluation Reports: Evidence of fire-resistive joint systems' compliance with ICBO ES AC30, from the ICBO Evaluation Service.
  - G. Research/Evaluation Reports: For each type of fire-resistive joint system.
- 1.5 QUALITY ASSURANCE
- A. Installer Qualifications: Must be a single installer and a firm experienced in installing fire resistive smoke joint systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Installer shall be certified, licensed, FM approved in accordance with PM 4991, certified by UL as a qualified contractor.
  - B. Fire-Test-Response Characteristics: Fire resistive smoke joint systems shall comply with the following requirements:
    - 1. Fire resistive smoke joint system tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
    - 2. Fire resistive smoke joint systems are identical to those tested per testing standard referenced in "Fire resistive smoke joint systems" Article.
    - 3. Provide rated systems complying with the following requirements:
      - a. Fire resistive smoke joint systems products bear classification marking of a qualified testing and inspecting agency.
      - b. Fire resistive smoke joint systems markings on penetration fire stopping correspond to designations listed by the following: 1) UL in its "Fire Resistance Directory."
      - c. Obtain fire stop systems for each type of Fire resistive smoke joint systems and construction condition Indicated from a single manufacturer.
      - d. Fire Stopping Contractor shall submit certificates and qualifications for approval prior to commencement of work.
    - 4. A manufacturer's willingness to sell its through-penetration firestop system products to Contractor or to an installer engaged by Contractor does not in itself confer qualification on buyer.
  - C. Source Limitations: Obtain fire-resistive joint systems for each kind of joint and construction condition indicated through one source from a single manufacturer.

- D. Fire-Test-Response Characteristics: Provide fire-resistive joint systems that comply with the following requirements and those specified in "Performance Requirements" Article:
1. Fire-resistance tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL or another agency performing testing and follow-up inspection services for fire-resistive joint systems acceptable to authorities having jurisdiction.
  2. Fire-resistive joint systems are identical to those tested per UL 2079. Provide rated systems complying with the following requirements:
    - a. Fire-resistive joint system products bear classification marking of qualified testing and inspecting agency.
    - b. Fire-resistive joint systems correspond to those indicated by referencing system designations listed by the following:
      - 1) UL in its "Fire Resistance Directory."

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fire-resistive joint system products to Project site in original, unopened containers or packages with qualified testing and inspecting agency's classification marking applicable to Project and with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials for fire-resistive joint systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

#### 1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Ventilate fire-resistive joint systems per manufacturer's written instructions by natural means or, if this is inadequate, forced-air circulation.

#### 1.8 COORDINATION

- A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.
- B. Coordinate sizing of joints to accommodate fire-resistive joint systems.
- C. Do not cover up fire-resistive joint system installations that will become concealed behind other construction until Owner's inspecting agency and building inspector, if required by authorities having jurisdiction, have examined each installation.

### 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. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Fire-Resistive Joint Systems:
      - 1) Hilti, Inc.
      - 2) Specified Technologies Inc.
      - 3) 3M Fire Protection Products.
    - b. Smoke-Resistive Joint Systems
      - 1) Hilti, Inc. CP506 Smoke and Acoustic Sealant
      - 2) Specified Technologies Inc.: Smoke 'N' Sound Sealant
- B. It is the intent to have all firestopping materials (penetration and fire-resistive joint systems) installed in one color.

## 2.2 FIRE-RESISTIVE JOINT SYSTEMS, GENERAL

- A. Compatibility: Provide fire-resistive joint systems that are compatible with joint substrates, under conditions of service and application, as demonstrated by fire-resistive joint system manufacturer based on testing and field experience.
- B. Accessories: Provide components of fire-resistive joint systems, including forming materials, that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing and inspecting agency for systems indicated.

## 2.3 FIRE-RESISTIVE JOINT SYSTEMS

- A. Where UL-classified fire-resistive joint systems are indicated, they refer to alphanumeric designations listed in UL's "Fire Resistance Directory" under product Category XHBN.
- B. Floor-to-Wall, Fire-Resistive Joint Systems:
  - 1. Available UL-Classified Products:
    - a. Submit manufacturer's assembly to satisfy requirement.
  - 2. Assembly Rating: Per drawings.
  - 3. Joint Width: Per drawings, field verify.
  - 4. Movement Capabilities: Class I
- C. Head-of-Wall, Fire-Resistive Joint Systems:
  - 1. Available UL-Classified Products:
    - a. Submit manufacturer's assembly to satisfy requirement.
  - 2. Assembly Rating: Per drawings.

3. Joint Width: Per drawings, field verify.
4. Movement Capabilities: Class I

D. Wall-to-Wall, Fire-Resistive Joint System:

1. Available UL-Classified Products:
  - a. Submit manufacturer's assembly to satisfy requirement.
2. Assembly Rating: Per drawings.
3. Joint Width: Per drawings, field verify.
4. Movement Capabilities: Class I

2.4 SMOKE-RESISTIVE JOINT SYSTEMS

- A. Use smoke-resistive joint sealant systems where the construction requires a smoke-rating but is a Non Fire-Rated Assembly. Smoke-resistive joint sealant shall be passed the Air Leakage test (Modified UL 2079 L-Rating, or other air leakage testing.)
- B. Compatibility: Provide smoke-resistive joint systems that are compatible with joint substrates, under conditions of service and application, as demonstrated by smoke-resistive joint system manufacturer based on testing and field experience.
- C. Accessories: Provide components of smoke-resistive joint systems that are needed to install materials and to comply with Code requirements. Use only components specified by smoke-resistive joint system manufacturer and approved by the qualified testing and inspecting agency for systems indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
  1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.
  2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
  3. Remove laitance and form-release agents from concrete.

- B. Priming: Prime substrates where recommended in writing by fire-resistive joint system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from fire-resistive joint system materials. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates.

### 3.3 INSTALLATION

- A. General: Install fire-resistive joint systems to comply with Part 1 "Performance Requirements" Article and fire-resistive joint system manufacturer's written installation instructions for products and applications indicated.
- B. Install forming/packing/backing materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
- C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:
  1. Fill voids and cavities formed by openings and forming/packing/backing materials as required to achieve fire-resistance ratings indicated.
  2. Apply fill materials so they contact and adhere to substrates formed by joints.
  3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.
- D. Install wall-mounted, self-adhesive labels at each penetration upon completion of installation.

### 3.4 FIELD QUALITY CONTROL

- A. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and inspecting agency has approved installed fire-resistive joint systems.
- B. If deficiencies are found, repair or replace fire-resistive joint systems so they comply with requirements.

### 3.5 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to joints as Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure fire-resistive joint systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and

install new materials to produce fire-resistive joint systems complying with specified requirements.

END OF SECTION 07 8446.13

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## 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 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes joint sealants for the following applications, including those specified by reference to this Section:

- 1. 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. Vertical joints on exposed surfaces of walls and partitions.
- d. Perimeter joints between interior wall surfaces and frames of interior doors and windows.
- e. Joints between plumbing fixtures and adjoining walls, floors, and counters.
- f. Other joints as indicated.

- B. Related Sections include the following:

- 1. Division 07 Section "Fire-Resistive Joint Systems" for sealing joints in fire-resistance-rated construction.
- 2. Division 08 Section "Glazing" for glazing sealants.
- 3. Division 09 Section "Gypsum Board Assemblies" for sealing perimeter joints of gypsum board partitions to reduce sound transmission.
- 4. Division 09 Section "Acoustical Panel 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.
- B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

#### 1.4 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Initial 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: For each type of joint sealant and accessory, signed by product manufacturer.



- D. Product Test Reports: Based on comprehensive testing of product formulations performed by a qualified testing agency, indicating that sealants comply with requirements.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- C. Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period preceding the Notice to Proceed with the Work.

#### 1.6 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
  - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (5 deg C).
  - 2. When joint substrates are wet.
  - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
  - 4. 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, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

#### 2.3 ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

B. 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.

C. Single-Component Neutral-Curing Silicone Sealant:

1. Products:

- a. Dow Corning Corporation; 791. [Class 50, Use NT]
- b. GE Silicones; SilPruf NB SCS9000. [Class 50, Use NT]
- c. Pecora Corporation; 865. [Class 50, Use NT]

2. Type and Grade: S (single component) and NS (nonsag).

3. Class: As indicated.

4. Use Related to Exposure: As indicated; NT (nontraffic).

5. Uses Related to Joint Substrates:

a. As applicable to joint substrates indicated, O.

1) Ceramic tile

2) Plastic laminate to gypsum drywall/ CMU at backsplashes

D. Sink Areas: All sink areas shall be sealed with "Poly-Seam-Seal." Latex caulk shall not be allowed in these areas.

E. Door Jamb / Floor Intersections: Seal joint at intersection of door jambs and VCT flooring with Pecora 898 Silicone Sanitary Sealant.

2.4 **Contractor's Option for Urethane Sealants:** At the contractor's option, the urethane sealants may be single- or multi-component. However, the sealant systems used must meet the Use Classification of the joints being sealed. A list of potential urethane sealants is listed below.

A. Nonsag Urethane Sealant - Multicomponent:

1. Products:

- a. Pecora Corporation; Dynatrol II. [Class 50, Use NT]
- b. Tremco; Dymeric ~~511~~ 240. [Class 50, Use NT]
- c. Sika Corporation, Inc.; Sikaflex - 2c NS TG. [Class 25, Use NT & T]
- d. Sonneborn, Division of ChemRex Inc.; NP 2. [Class 25, Use NT & T]
- e. Tremco; Vulkem 227. [Class 25, Use NT & T]

2. Type and Grade: M (multicomponent) and NS (nonsag).

3. Class: As indicated.

4. Uses Related to Exposure: As indicated.

5. Uses Related to Joint Substrates:

a. M - masonry

b. G - glass

c. A - aluminum

d. And, as applicable to joint substrates indicated, O.

- 1) Color anodic aluminum
- 2) Aluminum coated with a high-performance coating
- 3) Galvanized steel
- 4) Brick
- 5) Granite
- 6) Limestone
- 7) Marble
- 8) Ceramic tile
- 9) Wood

B. Nonsag Urethane Sealant - Single-Component:

1. Products:

- |    |  |                            |
|----|--|----------------------------|
| a. | Sika Corporation, Inc.; Sikaflex - 15LM.   | [Class 100/50, Use NT & T] |
| b. | Sonneborn, Division of ChemRex Inc.; NP 1. | [Class 25, Use NT & T]     |
| c. | Tremco; Vulkem 116.                        | [Class 25, Use NT & T]     |
| d. | Bostik Findley; Chem-Calk 900.             | [Class 25, Use NT]         |
| e. | Pecora Corporation; Dynatrol I-XL.         | [Class 25, Use NT]         |
| f. | Tremco; DyMonic.                           | [Class 25, Use NT]         |
| g. | Tremco; Vulkem 931.                        | [Class 100/50, Use NT]     |

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: As indicated.
4. Uses Related to Exposure: As indicated.
5. Uses Related to Joint Substrates:

- a. M - masonry
- b. G - glass
- c. A - aluminum
- d. And, as applicable to joint substrates indicated, O.

- 1) Color anodic aluminum
- 2) Aluminum coated with a high-performance coating
- 3) Galvanized steel
- 4) Brick
- 5) Granite
- 6) Marble
- 7) Ceramic tile
- 8) Wood

2.5 ACOUSTICAL JOINT SEALANTS

- A. Acoustical sealants are specified in Section "Gypsum Board Assemblies."

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, Type C (closed-cell material with a surface skin) and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
- C. 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 to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
  1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and 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 after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
    - a. Concrete.

- b. Masonry.
- 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. Nonporous joint substrates include the following:
  - a. Metal.
  - b. Glass.
  - c. Porcelain enamel.
- B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer and/or 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 in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. 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.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. 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 in each joint configuration.
  - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. 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 sealant from surfaces adjacent to joints.
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.

#### 3.4 CLEANING

- A. Clean off excess sealant 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 original work.

END OF SECTION 07 9200

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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 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Hollow metal door frames.
- B. Related Sections include the following:
  - 1. Division 08 Section "Flush Wood Doors" for wood doors installed in hollow metal frames.
  - 2. Division 08 Section "Door Hardware" for door hardware and weather stripping.
  - 3. Division 08 Section "Glazing" for glass in glazed openings in doors and frames.
  - 4. Division 09 Section "Painting" for field painting factory-primed doors and frames.

#### 1.3 DEFINITIONS

- A. Steel Sheet Thicknesses: Thickness dimensions, including those referenced in ANSI A250.8, are minimums as defined in referenced ASTM standards for both uncoated steel sheet and the uncoated base metal of metallic-coated steel sheets.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of frame indicated, include door designation, type, level and model, material description, core description, construction details, label compliance, sound and fire-resistance ratings, and finishes.
- B. Shop Drawings: Show the following:
  - 1. Frame details for each frame type including dimensioned profiles.
  - 2. Details and locations of reinforcement and preparations for hardware.
  - 3. Details of each different wall opening condition.
  - 4. Details of anchorages, accessories, joints, and connections.
  - 5. Coordination of glazing frames and stops with glass and glazing requirements.
- C. Door Schedule: Use same reference designations indicated on Drawings in preparing schedule for doors and frames.

#### 1.5 QUALITY ASSURANCE

- A. Hollow metal Door and Frame Standard: Comply with ANSI A 250.8, unless more stringent requirements are indicated.
- B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having



jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252.

1. Test Pressure: Test using positive-pressure testing, unless otherwise noted or allowed by authorities having jurisdiction.
2. Temperature-Rise Rating: Where indicated, provide doors that have a temperature-rise rating of 450 deg F (250 deg C) maximum in 30 minutes of fire exposure.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished frames.
- B. Inspect frames on delivery for damage and notify shipper and supplier if damage is found. Minor damages may be repaired provided refinished items match new work and are acceptable to Architect. Remove and replace damaged items that cannot be repaired as directed.
- C. Store frames at building site under cover. Place units on minimum 4-inch- (100-mm-) high wood blocking. Do not use plastic or canvas shelters. If door packaging becomes wet, remove cartons immediately. Provide minimum 1/4-inch (6-mm) spaces between stacked doors to permit air circulation.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Hollow Metal Frames:
    - a. Amweld Building Products, Inc.
    - b. Ceco Door Products; a United Dominion Company.
    - c. CURRIES Company; an ASSA ABLOY Group Company.
    - d. Steelcraft; a division of Ingersoll-Rand.
    - e. Mesker Hollow Metal Doors and Frames.
    - f. Substitutions must meet and comply with SDI and be current members.

#### 2.2 MATERIALS

- A. Hot-Rolled Steel Sheets: ASTM A 569/A 569M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- B. Cold-Rolled Steel Sheets for All Door Faces: ASTM A 366/A 366M, Commercial Steel (CS), or ASTM A 620/A 620M, Drawing Steel (DS), Type B; stretcher-leveled standard of flatness.
- C. Metallic-Coated Steel Sheets for Exterior Doors and Frames: ASTM A 653/A 653M, Commercial Steel (CS), Type B, with an A40 (ZF120) zinc-iron-alloy (galvannealed) coating; stretcher-leveled standard of flatness.

- D. Electrolytic Zinc-Coated Steel Sheet for Interior Doors and Frames: ASTM A 591/A 591M, Commercial Steel (CS), Class B coating; mill phosphatized; suitable for unexposed applications; stretcher-leveled standard of flatness where used for face sheets.

## 2.3 FRAMES

- A. General: Provide hollow metal frames for doors, transoms, sidelights, borrowed lights, and other openings that comply with ANSI A250.8 and with details indicated for type and profile. Conceal fastenings, unless otherwise indicated.
- B. Interior Door Frames of 0.053-inch- (1.3-mm-) [16 gage] minimum thick steel sheet for:
  - 1. All interior doors, unless noted otherwise.
- C. Door Silencers: Except on weather-stripped frames, fabricate stops to receive three silencers on strike jambs of single-door frames and two silencers on heads of double-door frames.
- D. Supports and Anchors: Fabricated from not less than 0.042-inch- (1.0-mm-) thick, electrolytic zinc-coated or metallic-coated steel sheet.
- E. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where zinc-coated items are to be built into exterior walls, comply with ASTM A 153/A 153M, Class C or D as applicable.

## 2.4 FABRICATION

- A. General: Fabricate hollow metal frame units to comply with ANSI A250.8 and to be rigid, neat in appearance, and free from defects including warp and buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site.
- B. Frame Construction: Fabricate frames to shape shown.
  - 1. For interior applications, fabricate frames according to ANSI/SDI A250.8, conforming to the definition of Fully Welded Frames that are completely welded along all elements (along the face, soffit, stops, and rabbets).
  - 2. Equal Rabbet Frames: Provide frames with equal rabbet dimensions unless glazing and removable stops required wider dimension on glass side of frame.
  - 3. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 46-inch and wider with mortise/butt type hinges at top hinge location.
  - 4. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
- C. Reinforce frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project site.
- D. Locate hardware as indicated on Shop Drawings or, if not indicated, according to ANSI A250.8.

- E. Glazing Stops: Manufacturer's standard, formed from 0.032-inch- (0.8-mm-) thick steel sheet.
  - 1. Provide nonremovable stops on outside of exterior doors and on secure side of interior doors for glass, louvers, and other panels in doors.
  - 2. Provide screw-applied, removable, glazing stops on inside of glass, louvers, and other panels in doors.

## 2.5 FINISHES

- A. Prime Finish: Manufacturer's standard, factory-applied coat of rust-inhibiting primer complying with ANSI A250.10 for acceptance criteria.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General: Install hollow metal doors, frames, and accessories according to Shop Drawings, manufacturer's data, and as specified.
- B. Placing Frames: Comply with provisions in SDI 105, unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.
  - 1. In masonry construction, provide at least three wall anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Acceptable anchors include masonry wire anchors and masonry T-shaped anchors.
  - 2. In existing concrete or masonry construction, provide at least three completed opening anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Set frames and secure to adjacent construction with bolts and masonry anchorage devices.
  - 3. In metal-stud partitions, provide at least three wall anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Attach wall anchors to studs with screws.
  - 4. Install fire-rated frames according to NFPA 80.
  - 5. For openings 90 inches (2286 mm) or more in height, install an additional anchor at hinge and strike jambs.

### 3.2 ADJUSTING AND CLEANING

- A. Prime-Coat Touchup: Immediately after installation, sand smooth any rusted or damaged areas of prime coat and apply touch up of compatible air-drying primer.
- B. Protection Removal: Immediately before final inspection, remove protective wrappings from doors and frames.

END OF SECTION 08 1113

## SECTION 08 1416 - **FLUSH WOOD DOORS**

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Factory finishing flush wood doors.
- B. Related Requirements:
  - 1. Section 08 8000 "Glazing" for glass view panels in flush wood doors.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product, including the following:
  - 1. Door core materials and construction.
  - 2. Door edge construction
  - 3. Door face type and characteristics.
  - 4. Door trim for openings.
  - 5. Factory-machining criteria.
  - 6. Factory-finishing specifications.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:
  - 1. Door schedule indicating door location, type, size, fire protection rating, and swing.
  - 2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
  - 3. Details of frame for each frame type, including dimensions and profile.
  - 4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
  - 5. Dimensions and locations of blocking for hardware attachment.
  - 6. Dimensions and locations of mortises and holes for hardware.
  - 7. Clearances and undercuts.
  - 8. Requirements for veneer matching.
  - 9. Doors to be factory finished and application requirements.
- C. Samples for Verification:
  - 1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.

### 1.3 CLOSEOUT SUBMITTALS

- A. Special warranties.

### 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.
- B. Quality Standard: Comply with the following WDMA Performance Duty Level:
  - 1. Adhesive Bonding Durability: WDMA TM-6
  - 2. Cycle Slam: WDMA TM-7
  - 3. Hinge Loading: WDMA TM-8
  - 4. Screw Holding: WDMA TM-10
    - a. Door Face
    - b. Vertical Door Edge
    - c. Horizontal Door Edge
- C. Fire-Rated Wood Doors: Doors complying with NFPA 80 and IBC that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252 and IBC.

### 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.

### 1.6 FIELD CONDITIONS

- A. Environmental Limitations:
  - 1. Do not deliver or install doors until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of construction period.
  - 2. Do not deliver or install doors until building is enclosed and weathertight, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during remainder of construction period.

### 1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
  - a. Delamination of veneer.
  - b. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
  - c. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
2. Warranty also includes installation and finishing that may be required due to repair or replacement of defective doors.
3. Warranty Period for Solid-Core Interior Doors: Life of installation.
4. Warranty Period for Hollow-Core Interior Doors: Two year(s) from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Source Limitations: Obtain flush wood doors from single manufacturer.

### 2.2 FLUSH WOOD DOORS, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with ANSI/WDMA I.S. 1A.
- B. Adhesives: Do not use adhesives that contain urea formaldehyde.
- C. Composite Wood Products: Products shall be made without urea formaldehyde.

### 2.3 SOLID-CORE FIVE-PLY FLUSH WOOD VENEER-FACED DOORS FACTORY FINISHED

- A. Interior Doors, Solid-Core Five-Ply Veneer-Faced :
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Eggers Industries
  2. ANSI/WDMA I.S. 1A Grade: Premium.
  3. Faces: Single-ply wood veneer not less than 1/50 inch thick.
    - a. Species: Architect to select from manufacturer's standard range of available veneers.
    - b. Match between Veneer Leaves: Plain sliced, vertical graining
    - c. Assembly of Veneer Leaves on Door Faces: Running match.
    - d. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
    - e. Room Match:

- 1) Provide door faces of compatible color and grain within each separate room or area of building.
4. Exposed Vertical and Top Edges: Applied wood-veneer edges of same species as faces and covering edges of faces - Architectural Woodwork Standards edge Type B.
- a. Fire-Rated Single Doors: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed vertical edges.
  - b. Fire-Rated Pairs of Doors:
    - 1) 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.
    - 2) Provide formed-steel edges and astragals with intumescent seals.
      - a) Finish steel edges and astragals with baked enamel[ same color as doors].
      - b) Finish steel edges and astragals to match door hardware (locksets or exit devices).
  - c. Mineral-Core Doors: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
    - 1) Screw-Holding Capability: 550 lbf in accordance with WDMA T.M. 10.
5. Core for Non-Fire-Rated Doors:
- a. ANSI A208.1, Grade LD-2 particleboard.
    - 1) Provide doors with WDMA I.S. 10 structural-composite-lumber cores instead of particleboard cores for doors scheduled to receive exit devices in Section 08 7100 "Door Hardware."
  - b. Glued wood stave.
  - c. WDMA I.S. 10 structural composite lumber.
    - 1) Screw Withdrawal, Door Face: 550 lbf.
    - 2) Screw Withdrawal, Vertical Door Edge: 550 lbf.
  - d. Either glued wood stave or WDMA I.S. 10 structural composite lumber.
6. Core for Fire-Rated Doors: As required to achieve fire-protection rating indicated on Drawings.
- a. Blocking for Mineral-Core Doors: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated on Drawings as needed to eliminate through-bolting hardware.

7. Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

## 2.4 LIGHT FRAMES

- A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.
  1. Wood Species: Same species as door faces.
  2. Profile: Manufacturer's standard shape.
  3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.
- B. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated on Drawings. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.
- C. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048-inch- thick, cold-rolled steel sheet; [factory primed for paint] [with baked-enamel- or powder-coated] finish; and approved for use in doors of fire-protection rating indicated on Drawings.

## 2.5 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated.
  1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
  2. Comply with NFPA 80 requirements for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied.
  1. Locate hardware to comply with DHI-WDHS-3.
  2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
  3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.
  4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.
  5. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.
- C. Transom and Side Panels:
  1. Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors.
  2. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.



3. Fabricate door and transom panels with full-width, solid-lumber[, rabbeted,] meeting rails.
  4. Provide factory-installed spring bolts for concealed attachment into jambs of metal door frames.
- D. Openings: Factory cut and trim openings through doors.
1. Light Openings: Trim openings with moldings of material and profile indicated.
  2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 08 8000 "Glazing."
  3. Louvers: Factory install louvers in prepared openings.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine doors and installed door frames, with Installer present, before hanging doors.
1. Verify that installed 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 Section 08 7100 "Door Hardware."
- B. Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
- C. Install frames level, plumb, true, and straight.
1. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
  2. Anchor frames to anchors or blocking built in or directly attached to substrates.
    - a. Secure with countersunk, concealed fasteners and blind nailing.
    - b. Use fine finishing nails[ or finishing screws] for exposed fastening, countersunk and filled flush with woodwork.
      - 1) For factory-finished items, use filler matching finish of items being installed.
  3. Install fire-rated doors and frames in accordance with NFPA 80.
  4. Install smoke- and draft-control doors in accordance with NFPA 105.
- D. Job-Fitted Doors:

1. Align and fit doors in frames with uniform clearances and bevels as indicated below.
    - a. Do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors.
  2. Machine doors for hardware.
  3. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
  4. Clearances:
    - a. Provide 1/8 inch at heads, jambs, and between pairs of doors.
    - b. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated on Drawings.
    - c. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.
    - d. Comply with NFPA 80 for fire-rated doors.
  5. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
  6. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.
- E. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- F. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

### 3.3 FIELD QUALITY CONTROL

- A. Inspection Agency: Owner will engage a qualified inspector to perform inspections and to furnish reports to Architect.
- B. Inspections:
1. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.
  2. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.
- C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.
- E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.4 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

## SECTION 08 7111 – 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 finish hardware for the proper operation and control of all doors in the Project. Prior to bidding, notify Architect of any doors that do not have hardware meeting this intention.
- B. Hardware supplier will be responsible to furnish and install hardware on labeled doors to satisfy State and Local Building Codes.
- C. Related Sections include the following:
  - 1. Division 8 Section "Hollow Metal Doors and Frames."
  - 2. Division 8 Section "Flush Wood Doors."

#### 1.3 SUBMITTALS

- A. Product Data: For each product and material indicated, submit manufacturer's technical product data. Include information necessary to show compliance with requirements, installation instructions and maintenance instructions.
- B. Hardware Schedule: Submit a hardware schedule organized into sets, including the information below. Designations for door numbers and hardware sets shall match those used in the construction documents.
  - 1. Opening Number
  - 2. Door Type and Size
  - 3. Frame Type and Size
  - 4. Frame Anchoring Method
  - 5. Hardware Set
  - 6. Assembly Rating

- C. Hardware Schedule shall be coordinated with the doors, frames and related work to ensure proper size, thickness, hand function and finish of door hardware

#### 1.4 QUALITY ASSURANCE

- A. Supplier Qualifications: A recognized Architectural Finish Hardware Supplier, with warehousing facilities, who has been furnishing hardware in the Project's vicinity for a period of not less than two (2) years. Supplier shall be or employ an experienced Architectural Hardware Consultant (AHC) who is certified by and member of the Door and Hardware Institute. The Architectural hardware Consultant shall be available, at reasonable times during the course of the work, for consultation about Project's hardware requirements, to Owner, Architect and Contractor.

- B. Fire-Rated Openings: Provide hardware for fire-rated openings in compliance with NFPA Standard No. 80, No. 101 and local building code requirements. Provide only hardware, which has been tested and listed, by UL, FM or Warnock Hersey for types and sizes of doors required and complies with requirements of door and door frame labels.
- C. Standards: Comply with the requirements of the latest edition of the following standards unless indicated otherwise:
  - 1. American National Standards Institute Publications:
    - a. A115 Series – Door and Frame Preparation
    - b. A156 Series – Hardware
  - 2. Builders Hardware Manufacturer's Association Publications:
    - a. 1201 – Auxiliary Hardware
    - b. 1301 – Materials and Finishes
  - 3. Door and Hardware Institute Publications:
    - a. Keying – Procedures, Systems and Nomenclature
    - b. Abbreviations and Symbols
    - c. Hardware for Labeled Fire Doors
    - d. Recommended Locations for Builder's Hardware for Standard and Custom Steel Doors and Frames
    - e. Wood Door Standards W1, W2, WDHS-2, WDHS-3
  - 4. National Fire Protection Association Publications
    - a. NFPA 80 – Standards for Fire Doors and Windows
    - b. NFPA 101 – Life Safety Code
  - 5. International Building Code – 2015 Edition
  - 6. American with Disabilities Act.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Package each hardware item in separate containers with all screws, wrenches, installation instructions and installation templates. Mark each box with hardware heading and door number according to approved hardware schedule.
- B. Deliver individually packaged hardware items at the proper times to the proper locations (shop or project site) for installation: Provide a complete packing list showing items, door numbers and hardware headings with each shipment.
- C. Store hardware in shipping cartons above ground and under cover to prevent damage. Provide secure lockup for door hardware delivered to the Project, but not yet installed. Control handling and installation of hardware items that are not immediately replaceable -so that completion of the Work will not be delayed by hardware losses both before and after installation.

#### 1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with delivery and/or installation when ambient and substrate temperature conditions are outside limits permitted by material manufacturers.

### PART 2 - PRODUCTS

## 2.1 HARDWARE GENERAL

- A. Provide the materials of products indicated by trade names, manufacturer's name, or catalog number. Substitutions will not be permitted except as described in Division 1.
- B. Provide manufacturer's standard products meeting the design intent of this Specification, free of imperfections affecting appearance or serviceability.
  - 1. Provide hardware complete with all fasteners, anchors, instructions, layout templates, and any specialized tools as required for satisfactory installation and adjustment.
  - 2. Hand of Door: Drawings show direction of slide, swing or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.
  - 3. Furnish screws for installation with each hardware item. Provide Phillips flat head screws except as otherwise indicated or approved. Finish screws exposed under any condition to match hardware finish, or, if exposed in surface of other work, to match finish of such other work as closely as possible. Use machine screws for metal connections and wood screws for connections to wood. Use manufacturer's screws to secure hardware.
  - 4. Provide concealed fasteners for hardware unit with care exposed when door is closed, except to extent no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt, head or nut on opposite face is exposed in other work, except where indicated otherwise or where it is not feasible to adequately reinforce the work. In such cases, provide sleeves for each thru-bolt or use sex screw fasteners.
  - 5. Special Tools: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance and removal and replacement of finish hardware.
- C. Hardware is specified in the hardware schedule by set, type and functions, which have been selected as best meeting the application requirements. Acceptable products for each category are specified in Paragraph 2.5 "Hardware Products".

## 2.2 SPECIAL REQUIREMENTS

- A. General:
  - 1. Where new doors and hardware are scheduled to be installed in existing frames, contractor to coordinate hinge sizes and locations, lockset backsets, strikes, hardware mounting heights, etc with existing frames to ensure new door and hardware fits and functions properly in existing frame.
- B. Hinges:
  - 1. Use nonrising pins for all interior doors.
- C. Locksets:
  - 1. All locksets to be grade 1 heavy duty cylindrical or as specified.
  - 2. Stanley Patient Safety Lever (SPSL) to be used in psych safe patient areas.
  - 3. Lever Stile 14 (Curved Return) and Rose Style D (3-1/2" Convex"
- D. Closers:

1. Comply with manufacturer's recommendations for unit size based on door size and usage.
2. Provide parallel arms for all overhead closers, except as otherwise indicated.
3. All closers UL Listed Certified to be in compliance with UBC 7.2 and UL 10C.
4. Closers with Pressure Relief Valves will not be acceptable.
5. Supplier to provide any brackets or plates required for proper installation of door closers.

E. Exit Devices:

1. All latchbolts to be deadlatching type.
2. All touchbars to be stainless steel.

F. Power Supplies

1. All power supplies shall be provided and installed by General Contractor.

G. Access Control

1. Head end equipment to be furnished and installed by Owner.
2. Backboxes and conduits to be furnished and installed by General Contractor.
3. Devices (Card readers, keypads, etc.) to be furnished and installed by Owner.
4. Interconnection wiring and terminations to be furnished and installed by Owner.

## 2.3 KEYING

- A. All cylinders to be keyed to existing master key system. Keying schedule must be approved by Owner prior to ordering locks.
- B. Key all locks separately or alike, as directed by Owner.
- C. Provide keys as follows:
  1. Change Keys: 2 per lock
  2. Master Keys: 6 required (per system)
- D. Identification: Stamp all (master-type) keys with the following:
  1. "Do Not Duplicate"
  2. Key Change number (all keys)

## 2.4 FINISHES

- A. Standard: Comply with BHMA A156.18
  1. All door hardware to be US26D throughout project.
- 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 application units of hardware.
- C. Protect finishes on exposed surfaces from any damage by applying a strippable temporary protective covering before shipping.

- D. BHMA Designations: Comply with base material and finish requirements indicated by BHMA standards.

## 2.5 HARDWARE PRODUCTS

ITEM	SPECIFIED	APPROVED EQUAL
Hinges	Ives	Stanley
Locksets	Best	No Substitutions
Closers	LCN	No Substitutions
Flatgoods	Ives	Burns, Rockwood, Trimco
Stops	Ives	Burns, Rockwood, Trimco
Overhead Stops	Glynn Johnson	Rixon
Gasket	National Guard	Pemko, Reese
Electric Strike 24V	Von Duprin	Folger Adams
Prox Card Readers	HIDR (by Owner)	No Substitutions

**Note:** Provide Top Hinge Reinforcement straps for Doors over 3'-6" wide.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine doors and frames with installer present for compliance with the requirements, for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Examine rough-in for electrical source power to verify actual locations of wiring connections before electrified door hardware installation.
- C. Notify Architect of any discrepancies or conflicts between the door schedule, door types, frame types, drawings, scheduled hardware and built condition.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Steel Frames: Comply with ANSI/DHI A115 Series
- B. Wood Doors: Comply with ANSI/DHI A115-W Series.

### 3.3 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights indicated in the following applicable publications, or as 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. Custom Steel Doors and Frames: DHI's "Recommended Locations for Builder's Hardware for Custom Steel Doors and Frames."
  3. Wood Doors: DHI WDHS.2 "Recommended Locations for Architectural Hardware for Wood Flush Doors."



- B. Install each door hardware item to complete with manufacturer's 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 to with finishing work. Do not install surface mounted items until finishes have been completed on substrates involved.

3.4 FIELD QUALITY CONTROL

- A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in written report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating items of door hardware and each door to ensure proper operation of function of every unit. Replace units that cannot be adjusted to operate as intended and/or required. Adjust door control devices to compensation for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper finish and provide final protection and maintain condition that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION AND TRAINING

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain door hardware and door hardware finishes.

3.8 DOOR HARDWARE SETS

**Hardware Set #1 – Interior | Single | Non-Rated | Storeroom Function | Secured**

Openings: 0103, 0102B

3	Hinges	BB1168 – 5" x 4.5"	26D	HAG
1	Storeroom Lockset	9K37 – D – 14D	626	BEST
1	Closer (Pull Side mount)	4040XP Series	626	LCN
1	Electric Strike	7240	US26D	ADA
1	Card Reader	Owner Furnished, Owner Installed		
1	Overhead Stop	906S	US32D	GJ
1 set	Silencers			

Set #1 Notes:

1. Default is closed, latched and secured from corridor side of door.
2. Card Reader momentarily releases electric strike to allow door to be opened.
3. Electric strike is fail secure during fire alarm events.

**Hardware Set #2 – Interior | Single | Non-Rated | Passage**

Openings: 0102D, 0102E, 0102F, 0102H, 0102K

1	Passage Latchset	9K37 – N – 14D	626	BEST
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Set #2 Notes:

- Existing doors to remain. Existing office locksets to be removed and replaced with passage style locksets.

**Hardware Set #3 – Interior | Single | Non-Rated | Passage**

Openings: 0102C, 0102J, 0102L, 0102M

3	Hinges	BB1168 – 5" x 4.5"	26D	HAG
1	Passage Latchset	9K37 – N – 14D	626	BEST
1	Wall Stop	409	26D	RO
1 set	Silencers			

**Hardware Set #4 – Interior | Single | Non-Rated | Privacy**

Openings: 0102N

3	Hinges	BB1168 – 5" x 4.5"	26D	HAG
1	Privacy Lockset	9K37 – LL – 14D	626	BEST
1	Wall Stop	409	26D	RO
1 set	Silencers			

**Hardware Set #5 – Interior | Single | Non-Rated | Storeroom Function | Secured**

Openings: 0102

3	Hinges	BB1168 – 5" x 4.5"	26D	HAG
1	Storeroom Lockset	9K37 – D – 14D	626	BEST
1	Electric Strike	7240	US26D	ADA
1	Card Reader	Owner Furnished, Owner Installed		
1	Auto Operators	4100 Series	626	HOR
1	Touchless Actuator	8310-813		LCN
1 set	silencers			
1	Wireless remote button provided by MUHC			

Set #5 Notes:

- Default is closed, latched and secured from public corridor/waiting side of door.
- Card Reader on Corridor/Waiting side momentarily releases electric strike to allow door to be opened.
- Touchless actuator on Clinic side momentarily releases electric strike and engages auto operator.
- Electric strike and auto operator can be activated by a remote button at Check-in 0102 to allow visitors access to the clinic. This function works during default conditions and fire alarm events.
- Electric strike is fail secure from waiting room side during fire alarm events.

**Hardware Set #6 – Interior | Single | Non-Rated | Storeroom Function | Secured**

Openings: 0101

3	Hinges	BB1168 – 5" x 4.5"	26D	HAG
1	Storeroom Lockset	9K37 – D – 14D	626	BEST
1	Electric Strike	7240	US26D	ADA

1	Card Reader	Owner Furnished, Owner Installed		
1	Wall Stop	409	26D	RO
1	Auto Operator	4100 Series	626	HOR
2	Touchless Actuators	8310-813		LCN
1 set	Silencers			

Set #6 Notes:

1. Default is closed, latched and secured from main public corridor side of door (South side).
2. Card Reader on public corridor side momentarily releases electric strike to allow door to be opened. (After hours)
3. Touchless actuators on both sides momentarily releases electric strike and engages auto operator. (During normal business hours)
4. Electric strike is fail secure from public corridor side during fire alarm events.

END OF SECTION 08 7111

## 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.
- B. Related Sections include the following:
  - 1. Division 8 Section "Hollow Metal Doors and Frames"
  - 2. Division 8 Section "Flush Wood Doors"
  - 3. Division 8 Section "Joint Sealants"

#### 1.3 DEFINITIONS

- A. **Manufacturer:** A firm that produces primary glass or fabricated glass as defined in referenced glazing publications.
- B. **Interspace:** Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.
- C. **Deterioration of Coated Glass:** Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.
- D. **Deterioration of Laminated Glass:** Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
- E. **Deterioration of Insulating Glass:** Failure of the hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
  
- B. Glass Design: Glass 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. Specified Design Wind Loads: Determine design wind loads applicable to Project from basic wind speed indicated in miles per hour (meters per second) at 33 feet (10 m) above grade, according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 6.4.2, "Analytic Procedure," based on mean roof heights above grade indicated on Drawings.
    - b. Specified Design Snow Loads: As indicated, but not less than snow loads applicable to Project, required by ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 7, "Snow Loads."
    - c. 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.
    - d. Probability of Breakage for Sloped Glazing: 1 lite per 1000 for lites set more than 15 degrees off vertical and under wind and snow action.
      - 1) Load Duration: 30 days.
    - e. 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 (25 mm), whichever is less.
    - f. Minimum Glass Thickness for Exterior Lites: Not less than 6 mm.
    - g. Thickness of Tinted and Heat-Absorbing Glass: Provide the same thickness for each tint color indicated throughout Project.
  
- C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

- D. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:
1. For monolithic-glass lites, properties are based on units with lites 6 mm thick.
  2. For laminated-glass lites, properties are based on products of construction indicated.
  3. For insulating-glass units, properties are based on units with lites 6 mm thick and a nominal 1/2-inch- (13-mm-) wide interspace.
  4. Center-of-Glass U-Values: NFRC 100 methodology using LBL-35298 WINDOW 4.1 computer program, expressed as Btu/ sq. ft. x h x deg F (W/sq. m x K).
  5. Center-of-Glass Solar Heat Gain Coefficient: NFRC 200 methodology using LBL-35298 WINDOW 4.1 computer program.
  6. Solar Optical Properties: NFRC 300.

#### 1.5 SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. Samples: For the following products, in the form of 12-inch- (300-mm-) square Samples for glass.
1. Each color of tinted float glass.
  2. Fire-resistive glazing products.
  3. Each type of laminated glass with colored interlayer.
  4. Insulating glass for each designation indicated.
  5. 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. 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.

#### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association Glazier Certification Program as Level 2 (Senior Glaziers) or Level 3 (Master Glaziers).
- B. Source Limitations for Clear Glass: Obtain clear float glass from one primary-glass manufacturer.

- D. Source Limitations for Coated Glass: Obtain coated glass from one manufacturer for each type of coating and each type and class of float glass indicated.
- F. Source Limitations for Laminated Glass: Obtain laminated-glass units from one manufacturer using the same type of glass lites and interlayers for each type of unit indicated.
- G. Source Limitations for Glazing Accessories: Obtain glazing accessories from one source for each product and installation method indicated.
- H. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.
- I. Fire-Rated Window Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 257.
- J. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201
  - 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.
- K. 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."
  - 2. AAMA Publications: AAMA GD5G-1, "Glass Design for Sloped Glazing," and AAMA TIR-A7, "Sloped Glazing Guidelines."
  - 3. SIGMA Publications: SIGMA TM-3000, "Vertical Glazing Guidelines," and SIGMA TB-3001, "Sloped Glazing Guidelines."
- M. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. For insulating-glass units that will be exposed to substantial altitude changes, comply with insulating-glass manufacturer's written recommendations for venting and sealing to avoid hermetic seal ruptures.

#### 1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers

and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F (4.4 deg C).

## 1.9 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.
- B. Manufacturer's Special Warranty on Coated-Glass Products: Written warranty, made out to Owner and signed by coated-glass manufacturer agreeing to furnish replacements for those coated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
  1. Warranty Period: 10 years from date of Substantial Completion.
- C. Manufacturer's Special Warranty on Laminated Glass: Written warranty, made out to Owner and signed by laminated-glass manufacturer agreeing to furnish replacements for laminated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
  1. Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PRODUCTS AND MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products indicated in schedules at the end of Part 3.

### 2.2 PRIMARY FLOAT GLASS MATERIALS (MONOLITHIC)

- A. Manufacturers of Primary Float Glass: Subject to compliance with requirements, manufacturers offering primary float glass products that may be incorporated in the Work shall be one of the following companies:
  1. Basis of Design: PPG Industries, Inc.
  2. ACH Glass Operations (Formerly Visteon/ Ford)
  3. AFG Industries Inc.
  4. Pilkington Building Products North America.

### 2.3 PRIMARY FLOAT GLASS

- 2.4 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.



## 2.5 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. Fabrication Process: By vertical (tong-held) or horizontal (roller-hearth) process, at manufacturer's option, except provide horizontal process where indicated as tongless or free of tong marks.
- C. 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.

## 2.6 LAMINATED GLASS (LG-1) (NOT USED)

- A. Laminated Glass: Comply with ASTM C 1172 for kinds of laminated glass indicated and other requirements specified, including those in the Laminated-Glass Schedule at the end of Part 3.
- B. Interlayer: Interlayer material as indicated below, clear or in colors, and of thickness indicated with a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after laminating glass lites and installation.
  - 1. Interlayer Material: Polyvinyl butyral sheets.
- C. Laminating Process: Fabricate laminated glass to produce glass free of foreign substances and air or glass pockets as follows:
  - 1. Laminate lites with polyvinyl butyral interlayer in autoclave with heat plus pressure.

## 2.11 FIRE-RATED GLAZING PRODUCTS (FG-1) (NOT USED)

- A. Laminated Ceramic Glazing Material: Proprietary product in the form of two lites of clear ceramic glazing material laminated together to produce a laminated lite of 5/16-inch (8-mm) nominal thickness; polished on both surfaces; weighing 4 lb/sq. ft. (19.5 kg/sq. m); and as follows:
  - 1. Fire-Protection Rating: As indicated for the assembly in which the glazing material is installed, and permanently labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.
  - 2. Polished on both surfaces, transparent.
  - 3. Product: Subject to compliance with requirements, provide "FireLite Plus" manufactured by Nippon Electric Glass Co., Ltd. and distributed by Technical Glass Products.

## 2.13 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.
- C. Glazing Sealant for Fire-Resistive Glazing Products: Identical to product used in test assembly to obtain fire-protection rating.

#### 2.14 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tape: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
1. AAMA 804.3 tape, where indicated.
  2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
  3. AAMA 807.3 tape, for glazing applications in which tape is not 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.

#### 2.15 GLAZING GASKETS

- A. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock strips, complying with ASTM C 542, black.

- B. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:
  - 1. Neoprene, ASTM C 864.
  - 2. EPDM, ASTM C 864.
  - 3. Silicone, ASTM C 1115.
  - 4. Thermoplastic polyolefin rubber, ASTM C 1115.
  - 5. Any material indicated above.
  
- C. 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.

#### 2.16 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.
- G. Perimeter Insulation for Fire-Resistive Glazing: Identical to product used in test assembly to obtain fire-resistance rating.
- H. Fixed Glazing Frame at reception desk shall be 3 Form 0-15-6668 or approved equal.

#### 2.17 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 (1270 mm) 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 (3-mm) 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 LOCK-STRIP GASKET GLAZING

- A. Comply with ASTM C 716 and gasket manufacturer's written instructions. Provide supplementary wet seal and weep system, unless otherwise indicated.

### 3.8 PROTECTION AND CLEANING

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.
- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for build-up of dirt, scum, alkaline deposits, or stains; remove as recommended by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents, and vandalism, during construction period.

- E. 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.

END OF SECTION 08 8000

## SECTION 09 2116 - GYPSUM BOARD ASSEMBLIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Interior gypsum wallboard.
  - 2. Non-load-bearing steel framing.
  - 3. Stenciling fire and smoke ratings on rated partitions.
- B. Related Sections include the following:
  - 1. Division 09 Section "Gypsum Board Shaft Wall Assemblies" for framing, gypsum panels, and other components of shaft wall assemblies.

#### 1.3 DEFINITIONS

- A. Gypsum Board Terminology: Refer to ASTM C 11 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.
- B. Wet Area Definition: The definition of a wet area shall conform to the definition given in TCA, "Handbook for Ceramic Tile Installation", which is as follows:
  - 1. "Tile surfaces that are either soaked, saturated, or subject to moisture or liquids (usually water) such as gang showers, tub enclosures, showers, laundries, saunas, steam rooms, swimming pools, hot tubs, and exterior areas."

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show locations, fabrication, and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other units of Work.

#### 1.5 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: For gypsum board assemblies with fire-resistance ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
  - 1. Fire-Resistance-Rated Assemblies: Indicated by design designations from FM's "Approval Guide, Building Products.", UL's "Fire Resistance Directory.", GA-600, "Fire Resistance Design



Manual.", or in the listing of another testing and inspecting agency acceptable to authorities having jurisdiction.

- B. Stencil fire and/or smoke rating of each rated assembly on each side of the wall above ceiling, or above 9'-0" where no ceiling is scheduled. Refer to labeling requirements at the end of this Section.
- C. Sound Transmission Characteristics: For gypsum board assemblies with STC ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by a qualified independent testing agency.
  - 1. STC-Rated Assemblies: Indicated by design designations from GA-600, "Fire Resistance Design Manual."

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Stack gypsum panels flat to prevent sagging.

#### 1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the Work include, but are not limited to, the following:
  - 1. Steel Framing and Furring:
    - a. Clark Steel Framing Systems.
    - b. Consolidated Systems, Inc.
    - c. Dale Industries, Inc. - Dale/Incor.
    - d. Dietrich Industries, Inc.
    - e. MarinoWare; Division of Ware Ind.
    - f. National Gypsum Company.
    - g. Scafco Corporation.
    - h. Unimast, Inc.
    - i. Western Metal Lath & Steel Framing Systems.
  - 2. Grid Suspension System for Interior Ceilings:
    - a. Armstrong World Industries, Inc.
    - b. Chicago Metallic Corporation.

- c. USG Interiors, Inc.
3. Gypsum Boards and Related Products:
- a. American Gypsum Co.
  - b. G-P Gypsum Corp.
  - c. National Gypsum Company.
  - d. United States Gypsum Co.

## 2.2 STEEL SUSPENDED CEILING AND SOFFIT FRAMING

- A. Components, General: Comply with ASTM C 645 and ASTM C 754 for conditions indicated.
- B. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- (1.59-mm-) diameter wire, or double strand of 0.0475-inch- (1.21-mm-) diameter wire.
- C. Hanger Attachments to Concrete: As follows:
  - 1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching hanger wires and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by a qualified independent testing agency.
    - a. Type: Postinstalled, expansion anchor.
  - 2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by a qualified independent testing agency.
- D. Hangers: As follows:
  - 1. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch (4.12-mm) diameter.
- E. Carrying Channels: Cold-rolled, commercial-steel sheet with a base metal thickness of 0.0538 inch (1.37 mm), a minimum 1/2-inch- (12.7-mm-) wide flange, with ASTM A 653/A 653M, G40 (Z120), hot-dip galvanized in areas of normal humidity; ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized in humid areas such as kitchens, showers and swimming
  - 1. Depth: As indicated.
- F. Furring Channels (Furring Members): Commercial-steel sheet with ASTM A 653/A 653M, G40 (Z120), hot-dip galvanized ASTM A 653/A 653M in areas of normal humidity; G60 (Z180), hot-dip galvanized in humid areas
  - 1. Cold Rolled Channels: 0.0538-inch (1.37-mm) bare steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flange, 3/4 inch (19.1 mm) deep.
  - 2. Steel Studs: ASTM C 645.

- a. Minimum Base Metal Thickness: .0179 inch (0.45 mm)
  - b. Depth: As indicated.
- 3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch (22.2 mm) deep.
  - a. Minimum Base Metal Thickness: 0.0312 inch (0.79 mm)
- 4. Resilient Furring Channels: 1/2-inch- (12.7-mm-) deep members designed to reduce sound transmission.
- G. Grid Suspension System for Interior Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Armstrong World Industries, Inc.; Furring Systems/Drywall.
    - b. Chicago Metallic Corporation; Drywall Furring 640 System.
    - c. USG Interiors, Inc.; Drywall Suspension System.

## 2.3 STEEL PARTITION AND SOFFIT FRAMING

- A. Components, General: As follows:
  - 1. Comply with ASTM C 754 for conditions indicated.
  - 2. Steel Sheet Components: Complying with ASTM C 645 requirements for metal and with ASTM A 653/A 653M, G40 (Z120), hot-dip galvanized and ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized, unless noted otherwise.
- B. Partition/Soffit Support Materials:
  - 1. Studs: Steel sheet components complying with ASTM C 645 requirements for metal and with ASTM A53/A 653M, hot dip galvanized; standard G40 unless as noted below. The minimum base metal thickness to be used for stud partition construction shall be 0.0312 inch (20 gage) (0.79 mm), unless otherwise indicated and with special arrangement at door jamb and opening construction specified in Part 3 below.
  - 2. Use G60 studs in all exterior walls and wet applications and G40 studs for normal interior partitions and dry applications,
    - a. Depth of Section: 3-5/8", except as otherwise indicated.
    - b. Runners: Match studs; type recommended by stud manufacturer for floor and ceiling support of studs, and for vertical abutment of drywall work at other work.
- C. Deflection Track: Provide a slotted track with positive attachment for wall strength and to allow vertical movement. Track shall meet requirements of all standard building codes, ICBO - ER 5344 and be UL Classified R19236, and the latest seismic cycling standards found in UL2079 and ASTM 1966. Anchorage of the studs to the track shall be as recommended by the manufacturer with #8 waferhead screws. Refer to the Drawings and to manufacturer's details.

- D. Firestop Track: Provide a slotted track with positive attachment for wall strength and to allow vertical movement. Track shall meet requirements of all standard building codes, ICBO - ER 5344 and be UL Classified R19236, and the latest seismic cycling standards found in UL2079 and ASTM 1966. Refer to Drawings for referenced UL assembly number. Anchorage of the studs to the track shall be as recommended by the manufacturer with #8 waferhead screws. Refer to the Drawings and to manufacturer's details.
  - E. Cold-Rolled Channel Bridging: 0.0538-inch (1.37-mm) bare steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flange.
    - 1. Depth: 1-1/2 inches (38.1 mm), unless noted otherwise.
    - 2. Clip Angle: 1-1/2 by 1-1/2 inch (38.1 by 38.1 mm), 0.068-inch- (1.73-mm-) thick, galvanized steel.
  - F. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
    - 1. Minimum Base Metal Thickness: 0.0179 inch (25 gage) (0.45 mm), unless noted otherwise.
    - 2. Depth: 7/8 inch (22.2 mm), unless noted otherwise.
  - G. Resilient Furring Channels: 1/2-inch- (12.7-mm-) deep, steel sheet members designed to reduce sound transmission.
  - H. Cold-Rolled Furring Channels: 0.0538-inch (1.37-mm) bare steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flange.
    - 1. Depth: 3/4 inch (19.1 mm).
    - 2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum bare steel thickness of 0.0312 inch (0.79 mm).
    - 3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- (1.59-mm-) diameter wire, or double strand of 0.0475-inch- (1.21-mm-) diameter wire.
  - I. Z-Shaped Furring: With slotted or non-slotted web, face flange of 1-1/4 inches (31.8 mm), wall attachment flange of 7/8 inch (22.2 mm), minimum bare metal thickness of 0.0179 inch (0.45 mm), and depth required to fit insulation thickness indicated.
  - J. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- 2.4 PANEL PRODUCTS, GENERAL
- A. Panel Size, General: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.
  - B. "GREEN BOARD" or "BLUE BOARD" will not be allowed for use as a "WATER-RESISTANT GYPSUM BOARD" nor "TILE BACKING BOARD" application.
- 2.5 GENERAL-USE GYPSUM WALLBOARD AND CEILING BOARD
- A. Provide the following general-use wallboard for all applications:
    - 1. in areas that are not defined as wet areas or abuse resistant

2. or in areas where moisture, mold, and mildew resistance is not required.

B. Gypsum Wallboard: ASTM C 36.

1. Type X Wallboard: Provide at all vertical and soffit gypsum wallboard as Type X, 5/8" thickness whether used in a rated assembly or not, with long edges tapered.

C. Sag-Resistant Gypsum Ceiling Board: ASTM C 36.

1. Sag-Resistant Ceiling Board: Provide at all gypsum board ceilings as, 1/2 inch (12.7 mm) thickness, and with long edges tapered. Manufactured to have more sag resistance than regular-type gypsum board.

2. Products:

a. Georgia Pacific: ToughRock CD Ceiling Board.

b. National Gypsum: 1/2" High Strength Ceiling Board.

c. United States Gypsum: Sheetrock Brand Sag-Resistant Interior Gypsum Ceiling Board.

## 2.6 MOISTURE/ MOLD/ MILDEW RESISTANT GYPSUM WALLBOARD

A. Moisture/ Mold/ Mildew Resistant Gypsum Wallboard: Manufactured with additives to enhance the fire resistance and moisture/ mold/ mildew resistance. Complying with ASTM C630/ 1396 or ASTM C 1278. Product shall have a mold and mildew resistance score of "10" when tested in accordance with ASTM D 3237.

1. Acceptable Products:

a. National Gypsum Company: Gold Bond® Brand XPT™ Fire Shield Gypsum Wallboard.

b. United States Gypsum Company, Fiberock® Aqua Tough Interior Gypsum Panel.

c. Georgia Pacific Gypsum Company: DensArmor® Plus Fire Guard Interior Panel.

2. Thickness: 5/8 inch (15.9 mm).

3. Core: Type X, Fire-Resistant.

4. Width: 4 ft.

5. Length: 8ft., 10 ft., or 12ft.

6. Long Edges: Tapered.

7. Location: Use Moisture/ Mold/ Mildew Resistant board in the following locations:

a. All areas where moisture, mold, and mildew resistance is required

b. As a tile backer board in dry areas

c. In areas with limited water exposure such as toilet/sink areas, janitor closets

d. In areas above tile in tubs and showers, soiled utility

e. Within 48" horizontally either side of all other plumbing fixtures.

f. Interior side of exterior walls where moisture intrusion may occur.

B. Joint Treatment for Moisture, Mold and Mildew Resistant Gypsum Board: Setting type powder compound used for covering fasteners, pre-filling and taping joints of all Moisture, Mold, and Mildew Resistant Gypsum Board. Complying with ASTM C 475.

1. Acceptable Products per gypsum board manufacturer's installation recommendations:
  - a. National Gypsum Company: ProForm® Brand XPT™ Ready Mix: Drying type pre-mixed compound manufactured with additives for optimum mold and mildew resistance.
  - b. National Gypsum Company: ProForm® Brand Sta-Smooth/ Sta-Smooth Lite setting compounds.
  - c. United States Gypsum Company: Sheetrock® Brand Durabond® setting compound.
  - d. Georgia Pacific Gypsum Company: ToughRock® 90 Compound.

## 2.7 TILE BACKING PANELS

- A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.
- B. Provide the following at porcelain wall tile in dry installations:
  1. Water-Resistant Gypsum Tile Backing Board: Manufactured from a blend of gypsum/cellulose-fiber combination, with tapered edges and of type and thickness indicated; in maximum lengths available to minimize end-to-end butt joints. Product shall also have been tested per ASTM D 3273-00 "Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber," and score an "10".
    - a. Type: Type X - fire-rated, unless otherwise indicated.
    - b. Thickness: 5/8 inch, unless otherwise indicated.
    - c. Use this product as a tile backing board; not as a finish surface.
    - d. Products:
      - 1) USG Fiberock® Aqua-Tough™ Tile Backerboard.
      - 2) National Gypsum Gold Bond® Brand XPT™ Fire Shield Gypsum Wallboard.
      - 3) An approved equal.
    - e. Location: As a tile backing board in the following locations:
      - 1) In all areas as a tile backer board where tile **is not** subject to wetting by liquid water moisture.
- C. Provide the following at porcelain wall tile in wet installations:
  1. Cementitious Backer Units: ANSI A118.9.
    - a. Products: Subject to compliance with requirements, provide [one of] the following:
      - 1) 1/2" Wonderboard, Custom Building Products.
      - 2) 1/2" Durock® Brand Cement Board as manufactured by USG Corporation. [Textured side for tile and smooth side for finish]

3) 1/2" HardieBacker™ Cement Board as manufactured by JamesHardie International. [Smooth for tile or finish]

- b. Extend cement board a minimum of 4 feet past wet area.
- c. Thickness: As indicated.
- d. Location: As a tile backing board in the following locations:

1) In all "wet areas" as a tile backer board where tile is subject to wetting by liquid water moisture.

## 2.10 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

- 1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc. Plastic edge trim is not permitted.
- 2. Shapes:
  - a. Cornerbead: Use at outside corners Sheetrock B1 Beaded Flex, Flexible Metal Outside Corner Bead.
  - b. LC-Bead: J-shaped; exposed long flange receives joint compound; use at exposed panel edges.
  - c. Expansion (Control) Joint: Use where indicated or required.
  - d. Curved-Edge Cornerbead: With notched or flexible flanges; use at curved openings.

## 2.11 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475.

B. Joint Tape:

- 1. Interior Gypsum Wallboard: Paper.
- 2. Tile Backing Panels: As recommended by panel manufacturer.

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. Use drying-type unless otherwise noted.

D. Joint Compound for Tile Backing Panels:

- 1. Water-Resistant Gypsum Backing Board: Use setting-type taping and setting-type, sandable topping compounds.
- 2. Glass-Mat, Water-Resistant Backing Panel: As recommended by manufacturer.
- 3. Cementitious Backer Units: As recommended by manufacturer.

## 2.12 ACOUSTICAL SEALANT

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

- 1. Acoustical Sealant for Exposed and Concealed Joints:

- a. Pecora Corp.; AC-20 FTR Acoustical and Insulation Sealant.
  - b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.
- B. Acoustical Sealant for Exposed and Concealed Joints: Nonsag, paintable, nonstaining, latex sealant complying with ASTM C 834 that effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
- C. Putty Pad:
  - 1. Available Products:
    - a. QuietRock: Quietputty, 7"x7"x1/8<sup>th</sup> thick or equal

## 2.13 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards, notes and details shown on drawings, and manufacturer's written recommendations.
- B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
  - 1. Screws for Cold-Formed Metal Framing: Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
  - 2. Screws for Cementitious Backer Units: For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- C. Isolation Strip at Exterior Walls:
  - 1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
  - 2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.
- D. In-Wall Metal Blocking: Install 20-gauge steel backing at 10 inches above floors along all corridors, handrails, cabinetry, and any wall hung items exceeding 20 pounds, including but not limited to monitors, televisions, and baby changing stations. Blocking shall be installed whether shown on the drawings or not.
- E. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
  - 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

## 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. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Suspended Ceilings: Coordinate installation of ceiling suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive ceiling hangers at spacing required to support ceilings and that hangers will develop their full strength.
  - 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

### 3.3 INSTALLING STEEL FRAMING, GENERAL

- A. Installation Standards: ASTM C 754, and ASTM C 840 requirements that apply to framing installation.
- B. Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with gypsum board manufacturer's written recommendations or, if none available, with United States Gypsum's "Gypsum Construction Handbook."
- C. Isolate steel framing from building structure at locations indicated to prevent transfer of loading imposed by structural movement.
  - 1. Isolate ceiling assemblies where they abut or are penetrated by building structure.
  - 2. Isolate partition framing and wall furring where it abuts structure, except at floor. Install slip-type joints at head of assemblies that avoid axial loading of assembly and laterally support assembly.
    - a. Use deep-leg deflection track where indicated.
    - b. Use firestop track where indicated.
- D. Do not bridge building control and expansion joints with steel framing or furring members. Frame both sides of joints independently.

### 3.4 INSTALLING STEEL SUSPENDED CEILING AND SOFFIT FRAMING

- A. Suspend ceiling 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 ceiling suspension system. 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 the location of hangers required to support standard suspension system members, install supplemental suspension members

and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

3. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail.
  4. Secure hangers to structure, including intermediate framing members, by attaching to inserts, eyescrews, 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 support ceilings directly from permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
  6. Do not attach hangers to steel deck tabs.
  7. Do not attach hangers to steel roof deck. Attach hangers to structural members.
  8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- B. Installation Tolerances: Install steel framing components for suspended ceilings so members for panel attachment are level to within 1/8 inch in 12 feet (3 mm in 3.6 m) measured lengthwise on each member and transversely between parallel members.
- C. Seismic Bracing: Sway-brace suspended steel framing with hangers used for support, as required by Authorities having jurisdiction.
- D. Wire-tie furring channels to supports, as required to comply with requirements for assemblies indicated.
- E. Install suspended steel framing components in sizes and spacings indicated, but not less than that required by the referenced steel framing and installation standards. If spacings not indicated, the following are maximum spacings.
1. Hangers: 48 inches (1219 mm) o.c.
  2. Carrying Channels (Main Runners): 48 inches (1219 mm) o.c.
  3. Furring Channels (Furring Members): 16 inches (406 mm) o.c.
- F. Grid Suspension System: Attach perimeter wall track or angle where grid suspension system meets vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- ### 3.5 INSTALLING STEEL PARTITION AND SOFFIT FRAMING
- A. Install tracks (runners) at floors, ceilings, and structural walls and columns where gypsum board assemblies abut other construction.
1. Where studs are installed directly against exterior walls, install asphalt-felt or foam-gasket isolation strip between studs and wall.
- B. Installation Tolerance: Install each steel framing and furring member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by the faces of adjacent framing.
- C. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings.

Continue double studs at door jambs and framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.

1. Cut studs 1/2 inch (13 mm) short of full height to provide perimeter relief.
  2. For fire-resistance-rated and/or STC-rated partitions that must extend to the underside of continuous solid-structure surfaces to obtain ratings, install framing around structural and other members extending below floor/roof slabs and decks, as needed to support gypsum board closures and to make partitions continuous from floor to underside of solid structure.
    - a. Terminate partition framing at suspended ceilings where indicated.
- D. Install steel studs and furring at the following spacings:
1. Single-Layer Construction: 16 inches (406 mm) o.c., unless otherwise indicated.
  2. Multilayer Construction: 16 inches (406 mm) o.c., unless otherwise indicated.
- E. Install steel studs so flanges point in the same direction and leading edge or end of each panel can be attached to open (unsupported) edges of stud flanges first.
- F. Frame door openings to comply with GA-600 as a minimum requirement and with gypsum board manufacturer's applicable written recommendations, and as specified below.
1. Door Jamb Framing: Frame door openings with vertical studs securely attached by screws at each jamb either directly to frames or to jamb anchor clips on door frame; install runner track sections (for cripple studs) at head and secure to jamb studs.
    - a. Runner Tracks at Head of Door Openings: Provide runner tracks at head of same gage as jamb studs. Space cripple studs at same spacing and gage as partition studs.
    - b. Jambs of All Interior Door Conditions: As a minimum, double studs shall be provided at all interior door conditions. Strap all jamb studs with 18-gage minimum 1" wide bands at 16" o.c. maximum vertically, floor to bottom of structure above. Install angle bracing above ceiling to structure in each direction at strike side of door except as noted.
      - 1) Single Door Openings Less Than 4'-0" Wide: Install double, 20-gage (0.79 mm) studs at each jamb. Extend studs to deck above and anchor.
      - 2) Doors Openings 4'-0" Wide and Greater: Install triple 20-gage studs at each jamb. Extend studs to deck above and anchor. Provide kickers at ends and midpoint of openings.
  2. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (13-mm) clearance from jamb stud to allow for installation of control joint.
  3. Extend jamb studs through suspended ceilings and attach to underside of floor or roof structure above.

- G. 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.
- H. Sound-Attenuation Batts:
  - 1. Erect sound attenuating batts in cavities formed by framing members according to the manufacturer's recommendations. Place batts in cavities to produce a friction fit between edges of insulation and adjoining framing members. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced batts mechanically and support faced batts by taping stapling flanges to flanges of metal studs. Install supplementary framing, runners, furring, blocking and backing at opening and termination in the work, and at locations required to support fixtures, equipment, services, heavy trim, furnishings and similar work which cannot be adequately supported directly on gypsum board alone.

### 3.6 APPLYING AND FINISHING PANELS, GENERAL

- A. Gypsum Board Application and Finishing Standards: ASTM C 840 and GA-216.
- B. Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.
- C. Install ceiling board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- D. Install gypsum panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.
- E. 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.
- F. Attach gypsum panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- G. Attach gypsum panels to framing provided at openings and cutouts.
- H. Form control and expansion joints with space between edges of adjoining gypsum panels.
- I. Cover both faces of steel stud partition 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. (0.7 sq. m) in area.
  - 2. Fit gypsum panels around ducts, pipes, and conduits.

3. Where partitions intersect open concrete coffers, concrete joists, and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by coffers, joists, and other structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.
- J. Isolate perimeter of non-load-bearing gypsum board partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations, and trim edges with U-bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
  - K. STC-Rated Assemblies: Seal construction at perimeters, behind control and expansion joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through gypsum board assemblies, including sealing partitions above acoustical ceilings.
  - L. Sound Treatment: Whether indicated on the drawings in the details or not, provide the following as minimum sound treatment requirements for gypsum partitions around private offices, patient exam rooms, consulting rooms, toilet rooms (public or private), corridor walls and any other sound-sensitive areas. Sound gasketing shall be required at any doors through these walls (whether indicated in the Hardware Schedule or not). If not indicated, provide a set of Sound Gasket Seal 5050B, brown in color, by NGP or equal as a minimum requirement.
    1. Seal construction at perimeters, behind control and expansion joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at perimeters of both faces of partitions and at any through penetrations. Comply with ASTM C 919 and manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through gypsum board assemblies, including sealing partitions above acoustical ceilings.
  - M. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's written recommendations.
    1. Space screws a maximum of 12 inches (304.8 mm) o.c. for vertical applications.
  - N. Space fasteners in panels that are tile substrates a maximum of 8 inches (203.2 mm) o.c.

### 3.7 PANEL APPLICATION METHODS

- A. Single-Layer Application:
  1. On ceilings, apply gypsum panels before wall/partition board application to the 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.
  3. Do not butt boards to concrete floor. Maintain a minimum 1/4" to a maximum 3/8" space between bottom of board and concrete.

- a. Stagger abutting end joints not less than one framing member in alternate courses of board.
  - b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
- B. Multilayer Application on Partitions/Walls: Apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
- C. Single-Layer Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- D. Multilayer Fastening Methods: If required for fire-rated assemblies, fasten base layers and face layers separately to supports with screws. Otherwise, fasten base layers with screws; fasten face layers with adhesive and supplementary fasteners.
- E. Tile Backing Panels:
  - 1. Water-Resistant Gypsum Backing Board: Install at showers, tubs, and where indicated. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.
  - 2. Glass-Mat, Water-Resistant Backing Panel: Comply with manufacturer's written installation instructions and install at locations indicated to receive tile. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.
  - 3. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.
  - 4. Areas Not Subject to Wetting: Install standard gypsum wallboard panels to produce a flat surface except at showers, tubs, and other locations indicated to receive water-resistant panels.
  - 5. Where tile backing panels abut other types of panels in the same plane, shim surfaces to produce a uniform plane across panel surfaces.

### 3.8 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 (beaded type) according to ASTM C 840 and in specific locations approved by Architect for visual effect.
  - 1. At any point where the mass of the wall is reduced.
  - 2. At continuous vertical expanses of drywall such as at stairwells, place horizontal control joints at each floor level.
  - 3. Locate joints where no expanse of drywall (including joints in ceilings, soffits/ ceiling drops, and partitions) exceeds 30 feet in any direction, verify locations with Architect before proceeding.
  - 4. Provide a vertical control joint on the strike side of all single doors, both sides of the wall, extending to the top of the gypsum board. Provide a vertical control joint on each hinge side of all double doors, both sides of the wall, extending to the top of the gypsum board.
  - 5. Seal joints with acoustical sealant.

### 3.9 FINISHING GYPSUM BOARD ASSEMBLIES

- 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, according to ASTM C 840, for locations indicated:
  - 1. Level 1: Embed tape at joints in ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistance-rated assemblies and sound-rated assemblies.
  - 2. Level 2: Embed tape and apply separate first coat of joint compound to tape, fasteners, and trim flanges where panels are substrate for tile and where indicated.
  - 3. Level 4: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges at panel surfaces that will be exposed to view, unless otherwise indicated.
    - a. LEVEL FOUR TO BE THE MINIMUM LEVEL OF FINISH AT ALL NEW WALLS, UNLESS NOTED OTHERWISE.
  - 4. Level 5: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges, and apply skim coat of joint compound over entire surface where indicated in the Finish Schedule.
    - a. LEVEL FIVE FINISH TO THE MINIMUM LEVEL OF FINISH AT ALL WALLS SCHEDULED TO RECEIVE AF-1.
- E. Glass-Mat, Water-Resistant Backing Panels: Finish according to manufacturer's written instructions.
- F. Cementitious Backer Units: Finish according to manufacturer's written instructions.

### 3.10 LABELING PARTITIONS/ CEILINGS

- A. Partition Identification: The Gypsum Board contractor shall be responsible for labeling any/all of the following applicable gypsum board partitions/ ceilings. Label shall be stenciled in 4-inch high RED letters, 12 inches above the ceiling, **on both sides of the partition** and at a maximum 8-foot apart maximum; a minimum of one label per partition elevation. Where no ceiling occurs, the stencil shall be located 9'-0" above the finished floor.
- B. Changes in Wall Type: Where changes in wall type occur, a vertical line shall be stenciled (ceiling to 12" above the ceiling) at the center line of the change and the correct wall type shall be stenciled immediately to each side of the line.
- C. Rating Changes: Work shall include the re-stenciling of walls where the construction type changes, this includes removal of stencils (painting over) on walls that are "decommissioned."

- D. The following identifications shall be applied; text to match exactly as given below. The text can be stenciled on using either one line of text or two; whichever fits. Labeling shall apply to all the partition/ ceiling types listed.

At Non-Rated Smoke Partitions the stencil shall read:	<b>0-HR SMOKE PARTITION</b>
At 1-Hour Rated Fire Partitions the stencil shall read:	<b>1-HR FIRE PARTITION</b>
At 1-Hour Rated Fire Barrier the stencil shall read:	<b>1-HR FIRE BARRIER</b>
At 2-Hour Rated Fire Barriers the stencil shall read:	<b>2-HR FIRE BARRIER</b>
At 3-Hour Rated Fire Barriers the stencil shall read:	<b>3-HR FIRE BARRIER</b>
At 4-Hour Rated Fire Barriers the stencil shall read:	<b>4-HR FIRE BARRIER</b>
At 1-Hour Rated Fire and Smoke Barriers the stencil shall read:	<b>1-HR SMOKE BARRIER</b>
At 2-Hour Rated Fire and Smoke Barriers the stencil shall read:	<b>2-HR SMOKE BARRIER</b>
At 1-Hour Rated Shaft Walls the stencil shall read:	<b>1-HR SHAFT</b>
At 2-Hour Rated Shaft Walls the stencil shall read:	<b>2-HR SHAFT</b>
At 2-Hour Rated Fire Walls the stencil shall read:	<b>2-HR FIRE WALL</b>
At 3-Hour Rated Fire Walls the stencil shall read:	<b>3-HR FIRE WALL</b>
At 4-Hour Rated Fire Walls the stencil shall read:	<b>4-HR FIRE WALL</b>
At 1-Hour Rated Bearing Walls the stencil shall read:	<b>1-HR BEARING WALL</b>
At 2-Hour Rated Bearing Walls the stencil shall read:	<b>2-HR BEARING WALL</b>
At 3-Hour Rated Bearing Walls the stencil shall read:	<b>3-HR BEARING WALL</b>
At 1-Hour Rated Exterior Walls the stencil shall read:	<b>1-HR EXTERIOR WALL</b>
At 2-Hour Rated Exterior Walls the stencil shall read:	<b>2-HR EXTERIOR WALL</b>
At 3-Hour Rated Exterior Walls the stencil shall read:	<b>3-HR EXTERIOR WALL</b>
At 1-Hour Rated Floor-Ceiling Assemblies (gypsum board assemblies only) apply one stencil in a visible location in each room. The stencil shall read:	<b>1-HR FLOOR-CEILING</b>



At 2-Hour Rated Floor-Ceiling Assemblies (gypsum board assemblies only) apply one stencil in a visible location in each room. The stencil shall read:	<b>2-HR FLOOR-CEILING</b>
At 1-Hour Rated Roof-Ceiling Assemblies (gypsum board assemblies only) apply one stencil in a visible location in each room. The stencil shall read:	<b>1-HR ROOF-CEILING</b>
At 1 1/2-Hour Rated Roof-Ceiling Assemblies (gypsum board assemblies only) apply one stencil in a visible location in each room. The stencil shall read:	<b>1 1/2-HR ROOF-CEILING</b>
At Lead Shielding Partitions the stencil shall read:	<b>LEAD SHIELDING __" THICK</b>

### 3.11 CLEANING AND PROTECTION

- A. Promptly remove any residual joint compound from adjacent surfaces.
- B. Provide final protection and maintain conditions, in a manner acceptable to Installer, that will ensure gypsum board assemblies are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 09 21 16

## SECTION 09 3000 - **TILING**

### 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. Porcelain tile.
2. Glass tile.
3. Crack-suppression membrane for thin-set tile installations.
4. Metal edge strips installed as part of tile installations.

- B. Related Sections include the following:

1. Division 07 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
2. Division 09 Section "Gypsum Board Assemblies" for glass-mat, water-resistant backer board.

#### 1.3 DEFINITIONS

- A. Module Size: Actual tile size (minor facial dimension as measured per ASTM C 499) plus joint width indicated.
- B. Facial Dimension: Nominal tile size as defined in ANSI A137.1.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:
  1. Level Surfaces: Minimum 0.6.
  2. Step Treads: Minimum 0.6.
  3. Ramp Surfaces: Minimum 0.8.

#### 1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
- C. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required.

- D. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

#### 1.6 QUALITY ASSURANCE

- A. Source Limitations for Tile: Obtain all tile of same type and color or finish from one source or producer.

1. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.

- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

#### 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 in ANSI A137.1 for labeling sealed tile packages.

- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

- D. Store liquid latexes and emulsion adhesives in unopened containers and protected from freezing.

- E. Handle tile that has 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 complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

#### 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. Tile and Trim Units: Furnish quantity of full-size units equal to 5-10 percent of amount installed, for each type, composition, color, pattern, and size indicated.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
  - 1. Products: Subject to compliance with requirements, provide one of the products specified in the finish materials legend.

### 2.2 PRODUCTS, GENERAL

- A. 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.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI standards referenced in "Setting and Grouting Materials" Article.
- C. 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. Refer to Materials Legend and Finish Plan on drawings.
- D. Factory Blending: For tile exhibiting color variations within ranges selected during Sample submittals, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- E. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless otherwise indicated.
  - 1. Tile in Wet Areas: 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 installation indicated and has a record of successful in-service performance.
- F. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

## 2.3 TILE PRODUCTS

- A. Refer to Finish Schedule for tile products.

## 2.4 CRACK-SUPPRESSION MEMBRANES FOR THIN-SET TILE INSTALLATIONS

- A. General: Manufacturer's standard product that complies with ANSI A118.10, selected from the following.
- B. Chlorinated-Polyethylene-Sheet Product: Nonplasticized, chlorinated polyethylene faced on both sides with high-strength, nonwoven polyester fabric, for adhering to latex-portland cement mortar; 60 inches (1524 mm) wide by 0.030-inch (0.76-mm) nominal thickness.
  - 1. Product: Noble Company (The); Noblesseal TS.
- C. Latex-Portland Cement Product: Flexible mortar consisting of cement-based mix and acrylic-latex additive.
  - 1. Products:
    - a. Boiardi Products Corporation; Elastiment 323.
    - b. MAPEI Corporation; PRP 315.
    - c. Southern Grouts & Mortars, Inc.; Southcrete 1100.
    - d. TEC Specialty Products Inc.; TA-324, Triple Flex.

## 2.5 SETTING AND GROUTING MATERIALS

- A. Manufacturers:
  - 1. Atlas Minerals & Chemicals, Inc.
  - 2. Boiardi Products Corporation.
  - 3. Bonsal, W. R., Company.
  - 4. Bostik.
  - 5. C-Cure.
  - 6. Custom Building Products.
  - 7. DAP, Inc.
  - 8. Jamo Inc.
  - 9. LATICRETE International Inc.
  - 10. MAPEI Corporation.
  - 11. Southern Grouts & Mortars, Inc.
  - 12. Summitville Tiles, Inc.
  - 13. TEC Specialty Products Inc.
- B. Dry-Set Portland Cement Mortar (Thin Set): ANSI A118.1.
  - 1. For wall applications, provide nonsagging mortar that complies with Paragraph C-4.6.1 in addition to the other requirements in ANSI A118.1.
- C. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4, consisting of the following:
  - 1. Prepackaged dry-mortar mix combined with liquid-latex additive.

- a. For wall applications, provide nonsagging mortar that complies with Paragraph F-4.6.1 in addition to the other requirements in ANSI A118.4.

## 2.6 SETTING MATERIALS

- A. Polymer-Modified Mortar: Mortar meeting or exceeding ANSI A128.4 and ANSI A118.11 requirements. Provide the following professional-grade, single-component, high-performance, polymer-modified thin-set mortar for interior and exterior installations of dimensional stone, ceramic, porcelain and quarry tile:
  1. Ultraflex® 2 as manufactured by Mapei. For tile 16 x 16 or larger use Ultraflex™ LTF.
  2. An approved equal product from TEC Specialty Products Inc.
  3. An Architect approved equal product.

## 2.7 GROUTING MATERIALS

- A. Cement-Based Polymer-Modified Tile Grout: ANSI A118.7, color as selected by the Architect.
  1. Polymer Type: Manufacturer's proprietary polymer, in dry, redispersible form, prepackaged with other dry ingredients.
    - a. Unsanded grout mixture for joints 1/8 inch (3.2 mm) and narrower.
  2. Provide one of the following:
    - a. Hydroment epoxy grout, as manufactured by Bostik
    - b. AccuColor XT™ Next Generation Sanded Grout as manufactured by TEC Specialty Products Inc.
    - c. Opticolor™ Stain-Free Grout as manufactured by Mapei Corporation, [www.mapei.com](http://www.mapei.com).
  3. Grout does not require a sealer.
  4. Installation of grout and cleaning of tile must be in accordance with grout manufacturer's recommendations.
- B. Sand-Portland Cement Grout: ANSI A108.10, composed of white or gray cement and white or colored aggregate as required to produce color indicated.
- C. Standard Sanded Cement Grout: ANSI A118.6, color as indicated.
- D. Standard Unsanded Cement Grout: ANSI A118.6, color as indicated.

## 2.8 ELASTOMERIC SEALANTS

- A. Refer to Division 07 Section "Joint Sealants."

## 2.9 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. Metal Corner Trim: Provide metal corner trim for all outside corners for corner protection. Installation shall also include any end cap or other trim pieces where required for a complete installation. Corner trim shall be anodized aluminum units, Schluter®-RONDEC, sized to compliment the thickness of tile and mortar setting. Units shall be as manufactured by Schluter® Systems, or an approved equal.
  - 1. An Approved Equal: Made in USA Products by the following:
    - a. Genotek  
41840 McAlby Court  
Murrieta, CA 92562  
800.741.8936  
800.963.5576 fax  
[www.genotek](http://www.genotek.com) website
- C. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications, stainless steel; ASTM A 666, 300 Series exposed-edge material.
- 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: Manufacturer's standard product for sealing grout joints that does not change color or appearance of grout.
  - 1. Products:
    - a. Bonsal, W. R., Company; Grout Sealer.
    - b. Bostik; CeramaSeal Grout Sealer.
    - c. C-Cure; Penetrating Sealer 978.

## 2.10 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- 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 of 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 joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.
- B. Provide concrete substrates for tile floors installed with adhesives or thin-set mortar that comply with flatness tolerances specified in referenced ANSI A108 Series of tile installation standards.
  - 1. Fill cracks, holes, and depressions with trowelable leveling and patching compound according to tile-setting material manufacturer's written instructions. Use product specifically recommended by tile-setting material manufacturer.
  - 2. Remove protrusions, bumps, and ridges by sanding or grinding.
- C. Blending: For tile exhibiting color variations within ranges selected during Sample submittals, verify that tile has been factory blended and packaged so tile units taken from one package show same range of 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 "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. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation." Comply with TCA installation methods indicated in ceramic tile installation schedules.
- C. Extend tile work into recesses and under or behind equipment and fixtures to form 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 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 same width as joints within tile sheets so joints between sheets are not apparent in finished work.
- F. Lay out tile wainscots to next full tile beyond dimensions indicated.
- G. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated 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 substrates.
  - 2. Expansion (Movement) Joints for Exterior Tile: All exterior expansion joints shall be a minimum of 3/8" for joints 12' on center, minimum 1/2" for joints 16' on center. Minimum widths must be increased 1/16" for each 15 deg F tile surface temperature change greater than 100 deg F between summer high and winter low.
- H. Grout tile to comply with 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 CRACK-SUPPRESSION MEMBRANE INSTALLATION

- A. Install crack-suppression membrane to comply with manufacturer's written instructions to produce membrane of uniform thickness bonded securely to substrate.

### 3.5 WALL TILE INSTALLATION

- A. Install types of tile designated for wall installations to comply with requirements in the Wall Tile Installation Schedule, including those referencing TCA installation methods and ANSI setting-bed standards.
- B. Install metal lath and scratch coat for walls to comply with ANSI A108.1A, Section 4.1.
- C. For installations indicated below, follow procedures in ANSI A108 Series tile installation standards for providing 95 percent mortar coverage.
  - a. Large tiles 8 by 8 inches (200 by 200 mm) or larger, ceramics or mosaics, or sheet of tiles.
  - b. Rib-backed tiles.
- D. Joint Widths: Install tile on walls with the following joint widths:
  - 1. Porcelain Tile: 1/8 inch, unless noted otherwise.

### 3.6 CLEANING AND PROTECTING

- A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
  - 1. Remove grout residue from tile as soon as possible.
  - 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
- B. When recommended by tile manufacturer, apply 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.
- C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

END OF SECTION 09 3000

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## SECTION 09 5113 - **ACOUSTICAL PANEL CEILINGS**

### 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 acoustical panels and exposed suspension systems for ceilings.

#### 1.3 DEFINITIONS

- A. CAC: Ceiling Attenuation Class.
- B. LR: Light Reflectance coefficient.
- C. NRC: Noise Reduction Coefficient.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Maintenance Data: For finishes to include in maintenance manuals.

#### 1.5 QUALITY ASSURANCE

- A. Source Limitations:
  - 1. Acoustical Ceiling Panel: Obtain each type through one source from a single manufacturer.
  - 2. Suspension System: Obtain each type through one source from a single manufacturer.
- B. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:
  - 1. Fire-Resistance Characteristics: Where indicated, provide acoustical panel ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
    - a. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
    - b. Identify materials with appropriate markings of applicable testing and inspecting agency.
  - 2. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:

- C. Seismic Standard: Provide acoustical panel ceilings designed and installed to withstand the effects of earthquake motions according to the following:
  - 1. CISCA's Recommendations for Acoustical Ceilings: Comply with CISCA's "Recommendations for Direct-Hung Acoustical Tile and Lay-in Panel Ceilings--Seismic Zones 0-2."

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

#### 1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
  - 1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

#### 1.8 COORDINATION

- A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, 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. Tile Units: Furnish quantity of full-size units equal to 5-10 percent of amount installed, for each type, composition, color, pattern, and size indicated.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Acceptable Manufacturer/ Products:
  - 1. ACT 1: Armstrong Ultima #1910, 24 x 24, or approved equal.
  - 2. ACT 2: Armstrong Mesa #680, 24 x 24, or approved equal. (Not Used)
  - 3. ACT 3: Armstrong Ultima, HealthZone, 24 x 24, or approved equal. (Not Used)
  - 4. ACT 4: Armstrong Ceramaguard -Unperforated #605, 24 x 48, or approved equal. (Not Used)

5. ~~ACT 5: Armstrong Soundscapes Blades, 3920, 3921, or approved equal. (Not Used)~~

## 2.2 ACOUSTICAL PANELS, GENERAL

- A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
- B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated by manufacturer's proprietary product designations for each product type.

## 2.3 METAL SUSPENSION SYSTEMS, GENERAL

- A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.
- B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.
- C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated.
  - 1. Anchors in Concrete: Expansion anchors fabricated from corrosion-resistant materials with holes or loops for attaching hangers of type indicated and with capability to sustain without failure a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
- D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
  - 1. Zinc-Coated Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
  - 2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire but provide not less than 0.106-inch- (2.69-mm-) diameter wire.
- E. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.
- F. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in-place.
- G. Hold-Down Clips: Where indicated, provide manufacturer's standard hold-down clips spaced 24 inches (610 mm) o.c. on all cross tees.

## 2.4 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILINGS

- A. Available Products:
  - 1. Chicago Metallic #200 Snap Grid Intermediate Duty or equal. Color shall be white.

## 2.5 METAL EDGE MOLDINGS AND TRIM

- A. Type and profile that are manufacturer's standard moldings for edges and penetrations that fit acoustical pane ledge details and suspension systems indicated.

## 2.6 ACOUSTICAL SEALANT

- A. Refer to Division 9 Section "Gypsum Board Assemblies."

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling or as indicated on the drawings. Unless specifically shown on the drawings, avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

### 3.3 INSTALLATION, GENERAL

- A. General: Install acoustical panel ceilings to comply with ASTM C 636 and seismic requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
- B. Suspend ceiling hangers from building's structural members and as follows:
  1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
  2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  3. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  4. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
  5. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.

6. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
  7. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
  8. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
  2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.66 m). Miter corners accurately and connect securely.
  3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
1. Arrange square directionally patterned acoustical panels as follows:
    - a. Install panels with pattern running in one direction parallel to short axis of space, unless otherwise noted.
  2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
  3. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
  4. For reveal-edged panels on suspension system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension system surfaces and panel faces flush with bottom face of runners.
  5. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
  6. Install hold-down clips in locations shown on the drawings.

### 3.4 CLEANING



- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 5113

## SECTION 09 6513 - **RESILIENT BASE**

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. This Section includes the following:

1. Rubber, vulcanized thermoset, wall base.
2. Accessories.

B. Related Sections include the following:

1. Division 09 Section "Resilient Sheet Flooring" for areas where resilient base will be required.

#### 1.2 SUBMITTALS

A. Product Data: For each product indicated.

B. Samples: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches (300 mm) long, of each resilient product color, texture, and pattern required.

#### 1.3 PROJECT CONDITIONS

A. Maintain temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), 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 postinstallation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Install resilient products after other finishing operations, including painting, have been completed.

#### 1.4 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. Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, of each type, color, pattern, and size of resilient product installed.

## 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 COLORS

- A. Colors: Refer to the Materials Legend – Finish Plan.

### 2.3 RESILIENT WALL BASE

- A. Wall Base: ASTM F 1861.
  - 1. Basis of Design: Johnsonite Wall Base
  - 2. Acceptable Manufacturers:
    - a. Armstrong
    - b. VPI, LLC, Floor products Division
    - c. Burke Mercer Flooring Products, A Division of Burke Industries, Inc.
    - d. Roppe Corporation
- B. Type (Material Requirement): TS (rubber, vulcanized thermoset).
- C. Group (Manufacturing Method): I (solid).
- D. Style: Refer to the Materials Legend – Finish Plan.
- E. Minimum Thickness: 0.125 inch (3.2 mm).
- F. Height: 4.375 – 4.5 inches
- G. Lengths: Coils in manufacturer's standard length. **Stick base is not allowed.**
- H. Outside Corners: Job formed.
- I. Inside Corners: Job formed.
- J. Surface: Smooth.

### 2.4 RESILIENT MOLDING ACCESSORY

- A. Resilient Edge Strips: 1/8" thick, homogeneous vinyl or rubber composition, tapered or bullnose edge, color to match flooring, or as selected by the Architect from standard colors available; not less than 1" wide.
- B. Subfloor Leveler: Provide a solid, homogeneous, thermoplastic rubber Subfloor Leveler – made from first quality recycled materials for indoor use. Product shall be extruded to provide a smooth transition between uneven subfloors and immediately accept new flooring. Product shall be Roppe Subfloor Leveling Product #303 (1/2" x 18"). Product shall have pre-scored markings for the most commonly needed transition

depths for ease of site trimming.

## 2.5 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic cement-based formulation provided or approved by resilient product manufacturers for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.
- B. Concrete Substrates for Accessories: 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. (1.36 kg of water/92.9 sq. m) 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 the same temperature as the 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.

### 3.2 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.
- F. Job-Formed Corners:
  - 1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends. Shave back of base at points where bends occur and remove strips perpendicular to length of base that are only deep enough to produce a snug fit without removing more than half the wall base thickness.
  - 2. Inside Corners: Use straight pieces of maximum lengths possible. Form by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.

### 3.3 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.

### 3.4 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 09 6513

## SECTION 09 6516 - RESILIENT SHEET FLOORING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Special Conditions, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes sheet vinyl floor coverings, without backings.
- B. Related Sections include the following:
  - 1. Division 09 Section "Resilient Base" for resilient base installed in other areas.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: In manufacturer's standard size, but not less than 6-by-9-inch (150- by-230-mm) sections of each different color and pattern of floor covering required.
- C. 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 (150-by-230- mm)**, sample applied to a rigid backing and prepared by Installer for this Project.
- D. Qualification Data: For Installer.
- 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 heat-welding techniques required by manufacturer for floor covering installation.
  - 1. Engage an installer who employs workers for this Project that are trained or certified by floor covering manufacturer for heat-welding techniques required.
- 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.
- C. Source Limitations: Obtain each type, color, and pattern of product specified from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.

- D. Floor Pattern Layout: Layout of designed floor patterns shall be verified in the field, in the presence of the Architect or with his/her approval of the overall layout on the slab before laying of flooring shall commence in these areas. Any required adjustments to the patterns (to make them fit the space) will be made at this time without additional cost to the Owner.

#### 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 deg F (10 deg C) or more than 90 deg F (32 deg C). Store rolls upright.

#### 1.6 PROJECT CONDITIONS

- A. Maintain temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 85 deg F (29 deg C), 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 postinstallation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).
- C. Close spaces to traffic during floor covering installation.
- D. Close spaces to traffic for 48 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. Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, in roll form and in full roll width for each color, pattern, and type of floor covering installed.

### PART 2 - PRODUCTS

#### 2.1 SHEET VINYL FLOOR COVERING

- A. Acceptable Manufacturer/ Products: Refer to Materials Legend - Finish Plan for selected manufacturer and product.

- B. Seaming Method: Heat welded.
- C. Fire-Test-Response Characteristics:
  - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm per ASTM E 648.
- D. Integral Base: Provide 4" integral cove base with metal cap strip where indicated in the Materials Legend - Finish Plan and on the Drawings. This includes extending the integral cove base into the toe space at all casework installations.

## 2.2 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 manufacturer to suit sheet vinyl floor covering and substrate conditions indicated.
  - 1. Use adhesives that have a VOC content of not more than 60 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 2. Adhesive at Hospital Beds: The area under the hospital bed must be adhered with epoxy adhesive. This area shall be centered on the headwall and extend from the headwall to the footwall in a 4 foot min. wide strip. In no case shall the entire room be installed using epoxy adhesive. Coordinate installation with information shown on the Drawings.
- C. Heat-Welding Bead: Solid-strand product of floor covering manufacturer.
  - 1. Color: As selected by Architect from manufacturer's full range.
- D. Integral-Flash-Cove-Base Accessories:
  - 1. Cove Support Strip: Self adhesive, resilient quarter-round plastic (FLEXCO #195 Cove Stick Fillet) or wood cove stick.
  - 2. Cap Strip: Square metal cap strip provided or approved by floor covering manufacturer.
  - 3. Corners: If required by the flooring manufacturer, provide metal inside and outside corners and end stops provided or approved by floor covering manufacturer.
- E. Sheet Vinyl Installation at wet locations, including patient showers.
  - 1. Comply with manufacturer's recommended details and products, including adhesives, regardless of details in architectural drawings.

## 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 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. Test for Relative Humidity: Testing for moisture using a Humidity Probe and Digital Meter (**ASTM F 2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using *in situ* Probes**) will require 3 tests for the first 1,000 sq. ft., and at least one additional test for each 1,000 sq. ft. thereafter. Maximum allowable reading shall be 75% RH.
      - b. Existing slab on grade as well as elevated slabs (new and existing) must be tested.
      - c. Report test results to Owner and Architect. Do not proceed with installation of flooring until acceptable test results are obtained.
    - 4. At flooring testing positive for ACM, the following is the Owner's standard floor preparation. **Note we do not remove any ACM floor fill per an agreement with EH&S, we do however remove all floor finishes and adhesives on all projects and do not lay over existing floor finishes except in special circumstances which need to be reviewed and approved by MUHC Engineering Services.**
      - 1. Remove all floor tiles, seamless flooring and adhesives containing ACM. If the floor fill tests positive for ACM please use the prescribed method for floor prep.
      - 2. Abate the floor finish and adhesive with EH&S recommended removal process.
      - 3. Prior to starting any floor work after ACM removal it is important for the floor to dry out for as long as possible before proceeding with any new flooring.
      - 4. If not already locked down by the Abatement personnel after removal completion. Remove any debris from the surface of the floor.
      - 5. Apply Acrylic 60 bonding agent (or manufacturers recommended product) tinted with red paint colorant to the floor and allow to dry tack free. Surface of the floor should appear red when dry.
      - 6. Apply 2 or more layers of Ardex feather finish till floor surface is level and smooth for the new flooring.

7. Hand scrape or light sand Ardex feather finish to desired smoothness. If any of the substrate is viewing as red while sanding (STOP) and add additional layers of Ardex feather finish until you achieve desired smoothness necessary to lay the new flooring.
- 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. Apply concrete slab primer, if recommended by flooring manufacturer, prior to application of adhesive. Apply in compliance with manufacturer's directions.
- E. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.
- F. Move floor coverings and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
  1. Do not install floor coverings until they are same temperature as space where they are to be installed.
- G. 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

- A. Unroll sheet vinyl floor coverings and allow them to stabilize before cutting and fitting.
- B. Lay out sheet vinyl 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 (152 mm) away from parallel joints in floor covering substrates.
  3. Match edges of floor coverings for color shading at seams.
  4. Avoid cross seams.
- C. 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. Install flooring prior to the installation of all equipment items, unless noted otherwise.
- D. Extend floor coverings into toe spaces, door reveals, closets, and similar openings.
- E. Maintain reference markers, holes, or openings that are in place or marked for future cutting by repeating on floor coverings as marked on substrates. Use chalk or other nonpermanent marking device.
- F. Install floor coverings on covers for telephone and electrical ducts and similar items in installation 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.

- G. 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.
- H. 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.
- I. Integral Flash Cove Base: Cove floor coverings 4 inches (102 mm) up vertical surfaces. Support floor coverings at horizontal and vertical junction by cove strip. Butt at top against cap strip.
  - 1. Install metal corners at inside and outside corners.

### 3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after completing floor covering installation:
  - 1. Remove adhesive and other 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 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.
  - 1. Apply protective floor polish to surfaces that are free from soil, visible adhesive, and blemishes if recommended in writing by manufacturer.
  - 2. Cover floor coverings with undyed, untreated building paper until Substantial Completion.
  - 3. Do not move heavy and sharp objects directly over floor coverings. 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 09 6516

## SECTION 09 6519 – LUXURY RESILIENT TILE FLOORING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Special Conditions, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Luxury Vinyl Tile (LVT).
- B. Related Sections include:
  - 1. Division 09 Section "Resilient Base".

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: Full-size units of each color and pattern of resilient floor tile required.
- C. Maintenance Data: For resilient products to include in maintenance manuals.

#### 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.
- B. Source Limitations: Obtain each type, color, and pattern of product specified from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.
- C. Floor Pattern Layout: Layout of designed floor patterns shall be verified in the field, in the presence of the Architect or with his/her approval of the overall layout on the slab before tiling shall commence in these areas. Any required adjustments to the patterns (to make them fit the space) will be made at this time without additional cost to the Owner.

#### 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 deg F (10 deg C) or more than 90 deg F (32 deg C). Store tiles on flat surfaces.

## 1.6 PROJECT CONDITIONS

- A. Maintain temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), 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 postinstallation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).
- C. Close spaces to traffic during floor covering installation.
- D. Close spaces to traffic for 48 hours after floor covering installation.

## 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. Floor Tile: Furnish 1 box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products listed on the finish schedule.

### 2.2 COLORS AND PATTERNS

- A. Colors and Patterns: Refer to Materials Legend. All product in a pattern shall come from the same manufacturer.

### 2.3 INSTALLATION MATERIALS

- A. Subfloor Leveler: Refer to Section 09 "Resilient Base" if leveler is required for transitions.
- B. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic cement based formulation provided or approved by resilient product manufacturer for applications indicated.
- C. 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 that 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. Broom clean or vacuum surfaces to be covered, and inspect subfloor. Start of flooring installation indicates acceptance of subfloor conditions and full responsibility for completed work.
- B. Use leveling compound as recommended by flooring manufacturer for filling small cracks and depressions in subfloors.
- C. 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. Test for Relative Humidity: Testing for moisture using a Humidity Probe and Digital Meter (ASTM F 2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using *in situ* Probes) will require 3 tests for the first 1,000 sq. ft., and at least one additional test for each 1,000 sq. ft. thereafter. Maximum allowable reading shall be 75% RH.
    - b. Existing slab on grade as well as elevated slabs (new and existing) must be tested.
    - c. Report test results to Owner and Architect. Do not proceed with installation of flooring until acceptable test results are obtained.
  - 4. At flooring testing positive for ACM, the following is the Owner's standard floor preparation. **Note we do not remove any ACM floor fill per an agreement with EH&S, we do however remove all floor finishes and adhesives on all projects and do not lay over existing floor finishes except in special circumstances which need to be reviewed and approved by MUHC Engineering Services.**
    - 1. Remove all floor tiles, seamless flooring and adhesives containing ACM. If the floor fill tests positive for ACM please use the prescribed method for floor prep.
    - 2. Abate the floor finish and adhesive with EH&S recommended removal process.
    - 3. Prior to starting any floor work after ACM removal it is important for the floor to dry out for as long as possible before proceeding with any new flooring.

4. If not already locked down by the Abatement personnel after removal completion. Remove any debris from the surface of the floor.
  5. Apply Acrylic 60 bonding agent (or manufacturers recommended product) tinted with red paint colorant to the floor and allow to dry tack free. Surface of the floor should appear red when dry.
  6. Apply 2 or more layers of Ardex feather finish till floor surface is level and smooth for the new flooring.
  7. Hand scrape or light sand Ardex feather finish to desired smoothness. If any of the substrate is viewing as red while sanding (STOP) and add additional layers of Ardex feather finish until you achieve desired smoothness necessary to lay the new flooring.
- D. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, by shot blasting method. Do not use solvents.
- E. Apply concrete slab primer, if recommended by flooring manufacturer, prior to application of adhesive. Apply in compliance with manufacturer's directions.
- F. Move floor coverings and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
1. Do not install floor coverings until they are same temperature as space where they are to be installed.
- G. 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 TILE INSTALLATION

- A. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
1. Lay tiles square with room axis in pattern indicated, unless noted otherwise.
- B. Match tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
1. Lay tiles with grain direction alternating in adjacent tiles (quarter turned or basket-weave pattern), unless noted otherwise.
  2. Lay tiles in pattern of colors and sizes indicated.
- C. Scribe, cut, and fit tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.
- D. Extend tiles into toe spaces, door reveals, closets, and similar openings.

- E. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.
- F. Install tiles on covers for telephone and electrical ducts and similar items in finished floor areas. Maintain overall continuity of color and pattern with pieces of tile installed on covers. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
- G. Adhere tiles to flooring 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 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.
  - 1. Apply protective floor polish to horizontal surfaces that are free from soil, visible adhesive, and surface blemishes **if recommended in writing by manufacturer.**
    - a. Use commercially available product acceptable to manufacturer.
    - b. Coordinate selection of floor polish with Owner's maintenance service.
  - 2. Cover products installed on horizontal surfaces with undyed, untreated building paper until Substantial Completion.
  - 3. Do not move heavy and sharp objects directly over surfaces. Place hardboard or plywood panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.

END OF SECTION 09 6519



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## SECTION 09 6813 - TILE CARPETING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Special Conditions, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes:
  - 1. Carpet tile and installation.
- B. Related Sections include the following:
  - 1. Division 02 Section "Selective Demolition of Building Components" for removing 2. Division 09 Section "Resilient Base" 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 methods.
- B. Shop Drawings: Show the following:
  - 1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
  - 2. Existing flooring materials to be removed.
  - 3. Existing flooring materials to remain.
  - 4. Carpet tile type, color, and dye lot.
  - 5. Type of subfloor.
  - 6. Type of installation.
  - 7. Pattern of installation.
  - 8. Pattern type, location, and direction.
  - 9. Pile direction.
  - 10. Type, color, and location of insets and borders.
  - 11. Type, color, and location of edge, transition, and other accessory strips.
  - 12. 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 Stripping and Accessory: 12-inch- (300-mm-) long Samples.

- D. Product Schedule: Use same room and product designations indicated on Drawings
- E. Maintenance Data: For carpet tile to include in maintenance manuals specified in Division 01.  
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.

#### 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 equal to the carpet tile specified, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
- C. Product Options: Products and manufacturers named the Product Data Sheets at the end of this Section, 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.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. General: Comply with CRI 104, Section 5, "Storage and Handling."

#### 1.6 PROJECT CONDITIONS

- A. General: Comply with CRI 104, Section 6.1, "Site Conditions; Temperature and Humidity."
- B. Environmental Limitations: Do not install carpet tile 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 tile 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.
- D. Where demountable partitions or other items are indicated for installation on top of carpet tile, install carpet tile before installing these items.

#### 1.7 WARRANTY

- A. General Warranty: Special warranty specified in this Article shall not deprive Owner

of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

- B. Special Carpet Tile Warranty: Written warranty, signed by carpet tile manufacturer agreeing to replace carpet tile that does not comply with requirements or that fails within specified warranty period. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, and delamination.

- 1. Warranty Period: 10 years from date of Substantial Completion, unless otherwise noted in the Carpet Tile Data Sheet.

#### 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 sq. yd. (8.3 sq. m).

### PART 2 - PRODUCTS

#### 2.1 CARPET TILE

- A. Products: Subject to compliance with requirements, products that may be incorporated into the Work shall be those listed in the Drawings.

#### 2.2 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided by or recommended by carpet tile manufacturer.

- B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and that is recommended by carpet tile manufacturer.

- 1. VOC Limits: Provide adhesives with VOC content not more than 50 g/L when calculated according to 40 CFR 59, Subpart D (EPA method 24).

### 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. Test for Relative Humidity: Testing for moisture using a Humidity Probe and Digital Meter (ASTM F 2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using *in situ* Probes) will require 3 tests for the first 1,000 sq. ft., and at least one additional test for each 1,000 sq. ft. thereafter. Maximum allowable reading shall be 75% RH.
    - b. Existing slab on grade as well as elevated slabs (new and existing) must be tested.
    - c. Report test results to Owner and Architect. Do not proceed with installation of flooring until acceptable test results are obtained.
  4. At flooring testing positive for ACM, the following is the Owner's standard floor preparation. **Note: do not remove any ACM floor fill per an agreement with EH&S. Remove all floor finishes and adhesives. Do not lay flooring over existing floor finishes except in special circumstances which need to be reviewed and approved by MUHC Engineering Services.**
    - a. Remove all floor tiles, seamless flooring and adhesives containing ACM. If the floor fill tests positive for ACM please use the prescribed method for floor prep.
    - b. Abate the floor finish and adhesive with EH&S recommended removal process.
    - c. Prior to starting any floor work after ACM removal it is important for the floor to dry out for as long as possible before proceeding with any new flooring.
    - d. If not already locked down by the Abatement personnel after removal completion. Remove any debris from the surface of the floor.
    - e. Apply Acrylic 60 bonding agent (or manufacturers recommended product) tinted with red paint colorant to the floor and allow to dry tack free. Surface of the floor should appear red when dry.
    - f. Apply 2 or more layers of Ardex feather finish till floor surface is level and smooth for the new flooring.
    - g. Hand scrape or light sand Ardex feather finish to desired smoothness. If any of the substrate is viewing as red while sanding (STOP) and add

additional layers of Ardex feather finish until you achieve desired smoothness necessary to lay the new flooring.

- 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. Apply concrete slab primer, if recommended by flooring manufacturer, prior to application of adhesive. Apply in compliance with manufacturer's directions.
- E. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.
- F. Move floor coverings and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
  - 1. Do not install floor coverings until they are same temperature as space where they are to be installed.
- G. 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

- A. General: Comply with CRI 104, Section 13, "Carpet Modules (Tiles)."
- B. Installation Method: Glue-down; install every tile with releasable adhesive.
- C. 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.
- D. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- E. 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.
- F. Install pattern parallel to walls and borders.

### 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 installed carpet tile to comply with CRI 104, Section 15, "Protection of Indoor Installations."
- C. 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 09 6813

## SECTION 09 7200 - VINYL-COATED FABRIC WALL COVERINGS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Vinyl-coated fabric wall covering.

#### 1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show location and extent of each wall-covering type. Indicate pattern placement, seams and termination points.
- C. Samples: For each type of wall covering and for each color, texture, and pattern required.
- D. Maintenance data.

#### 1.3 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Provide wall coverings and adhesives with the following fire-test-response characteristics as determined by testing identical products applied with identical adhesives to substrates per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
  - 1. Surface-Burning Characteristics: As follows, per ASTM E 84:
    - a. Flame-Spread Index: 25 or less.
    - b. Smoke-Developed Index: 450 or less.

#### 1.4 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. Rolls of Wall-Covering Material: Full-size units equal to 5 percent of amount of each type installed.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, products that may be incorporated into the Work include those listed in the Finish Legend on the drawings.



## 2.2 WALL-COVERING PRODUCTS

- A. General: Provide rolls of each type of wall covering from the same run number or dye lot.
- B. Vinyl Wall Covering:
  - 1. Vinyl Wall-Covering Standards: Provide mildew-resistant products complying with the following:
    - a. FS CCC-W-408 and CFFA-W-101 for Type II, Medium-Duty products.
  - 2. Type II - Medium Duty: Typical weights as follows:
    - a. Total Weight of Vinyl Wall Covering Excluding Coatings: 13 to 22 oz./sq.yd. (0.442 to 0.748 kg/sq. m).
    - b. Total Weight of Coatings: 7 to 12 oz./sq.yd. (0.237 to 0.407 kg/sq. m)
  - 3. Width: 54 inches (1372 mm).
  - 4. Backing Fiber Content: Polycotton if Osnaburg backing; Polyester cellulose if nonwoven backing.
  - 5. Backing Material: Osnaburg or Nonwoven.
  - 6. Stain-Resistant Coating: DuPont; Tedlar/Teflon
  - 7. Selection: Refer to Finish Schedule Legend on Drawings for product selection.

## 2.3 ACCESSORIES

- A. Adhesive: Mildew-resistant, nonstaining, strippable adhesive, for use with specific wall covering and substrate application, as recommended in writing by wall-covering manufacturer.
- B. Primer/Sealer: Mildew-resistant primer/sealer complying with requirements in Division 09 Section "Painting" and recommended in writing by wall-covering manufacturer for intended substrate.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.
  - 1. Gypsum Board: Refer to Division 09 Section Painting for priming of substrate.
  - 2. Check painted surfaces for pigment bleeding. Sand gloss, semigloss, and eggshell finishes with fine sandpaper.
- B. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.
- C. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

### 3.2 INSTALLATION

- A. Cut wall-covering strips in roll number sequence. Change roll numbers at partition breaks and corners.
- B. Patterned Wall Covering: Install strips in same order as cut from roll.
- C. Wall Covering Without Pattern: Install reversing every other strip.
- D. Install wall covering with no gaps or overlaps, no lifted or curling edges, and no visible shrinkage.
- E. Match pattern 72 inches (1830 mm) above the finish floor.
- F. Install seams vertical and plumb at least 6 inches (150 mm) from outside corners and 6 inches (150 mm) from inside corners unless a change of pattern or color exists at corner. No horizontal seams are permitted.
- G. Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.
- H. Trim edges and seams for color uniformity, pattern match, and tight closure. Butt seams without any overlay or spacing between strips.

END OF SECTION 09 7200

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## SECTION 09 9100 – **PAINTING**

### 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 surface preparation and field painting of exposed **interior** items and surfaces.
  - 1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.
  - 2. Work of this Section includes surface preparation, priming, and finish coats specified in this Section. Surfaces which have shop priming and surface treatment specified in other Sections that is in satisfactory condition, need only the required surface preparation (cleaning) and two finish coats, unless specifically noted otherwise.
- B. Paint exposed surfaces, except where these Specifications indicate that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will select from standard colors and finishes available.
  - 1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment which have been factory primed but do not have a factory-applied final finish.
- C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
  - 1. Prefinished items include the following factory-finished components:
    - a. Architectural woodwork and casework.
    - b. Metal toilet enclosures.
    - c. Metal lockers.
    - d. Elevator entrance doors and frames.
    - e. Finished mechanical and electrical equipment.
    - f. Light fixtures.
    - g. Distribution cabinets.
  - 2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
    - a. Foundation spaces.
    - b. Furred areas.
    - c. Ceiling plenums.
    - d. Utility tunnels.
    - e. Pipe spaces.
    - f. Duct shafts.
    - g. Elevator shafts.
  - 3. Finished metal surfaces include the following:
    - a. Anodized aluminum.

- b. Stainless steel.
- 4. Operating parts include moving parts of operating equipment and the following:
  - a. Valve and damper operators.
  - b. Linkages.
  - c. Sensing devices.
  - d. Motor and fan shafts.
- 5. Labels: Do not paint over UL, FMG, or other code-required labels, stamps, or equipment name, identification, performance rating, or nomenclature plates.

D. Related Sections include the following:

- 1. Division 05 Section "Structural Steel Framing" for shop priming structural steel.
- 2. Division 05 Section "Metal Fabrications" for shop priming ferrous metal.
- 3. Division 06 Section "Interior Architectural Woodwork" for shop priming interior architectural woodwork.
- 4. Division 08 Section "Hollow Metal Doors and Frames" for factory priming steel doors and frames.
- 5. Division 09 Section "Gypsum Board Assemblies" for surface preparation of gypsum board.
- 6. Division 09 Section "Vinyl-Faced Fabric Wall Coverings" for substrate sealer under wall coverings.
- 7. Division 09 Section "Epoxy Coatings" for special coatings.
- 8. Division 15: Painting of mechanical work is specified in Division 15.

E. Alternates: Refer to Division 01 Section "Alternates" for description of Work in this Section affected by alternates.

### 1.3 DEFINITIONS

A. Standard coating terms defined by MPI apply to this Section:

		Gloss at 60 degrees		Sheen at 85 degrees
Gloss Level 1	a traditional matte finish - flat	maximum 5 units	and	maximum 10 units
Gloss Level 2	a high side sheen flat - a 'velvet-like' finish	maximum 10 units	and	10-35 units
Gloss Level 3	a traditional 'eggshell-like' finish	10-25 units	and	10-35 units
Gloss Level 4	a 'satin-like' finish	20-35 units	and	minimum 35 units
Gloss Level 5	a traditional semi-gloss	35-70 units		
Gloss Level 6	a traditional gloss	70-85 units		
Gloss Level 7	a high gloss	more than 85 units		

### 1.4 SUBMITTALS

A. Product Data: For each paint system indicated. Include block fillers and primers.

- 1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.

2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.
- B. Samples for Verification: For each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.
    1. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.
    2. Provide a list of materials and applications for each coat of each Sample. Label each Sample for location and application.
  - C. Qualification Data: For Applicator.

#### 1.5 QUALITY ASSURANCE

- A. Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.
- B. Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:
  1. Product name or title of material.
  2. Product description (generic classification or binder type).
  3. Manufacturer's stock number and date of manufacture.
  4. Contents by volume, for pigment and vehicle constituents.
  5. Thinning instructions.
  6. Application instructions.
  7. Color name and number.
  8. VOC content.
- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain storage containers in a clean condition, free of foreign materials and residue.
  1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

## 1.7 PROJECT CONDITIONS

- A. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F (10 and 32 deg C).
- B. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F (7 and 35 deg C).
- C. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.
  - 1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

## 1.8 EXTRA MATERIALS

- A. Furnish extra paint materials from the same production run as the materials applied and in the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.
  - 1. Quantity: Furnish Owner with an additional 5 percent, but not less than 1 gal. (3.8 L) or 1 case, as appropriate, of each material and color applied.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products listed in the Finish Schedule on the Drawings.
- B. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
  - 1. Benjamin Moore & Co. (Moore).
  - 2. Diamond Vogel Paints (DVP).
  - 3. Glidden Professional/Devoe Coatings (Glidden Pro).
  - 4. Kwal Paint (Kwal)
  - 5. PPG Industries, Inc. (Pittsburgh).
  - 6. Pratt & Lambert, Inc. (P & L)
  - 7. Sherwin-Williams Co. (S-W).
  - 8. Tnemec where indicated, (Tnemec).

### 2.2 PAINT MATERIALS, GENERAL

- A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

C. Colors: Match colors selected by the Architect and indicated by reference to manufacturer's color designations. If required, provide custom colors to match Architect's samples.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application. Comply with procedures specified in PDCA P4.
1. Proceed with paint application only after unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
  2. Start of painting will be construed as Applicator's acceptance of surfaces and conditions within a particular area.
- B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
1. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.

### 3.2 PREPARATION

- A. Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.
1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.
- B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.
1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
- C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
1. Provide barrier coats over incompatible primers or remove and reprime.
  2. Cementitious Materials: Prepare concrete, concrete unit masonry, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.



- a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
  - b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces if moisture content exceeds that permitted in manufacturer's written instructions.
  - c. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting.
3. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
- a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
  - b. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and back sides of wood, including cabinets, counters, cases, and paneling.
  - c. If transparent finish is required, backprime with spar varnish.
  - d. Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on back side.
  - e. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.
4. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC's recommendations.
- a. Blast steel surfaces clean as recommended by paint system manufacturer and according to SSPC-SP 10/NACE No. 2.
  - b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
  - c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.
5. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.
- D. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
- 1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
  - 2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
  - 3. Use only thinners approved by paint manufacturer and only within recommended limits.

### 3.3 APPLICATION

- A. Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
1. Paint colors, surface treatments, and finishes are indicated in the paint schedules.
  2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
  3. Provide finish coats that are compatible with primers used.
  4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, convector covers, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
  5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
  6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
  7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
  8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
  9. Finish interior of wall and base cabinets and similar field-finished casework to match exterior.
  10. Sand lightly between each succeeding enamel or varnish coat.
- B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
  2. Omit primer over metal surfaces that have been shop primed and touchup painted.
  3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
  4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.
- C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
  2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
  3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.
- D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.

- E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and occupied spaces.
- F. Mechanical items to be painted include, but are not limited to, the following:
  1. Uninsulated metal piping.
  2. Uninsulated plastic piping.
  3. Pipe hangers and supports.
  4. Tanks that do not have factory-applied final finishes.
  5. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
  6. Duct, equipment, and pipe insulation having "all-service jacket" or other paintable jacket material.
  7. Mechanical equipment that is indicated to have a factory-primed finish for field painting.
- G. Electrical items to be painted include, but are not limited to, the following:
  1. Electrical equipment that is indicated to have a factory-primed finish for field painting.
- H. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.
- I. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.
- J. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque 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.
- K. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.
  1. Provide satin finish for final coats.
- L. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.
- M. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

### 3.4 CLEANING

- A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.
  1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

### 3.5 PROTECTION

- A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.
- B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.
  - 1. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

### 3.6 INTERIOR PAINT SCHEDULE

- A. GB - Interior Gypsum Board
  - 1. GB - PGB - Interior Gypsum Board Primer: Provide 1 coat of primer where required for vinyl wall covering installation.
    - a. PGB - Interior Gypsum Board Primer: Factory-formulated latex-based primer for interior application. Note: The following primer shall be used as a primer/sealer for vinyl wall coverings. Verify the acceptability of the proposed primer with the wall covering manufacturer to assure compatibility of the primer and vinyl wall covering adhesive.
  - 2.
    - 1) Moore: Moorcraft Super Spec Latex Enamel Undercoater & Primer Sealer No. 253: Applied at a dry film thickness of not less than 1.2 mils (0.030 mm).
    - 2) DVP; Interior Acrylic Primer/Sealer, DU-1502: Applied at a dry film thickness of 1.5 to 2.0 mils (0.038 to 0.051 mm).
    - 3) Glidden Pro; High Hide Interior Primer Sealer 1000-1200: Applied at a dry film thickness of not less than 1.3 mils.
    - 4) IPM: Prime Line Hi Hide PVA Primer: Applied at a dry film thickness of not less than 1.5 mils.
    - 5) Kwal; 0890 Accu-Pro Sandable Primer: Applied at a dry film thickness of not less than 1.5 mils.
    - 6) Pittsburgh: 6-2 SpeedHide Interior Quick-Drying Latex Sealer: Applied at a dry film thickness of not less than 1.0 mil (0.025 mm).
    - 7) P & L: Z-1004 Suprime "4" Interior Latex Wallprimer: Applied at a dry film thickness of not less than 1.2 mils.
    - 8) S-W: PrepRite 200 Latex Wall Primer B28W200 Series: Applied at a dry film thickness of not less than 1.6 mils (0.041 mm).
  - 3. GB - LLAC - Interior Low-Luster Acrylic Paint System: Provide 2 finish coats of GL4/GL5 acrylic-latex enamel over a primer.
    - a. NOTE: At offices and non-patient care areas, finish to be GL4. At patient care areas and trim, finish to be GL5, typical.
    - b. PGB - Interior Gypsum Board Primer: Factory-formulated latex-based primer for interior application.
      - 1) DVP; Interior PVA Primer/Sealer, DU-1507: Applied at a dry film thickness of 2.0 to 3.0 mils (0.051 to 0.0762 mm).
      - 2) Glidden Pro; High Hide Interior Primer Sealer 1000-1200: Applied at a dry film thickness of not less than 1.3 mils.

- 3) IPM; Prime Line Hi Hiding PVA Primer #514: Applied at a dry film thickness of not less than 1.5 mils. 6-7
  - 4) Kwal; 0890 Accu-Pro Sandable Primer: Applied at a dry film thickness of not less than 1.5 mils.
  - 5) Moore; Moorcraft Super Spec Latex Enamel Undercoater & Primer Sealer No. 253: Applied at a dry film thickness of not less than 1.2 mils (0.030 mm).
  - 6) Pittsburgh; 6-2 SpeedHide Interior Quick-Drying Latex Sealer: Applied at a dry film thickness of not less than 1.0 mil (0.025 mm).
  - 7) P & L; Z-1004 Suprime "4" Interior Latex Wallprimer: Applied at a dry film thickness of not less than 1.2 mils.
  - 8) S-W; PrepRite 200 Latex Wall Primer B28W200 Series: Applied at a dry film thickness of not less than 1.6 mils (0.041 mm).
- c. GB - LLAC Interior Low-Luster Acrylic Enamel: Factory-formulated GL4/GL5 acrylic-latex interior enamel.
- d. NOTE: At offices and non-patient care areas, finish to be GL4. At patient care areas and trim, finish to be GL5, typical.
- 1) DVP; Pro Plus Interior Latex Eggshell Enamel, DE-Series: Applied at a dry film thickness of 2.0 to 3.0 mils (0.051 to 0.0762 mm).
  - 2) Glidden Pro; Ultra-Hide 250 Interior Eggshell Paint 1402N: Applied at a dry film thickness of not less than 1.4 mils.
  - 3) IPM; Master Series Eggshell Enamel #2300: Applied at a dry film thickness of not less than 1.5 mils.
  - 4) Kwal; 2100 Accu-Pro PC Latex Eggshell: Applied at a dry film thickness of not less than 1.5 mils.
  - 5) Moore; Moorcraft Super Spec Latex Eggshell Enamel No. 274: Applied at a dry film thickness of not less than 1.3 mils (0.033 mm).
  - 6) Pittsburgh; 6-411 Series SpeedHide Eggshell Acrylic Latex Enamel: Applied at a dry film thickness of not less than 1.25 mils (0.032 mm).
  - 7) P & L; Z-8200 Pro-Hide Gold Interior Latex Eggshell: Applied at a dry film thickness of not less than 1.5 - 2.5 mils.
  - 8) S-W; ProMar 200 Interior Latex Egg-Shell Enamel B20W200 Series: Applied at a dry film thickness of not less than 1.6 mils (0.041 mm).

B. FM - Interior Ferrous Metal

1. FM - SGALK - Interior Semigloss Alkyd Paint System: Provide 2 finish coats of GL5 alkyd enamel over a primer.

- a. PFM - Interior Ferrous-Metal Primer: Factory-formulated quick-drying rust-inhibitive alkyd-based metal primer.
- 1) DVP; Cote-All Multi-Purpose Alkyd Metal Primer, AZ-0400: Applied at a dry film thickness of 2.0 to 3.0 mils (0.0508 to 0.0762 mm).
  - 2) Glidden Pro; Devguard 4160 Multi-Purpose Tank & Structural Primer 4160 Series. Applied at a dry film thickness of not less than 2.0 mils.
  - 3) IPM; Meta-Kote Rust Inhibitive Metal Primer #1064: Applied at a dry film thickness of not less than 2 mils.
  - 4) Kwal; 9210 Accu-Pro Rust Inhibitive Primer: Applied at a dry film thickness of not less than 2.0 mils.
  - 5) Moore; Moore's IMC Alkyd Metal Primer No. M06: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).

- 6) Pittsburgh; 90-712 Pitt-Tech One Pack Interior/Exterior Primer/ Finish DTM Industrial Enamel: Applied at a dry film thickness of not less than 1.5 mils (0.038 mm).
  - 7) P & L; S3206/S3207 SteelTech Universal Primer: Applied at a dry film thickness of not less than 2 - 2.5 mils.
  - 8) S-W; Kem Kromik Universal Metal Primer B50NZ6/B50WZ1: Applied at a dry film thickness of not less than 3.0 mils (0.076 mm).
- b. FM - SGALK Interior Semigloss Alkyd Enamel: Factory-formulated GL5 alkyd enamel for interior application.
- 1) DVP; Pro Plus Alkyd Interior/Exterior Alkyd Semi-Gloss Enamel, CS-Series: Applied at a dry film thickness of 2.0 to 3.0 mils (0.051 to 0.0762 mm).
  - 2) Glidden Pro; Alkyd Semi-Gloss Paint 1516N Series: Applied at a dry film thickness of not less than 1.7 mils.
  - 3) IPM; Synex Semi Gloss Alkyd Enamel #302: Applied at a dry film thickness of not less than 2 mils.
  - 4) Kwal; 4600 Accu-Pro Alkyd Semi Gloss: Applied at a dry film thickness of not less than 1.7 mils.
  - 5) Moore; Moorcraft Super Spec Alkyd Semi-Gloss Enamel No. 271: Applied at a dry film thickness of not less than 1.4 mils (0.036 mm).
  - 6) Pittsburgh; 6-1510 Speedhide Int/Ext WB Alkyd Semi-Gloss. Applied at a dry film thickness of not less than 1.4 mils (0.036 mm).
  - 7) P & L; S-8800 Pro-Hide Gold Alkyd Semi-Gloss: Applied at a dry film thickness of not less than 1.5 mils.
  - 8) S-W; ProMar 200 Interior Alkyd Semi-Gloss Enamel B34W200 Series: Applied at a dry film thickness of not less than 1.7 mils (0.043 mm).

C. ZM - Interior Zinc-Coated Metal

1. ZM - LLAC - Interior Low-Luster Acrylic Paint System: Provide 2 finish coats of GL4 acrylic-latex enamel over a primer.

- a. PZM - Interior Zinc-Coated Metal Primer: Factory-formulated galvanized metal primer.
- 1)
  - 2) DVP; V-Cote 200 Acrylic Maintenance Primer/Finish, MC-1501: Applied at a dry film thickness of 2.0 to 3.0 mils (0.0508 to 0.0762 mm).
  - 3) Glidden Pro; Devflex 4020PF Direct to Metal Flat Waterborne Primer & Finish: Applied at a dry film thickness of not less than 2.2 mils.
  - 4) IPM; Meta-Cryl Pure Acrylic Galvanized Primer #1069: Applied at a dry film thickness of not less than .5 mils and not more than 1 mil.
  - 5) Kwal; 5810 Ambassador G-Prime Acrylic Metal Primer: Applied at a dry film thickness of not less than 1.6 mils.
  - 6) Moore; Moore's IMC Acrylic Metal Primer No. M04: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
  - 7) Pittsburgh; 90--712 Pitt-Tech One Pack Interior/Exterior Primer/ Finish DTM Industrial Enamel: Applied at a dry film thickness of not less than 3.0 mils (0.076 mm).
  - 8) P & L; Primer not required on new galvanized metal. Apply 2 finish coats.
  - 9) S-W; primer not required over this substrate.
- b. ZM - LLAC Interior Low-Luster Acrylic Enamel: Factory-formulated GL4 acrylic-latex interior enamel.

- 1)
- 2) DVP; Pro Plus Interior Latex Eggshell Enamel, DE-Series: Applied at a dry film thickness of 2.0 to 3.0 mils (0.051 to 0.0762 mm).
- 3) Glidden Pro; Ultra-Hide 250 Interior Eggshell Paint 1402N: Applied at a dry film thickness of not less than ~~1.4 mils~~.
- 4) IPM; Master Series Eggshell Enamel #2300: Applied at a dry film thickness of not less than 1.5 mils.
- 5) Kwal; 2100 Accu-Pro PC Latex Eggshell: Applied at a dry film thickness of not less than 1.5 mils.
- 6) Moore; Moorcraft Super Spec Latex Eggshell Enamel No. 274: Applied at a dry film thickness of not less than ~~1.3 mils (0.033 mm)~~.
- 7) Pittsburgh; ~~6-411~~ Series SpeedHide Eggshell Acrylic Latex Enamel: Applied at a dry film thickness of not less than ~~1.25 mils (0.032 mm)~~.
- 8) P & L; Z-8200 Pro-Hide Gold Interior Latex Eggshell: Applied at a dry film thickness of not less than 1.5 - 2.5 mils
- 9) S-W; ProMar 200 Interior Latex Egg-Shell Enamel B20W200 Series: Applied at a dry film thickness of not less than ~~1.6 mils (0.041 mm)~~.

END OF SECTION 09 9100

## SECTION 09 9656 - EPOXY COATINGS

### 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 surface preparation and field application of interior epoxy coating systems to items and surfaces scheduled. Type of epoxy systems required is as follows:
  - 1. Two-component, epoxy emulsion.
- B. Related Sections include the following:
  - 1. Division 09 Section "Painting" for general field painting.

#### 1.3 DEFINITIONS

- A. Standard coating terms defined in ASTM D 16 apply to this Section.
- B. Gloss ranges used in this Section include the following:
  - 1. Semigloss refers to medium-sheen finish with a gloss range between 30 and 65 when measured at a 60-degree meter.
  - 2. High gloss refers to high-sheen finish with a gloss range more than 65 when measured at a 60-degree meter.

#### 1.4 SUBMITTALS

- A. Product Data: For each coating system indicated. Include primers.
  - 1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference the specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
  - 2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each material specified.
- B. Certification by manufacturer that products supplied comply with requirements indicated that limit the amount of VOCs in coating products.
- C. Samples for Verification: For each color and material to be applied, with texture to simulate actual conditions, on representative samples of the actual substrate.
  - 1. Provide stepped Samples defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.



2. List of material and application for each coat of each sample. Label each sample for location and application.
3. Submit samples on the following substrates for Architect's review of color and texture:
  - a. Gypsum Drywall: Provide two 8-inch- (200-mm-) long samples of each color and material on drywall.

#### 1.5 QUALITY ASSURANCE

- A. Applicator Qualifications: Engage an experienced applicator who has completed high-performance coating system applications similar in material and extent to those indicated for Project and whose work has a record of successful in-service performance.
- B. Source Limitations: Obtain primers and undercoat materials for each coating system from the same manufacturer as the finish coats.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label with the following information:
  1. Name or title of material.
  2. Product description (generic classification or binder type).
  3. Manufacturer's stock number and date of manufacture.
  4. Contents by volume, for pigment and vehicle constituents.
  5. Thinning instructions.
  6. Application instructions.
  7. Color name and number.
  8. Handling instructions and precautions.
- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain containers used in storage in a clean condition, free of foreign materials and residue.
  1. Protect materials from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and applying coatings.

#### 1.7 PROJECT CONDITIONS

- A. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 45 and 95 deg F (7 and 35 deg C).

#### 1.8 EXTRA MATERIALS

- A. Furnish extra high-performance coating materials from the same production run as materials applied and in quantities described below. Package coating materials in unopened, factory-sealed containers for storage and identify with labels describing contents.

1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. (3.785 L) or 1 case, as appropriate, of each material and color applied.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Acceptable Manufacturer/ Products: Refer to Finish Schedule for selected manufacturer and product. Alternate products may be used from the manufacturers listed below if samples of the proposed alternate products are submitted and approved by the Architect prior to ordering.
- B. Manufacturers' Names: The following manufacturers are referred to in the coating system descriptions by shortened versions of their names shown in parenthesis:
  1. ICI Dulux Paints; Devoe Coatings (ICI Devoe).
  2. Kwal Paint (Kwal).
  3. Moore: Benjamin Moore & Co. (Moore).
  4. Pittsburgh Paint; PPG Industries, Inc. (PPG).
  5. Sherwin Williams; Industrial and Marine Coatings (S-W).
  6. Tnemec Company, Inc. (Tnemec).

### 2.2 COATINGS MATERIALS, GENERAL

- A. Material Compatibility: Provide primers, undercoats, and finish-coat materials that are compatible with one another and substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. Material Quality: Provide manufacturer's highest grade of the various high-performance coatings specified. Materials not displaying manufacturer's product identification are not acceptable.
  1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.
- C. VOC Classification: Provide high-performance coating materials, including primers, undercoats, and finish-coat materials, that have a VOC classification of 450 g/L or less.

### 2.3 COLORS

- A. Colors: Match colors indicated in the Finish Schedule (EPT-1, EPT-2, etc.) which reference the general paint manufacturer's standard color designations indicated.

### 2.4 INTERIOR EPOXY COATING SYSTEMS

- A. Provide the following coating systems for substrates indicated:
  1. Where undercoats or other conditions show through final coat, apply additional coats until the cured film is of uniform coating finish, color, and appearance.

B. Drywall:

1. Two-Component, Epoxy Emulsion Coating: Provide two finish coats of factory-formulated, semigloss/ gloss, epoxy emulsion over base coat.
  - a. Prime Coat: Manufacturer's recommended latex primer which is compatible with the specified finish system.
    - 1) Kwal: 0890 Sandable Drywall Primer
    - 2) Moore: 253 Latex Drywall Primer.
  - b. Finish Coats: Semigloss, epoxy emulsion.
    - 1) ICI Devco: Tru-Glaze-WB 4406 Waterborne Epoxy Semi-Gloss Coating.
    - 2) Kwal: 3190 Semi-Gloss W/B Catalyzed Epoxy
    - 3) Moore: Poly-amide Water-based Epoxy, M43/M44, Semi-Gloss.
    - 4) PPG: 16-551 Series Pitt-Glaze Low Odor High Solids Acrylic Epoxy.
    - 5) S-W: Water Based Catalyzed Epoxy, B70 Series B60V25.
    - 6) Tnemec: Series 113 H.B. Tneme-Tufcoat.

2.5 INTERIOR EPOXY COATING COLOR SCHEDULE

- A. Color: Match colors indicated in the Finish Schedule Legend on the Drawings which reference the general paint color designations.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. With Applicator present, examine substrates and conditions under which high-performance coatings will be applied, for compliance with coating application requirements.
1. Apply coatings only after unsatisfactory conditions have been corrected and surfaces to receive coatings are thoroughly dry.
  2. Start of application is construed as Applicator's acceptance of surfaces within that particular area.
- B. Coordination of Work: Review other Sections in which primers or other coatings are provided to ensure compatibility of total systems for various substrates. On request, furnish information on characteristics of specified finish materials to ensure compatible primers.
1. If a potential incompatibility of primers applied by others exists, obtain the following from the primer Applicator before proceeding:
    - a. Confirmation of primer's suitability for expected service conditions.
    - b. Confirmation of primer's ability to be top coated with materials specified.
  2. Notify Architect about anticipated problems before using the coatings specified over substrates primed by others.

### 3.2 PREPARATION

- A. General: Remove plates, machined surfaces, and similar items already in place that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.
  - 1. After completing coating operations, reinstall items that were removed; use workers skilled in the trades involved.
- B. Cleaning: Before applying high-performance coatings, clean substrates of substances that could impair bond of coatings. Remove oil and grease before cleaning.
  - 1. Schedule cleaning and coating application so dust and other contaminants from cleaning process will not fall on wet, newly coated surfaces.
- C. Surface Preparation: Clean and prepare surfaces to be coated according to manufacturer's written instructions for each substrate condition and as specified.
  - 1. Provide barrier coats over incompatible primers or remove primers and reprime substrate.
- D. Material Preparation: Carefully mix and prepare coating materials according to manufacturer's written instructions.
  - 1. Maintain containers used in mixing and applying coatings in a clean condition, free of foreign materials and residue.
  - 2. Stir materials before applying to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into the material. Remove film and, if necessary, strain coating material before using.
  - 3. Use only the type of thinners approved by manufacturer and only within recommended limits.

### 3.3 APPLICATION

- A. General: Apply epoxy coatings according to manufacturer's written instructions.
  - 1. Use applicators and techniques best suited for the material being applied.
  - 2. Do not apply high-performance coatings over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to forming a durable coating film.
  - 3. Coating colors, surface treatments, and finishes are indicated in the coating system descriptions.
  - 4. Provide finish coats compatible with primers used.
  - 5. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, grilles, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
    - a. Coat surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
    - b. Coat back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.

- B. Scheduling Coating: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for coating as soon as practicable after preparation and before subsequent surface deterioration.
1. The number of coats and film thickness required is the same regardless of application method.
    - a. Omit primer on metal surfaces that have been shop primed and touchup painted.
    - b. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer.
    - c. Where manufacturer's written instructions require sanding, sand between applications to produce a smooth, even surface.
    - d. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until coating has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat does not cause undercoat to lift or lose adhesion.
  2. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance. Give special attention to edges, corners, crevices, welds, exposed fasteners, and similar surfaces to ensure that they receive a dry film thickness equivalent to that of flat surfaces.
- C. Application Procedures: Apply coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
1. Brush Application: Use brushes best suited for material applied and of appropriate size for the surface or item being coated.
    - a. Apply primers and first coats by brush unless manufacturer's written instructions permit using roller or mechanical applicators.
    - b. Brush out and work brush coats into surfaces in an even film.
    - c. Eliminate cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Neatly draw glass lines and color breaks.
  2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by manufacturer for the material and texture required.
  3. Spray Equipment: Use mechanical methods to apply coating if permitted by manufacturer's written instructions and governing regulations.
    - a. Use spray equipment with orifice size recommended by manufacturer for material and texture required.
    - b. Apply each coat to provide the equivalent hiding of brush-applied coats.
    - c. Do not double back with spray equipment building-up film thickness of two coats in one pass, unless recommended by manufacturer.
- D. Minimum Coating Thickness: Apply each material no thinner than manufacturer's recommended spreading rate. Provide total dry film thickness of the entire system as recommended by manufacturer.

- E. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by manufacturer, to material required to be coated or finished that has not been prime coated by others.
  - 1. Recoat primed and sealed substrates if there is evidence of suction spots or unsealed areas in first coat, to ensure a finish coat with no burn-through or other defects caused by insufficient sealing.
- F. Completed Work: Match approved Samples for color, texture, and coverage. Remove, refinish, or recoat work that does not comply with specified requirements.

### 3.4 CLEANING

- A. Cleanup: At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
  - 1. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

### 3.5 PROTECTION

- A. Protect work of other trades, whether being coated or not, against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.
  - 1. Provide "Wet Paint" signs to protect newly coated finishes. After completing coating operations, remove temporary protective wrappings provided by others to protect their work.
  - 2. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces. Comply with procedures specified in PDCA P1.

END OF SECTION 09 9656

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## SECTION 10 2813 - **TOILET 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. This Section includes the following:
  - 1. Toilet accessories

#### 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. Setting Drawings: For cutouts required in other work; include templates, substrate preparation instructions, and directions for preparing cutouts and installing anchoring devices.
- C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required. Use designations indicated in the Toilet and Bath Accessories Schedule and room designations indicated on Drawings in product schedule.
- D. 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.

#### 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.

#### 1.6 WARRANTY

- A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.



- B. Manufacturer's Mirror Warranty: Written warranty, executed by mirror manufacturer agreeing to replace mirrors that develop visible silver spoilage defects within minimum warranty period indicated.
  - 1. Minimum Warranty Period: 15 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work may be supplied from one of the approved manufacturers listed below.
  - 1. Toilet and Bath Accessories:
    - a. American Specialties, Inc.
    - b. Bobrick Washroom Equipment, Inc.
    - c. Bradley Corporation.
    - d. Royse Rolls

### 2.2 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, with No. 4 finish (satin), in 0.0312-inch (0.8-mm) minimum nominal thickness, unless otherwise indicated.
- B. Brass: ASTM B 19, leaded and unleaded flat products; ASTM B 16 (ASTM B 16M), rods, shapes, forgings, and flat products with finished edges; ASTM B 30, castings.
- C. Galvanized Steel Sheet: ASTM A 653/A 653M, G60 (Z180).
- D. Chromium Plating: ASTM B 456, Service Condition Number SC 2 (moderate service), nickel plus chromium electrodeposited on base metal.
- E. Baked-Enamel Finish: Factory-applied, gloss-white, baked-acrylic-enamel coating.
- F. Silvered Mirrored Glass: Tempered, clear float glass with successive layers of chemically deposited silver, electrically or chemically deposited copper, and manufacturer's standard organic protective coating applied to second glass surface to produce a coating system complying with FS DD-M-411.
- G. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- H. 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 TOILET AND BATH ACCESSORIES

- A. Grab Bars: Bobrick B-6806 Series or equal.
  - 1. GB18 = B-6806 x 18
  - 2. GB36 = B-6806 x 36

3. GB42 = B-6806 x 42

- B. Toilet Paper Dispenser (TPD) = Bobrick B-2888 or equal.
- C. Feminine Napkin Disposal Unit (FND) = Bobrick B-354 or equal.
- D. Mirror (MIR) = Bobrick B-165 1836 or equal.
- E. Diaper Changing Station = Bobrick KB310-SSWM or equal.

## 2.4 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. 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 (0.85 mm) and full mirror size, with nonabsorptive filler material. Corrugated cardboard is not an acceptable filler material.
- D. Mirror-Unit Hangers: Provide mirror-unit mounting system that permits rigid, tamper- and theft-resistant installation, as follows:
  - 1. One-piece, galvanized steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
  - 2. Heavy-duty wall brackets of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.

## 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. Secure mirrors to walls in concealed, tamper-resistant manner with special hangers, toggle bolts, or screws. Set units level, plumb, and square at locations indicated, according to manufacturer's written instructions for substrate indicated.

### 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.

END OF SECTION 10 2813

## SECTION 10 4400 - FIRE-PROTECTION 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:
  - 1. Fire-protection cabinets for the following:
    - a. Fire extinguisher cabinets and brackets.
    - b. NOTE: Fire Extinguishers are Owner Furnished, Owner Installed.
- B. Related Sections include the following:
  - 1. Division 07 Section "Through-Penetration Firestop Systems" for firestopping sealants at fire-rated cabinets.

#### 1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection cabinets.
  - 1. Fire-Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.
- B. Samples for Verification: For each type of exposed factory-applied color finish required for fire-protection cabinets, prepared on Samples of size indicated below.
  - 1. Size: 6 by 6 inches (150 by 150 mm) square.
- C. Maintenance Data: For fire extinguishers to include in maintenance manuals.

#### 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain fire-protection cabinets through one source from a single manufacturer.
- B. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements of ASTM E 814 for fire-resistance rating of walls where they are installed.

#### 1.5 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

## 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. Basis-of-Design Product: The design for each product is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

### 2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
- B. Stainless-Steel Sheet: ASTM A 666, Type 304.
- C. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

### 2.3 FIRE-PROTECTION CABINET

- A. Basis-of-Design Product: JL Industries, Ambassador Series OR a comparable product by one of the following:
- B. Manufacturers:
  - 1. General Accessory Mfg. Co.
  - 2. Kidde Fynetics.
  - 3. Larsen's Manufacturing Company.
  - 4. Modern Metal Products; Div. of Technico.
  - 5. Potter Roemer; Div. of Smith Industries, Inc.
  - 6. Watrous; Div. of American Specialties, Inc.
- C. Cabinet Type: Suitable for fire extinguisher.
- D. Cabinet Construction: Refer to drawings for cabinet locations in fire rated walls.
- E. Cabinet Material: Cold rolled steel.
- F. Semi recessed Cabinet: Cabinet box partially recessed in walls of shallow depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
  - 1. Rolled-Edge Trim: 2-1/2-inch (64-mm) backbend depth.
- G. Cabinet Trim Material: Cold rolled steel.
- H. Door Material: Cold rolled steel.

- I. Door Style: Solid Door, cold rolled steel.
- J. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
  - 1. Provide projecting door pull and friction latch.
  - 2. Provide continuous hinge or concealed hinge permitting door to open 180 degrees.
- K. Door Latch: Roller latch
- L. Accessories:
  - 1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
  - 2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
    - a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
      - 1) Location: Applied to cabinet door
      - 2) Application Process: Vinyl Letters.
      - 3) Lettering Color: Red.
      - 4) Orientation: Vertical unless door style is better suited for horizontal orientation.
- M. Finishes:
  - 1. Color to be White.

## 2.4 FABRICATION

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
  - 1. Weld joints and grind smooth.
  - 2. Construct fire-rated cabinets with double walls fabricated from 0.0428-inch- (1.1-mm-) thick, cold-rolled steel sheet lined with minimum 5/8-inch- (16-mm-) thick, fire-barrier material.
    - a. Provide factory-drilled mounting holes.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
  - 1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch (13 mm) thick.
  - 2. Miter and weld perimeter door frames.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

## 2.5 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire-protection cabinets after assembly.
- D. 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 walls and partitions for suitable framing depth and blocking where recessed or semi-recessed cabinets will be installed.
- B. Examine fire extinguishers for proper charging and tagging.
  - 1. Remove and replace damaged, defective, or undercharged units.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Prepare recesses for recessed or semi-recessed fire-protection cabinets as required by type and size of cabinet and trim style.

### 3.3 INSTALLATION

- A. General: Install fire-protection specialties in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
- B. Fire-Protection Cabinets: Fasten fire-protection cabinets to structure, square and plumb.
  - 1. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
- C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.
- D. Identification: Apply decals at locations indicated.

### 3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection specialties are installed, unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet manufacturer.
- E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 10 4400



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## TABLE OF CONTENTS

### DIVISION 20 – SEISMIC PROTECTION

20 0800 Seismic Protection

### DIVISION 21 – FIRE SUPPRESSION

21 0500 Common Work Results for Fire Suppression  
21 1100 Water Based Fire Suppression Systems

### DIVISION 22 – PLUMBING

22 0500 Common Work Results for Plumbing  
22 0523 General-Duty Valves for Plumbing Piping  
22 0529 Hangers and Supports for Plumbing Piping and Equipment  
22 0553 Identification for Plumbing Piping and Equipment  
22 0719 Plumbing Piping Insulation  
22 1116 Domestic Water Piping  
22 1316 Sanitary Waste and Vent Piping  
22 1319 Sanitary Waste Piping Specialties  
22 4000 Plumbing Fixtures

### DIVISION 23 – HEATING, VENTILATING, AND AIR CONDITIONING

23 0100 Basic Mechanical Requirements  
23 0500 Basic Mechanical Materials and Methods  
23 0513 Motors  
23 0519 Meters and Gages  
23 0523 Valves  
23 0529 Hangers and Supports  
23 0593 Test, Adjust Balance  
23 0700 Mechanical Insulation  
23 0900 Control Systems  
23 2113 Hydronic Piping  
23 3113 Metal Ducts  
23 3300 Duct Accessories  
23 3600 Air Terminal Units  
23 3713 Diffusers Registers and Grilles

### DIVISION 26 – ELECTRICAL

26 0500 Common Work Results for Electrical  
26 0519 Conductors and Cables  
26 0526 Grounding and Bonding  
26 0529 Hangers and Supports  
26 0533 Raceways  
26 0534 Boxes, Cabinets and Enclosures  
26 0553 Identification for Electrical Systems  
26 0600 Electrical Demolition  
26 0923 Lighting Control Devices

26 2726 Wiring Devices  
26 2816 Enclosed Switches  
26 5100 Lighting

DIVISION 27 – COMMUNICATIONS

27 1513 Communications Copper Horizontal Cabling

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

28 3111 Digital, Addressable Fire-Alarm System

END OF SECTION TOC

## SECTION 20 0800 - SEISMIC 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 the work of this Section.

#### 1.2 APPLICABILITY

- A. Seismic supports and restraints shall be provided for all Life Safety and Hazardous or Flammable systems. The following are defined as Life Safety and Hazardous or Flammable:

1. Fire protection equipment and systems.
2. Fire suppression piping.
3. Gas and high-hazard piping.
4. Emergency or standby electrical systems, and electrical systems which serve fire protection.
5. Communication and fire alarm systems.
6. Any system or component containing hazardous or flammable materials.

- B. In addition to the above, seismic supports and restraints shall be provided for all of the following systems:

1. Electrical bus ducts and primary cable systems.
2. Electrical motor control centers, motor control devices, switchgear, transformers, and unit substations.
3. Reciprocating or rotating equipment or any equipment with moving parts.
4. Boilers, tanks, heat exchangers, and pressure vessels.
5. Piping systems.
6. HVAC ducts.
7. Electrical panelboards.
8. Lighting fixtures.

#### 1.3 EXEMPTIONS

- A. The following mechanical and electrical components are exempt from the requirements of this Section:

1. MEP components that were existing prior to beginning of construction of this project and which are not disturbed during the course of this work, are exempt.
2. Piping and conduit are exempt if the entire run is suspended from hangers 12-inches or less in length from the top of the pipe to the supporting structure, and if the hangers are sufficient to avoid significant bending of the hangers and their connections.
3. Piping and conduit constructed of steel, copper, ductile iron, aluminum, or plastic, of nominal diameter 1-inch and smaller, are exempt.
4. If not part of Life Safety and Hazardous or Flammable systems, HVAC ducts are exempt if the entire duct run is suspended from hangers 12 inches or less in length

from the top of the duct to the supporting structure, and if the hangers are sufficient to avoid significant bending of the hangers and their connections.

5. If not part of Life Safety and Hazardous or Flammable systems, HVAC ducts are exempt if the entire duct run consists of ducts less than 6 square feet in cross-sectional area.

#### 1.4 SUMMARY

- A. Description of Work: The purpose of this section is to define seismic restraint requirements for mechanical and electrical systems, equipment and devices, hereinafter referred to as components.
- B. This Section does not specify seismic force resisting systems for building structures and structural elements, which are addressed in Divisions 03 through 06.
- C. The requirements for seismic protection specified herein are in addition to any requirements for support and/or seismic protection specified in other sections of these specifications.
- D. The Contractor shall be responsible for developing details to provide proper support of equipment and devices in accordance with the requirements specified herein.
- E. The Contractor shall not proceed with installation of equipment nor seismic protection system until all applicable submittals required by this section have been completed.
- F. This section includes the following:
  1. Applicable Code.
  2. Project-specific Code Coefficients
  3. Rigid Support Items.
  4. Non-rigid Support Items.
  5. Sway Braces.
  6. Anchors, Bolts and Clamps.
  7. Restraining Cables.
  8. Seismic Snubbers.
  9. Installation Requirements.
- G. Related sections: The following sections contain requirements that relate to this section:
  1. Division 23 Section "Basic Mechanical Materials and Methods" for general mechanical requirements.
  2. Division 23 Section "Hangers and Supports" for piping and equipment supports.
  3. Division 23 Section "Mechanical Insulation" for pipe and duct insulation.
  4. Division 26 Section "Common Work Results for Electrical" for general electrical requirements.
  5. All Division 21 to 28 Sections for mechanical and electrical equipment and systems requiring seismic protection.

## 1.5 DEFINITIONS

- A. Terminology used in this section is defined in ASCE/SEI 7-10: *Minimum Design Loads for Buildings and Other Structures*, as issued by the American Society of Civil Engineers, 2010; Reston, Virginia.
- B. OSHPD: Office of Statewide Health Planning & Development for the State of California.

## 1.6 PERFORMANCE REQUIREMENTS

- A. This facility is designated as Seismic Occupancy Category IV.
- B. The spectral response acceleration at short periods,  $S_s$ , shall be taken as 0.163g.
- C. The spectral response acceleration at one-second period,  $S_1$ , shall be taken as 0.094g.
- D. This facility site is designated as Site Class Definition D.
- E. The Site Coefficients,  $F_a$  shall be taken as 1.6 and  $F_v$  shall be taken as 2.4.
- F.  $S_{DS}$ , the Five-Percent damped design spectral response acceleration at short periods, shall be taken as  $S_{DS} = 0.173$ .
- G.  $S_{D1}$ , the Five-Percent damped design spectral response acceleration at one-second period, shall be taken as  $S_{D1} = 0.151$ .
- H. This facility is designated as Seismic Design Category D.
- I. The horizontal seismic force on a given component shall be noted as  $F_p$ . The seismic force  $F_p$  shall be applied at the center of gravity, independently longitudinally and laterally in combination with service loads associated with the component. The following equation shall be utilized individually on every component to determine  $F_p$ :
  - 1.  $F_p = 1.6 \times S_{DS} \times I_p \times W_p$  where
    - a.  $I_p$  = Component Importance Factor.
    - b.  $W_p$  = Component Operating Weight in pounds.
  - 2. In lieu of the above equation, a much more detailed calculation involving Equation 13.3-1 of ASCE 7-10 and its related Tables, which may yield somewhat lower results for  $F_p$ , may be utilized. If this option is selected, complete details of all such calculations shall be submitted as required under "Submittals" below.
- J. The vertical seismic force on a given component shall be taken as  $0.2 \times S_{DS} \times W_p$  and shall be determined individually for every component. This vertical force shall be applied at the center of gravity of the component, in either vertical direction, and shall be considered concurrent with the horizontal force determined above.

## 1.7 SUBMITTALS

- A. The Engineer shall receive one copy of all submittal data supplied to the Owner as required in this specification. It is the responsibility of the Contractor to provide seismic

protection as outlined herein. Receipt by the Engineer of a copy of the submittals is to verify conformance to the submittal requirements set forth in this specification section. It is not an admission by the Engineer as to the accuracy or completeness of the calculations submitted and equipment proposed.

- B. Prior to installation of equipment and devices requiring seismic restraints, the Contractor shall submit required documentation and details at the shop drawing review stage to the Owner. Submit the following in accordance with conditions of contract and Division 01 specification sections.
- C. Product data: Include installation details and instructions for each type of seismic support and restraint. Submit equipment support and restraint schedule showing size, location, and features for each required support and restraint.
- D. Product certificates: Signed by the manufacturer of seismic supports and restraints certifying that their products meet the specified requirements.
- E. Shop Drawings: Calculations and Drawings signed and sealed by a qualified professional engineer registered to practice in the State of Missouri, shall be provided for the installation details of each piece of equipment. Include the following:
  - 1. Design Calculations: Calculate requirements for selecting seismic restraints. Exception: Certified and stamped calculations are not required for seismic-restrained systems which have been pre-approved by OSHPD or comply with ANSI/SMACNA Standard 001-2008 *Seismic Restraint Manual; Guidelines for Mechanical Systems*, as issued by the Sheet Metal and Air Conditioning Contractors National Association, Inc., 2008; Chantilly, Virginia; Third Edition; except where more stringent requirements are described herein. A signed letter on Contractor's letterhead shall be provided as part of the submittal process stating which approved systems are being utilized.
  - 2. Seismic-Restraint Details: Detail fabrication and attachment of seismic restraints and snubbers. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.
  - 3. Assembly-type shop drawings: For each type of seismic support and restraint, indicate dimensions, weights, required clearances, and methods of assembly of components. Submittal Drawings shall indicate in complete detail size, type, material grade, locations and dimensions; and shall show construction details, reinforcement, anchorage and installation with relation to the building construction. Submittals shall include, but not be limited to sway braces, flexible couplings or joints, resilient type vibration devices, and anchorage of concrete equipment pads to structure.
  - 4. Where seismic anchors and braces for one component must unavoidably be attached to two or more elements of a structure subject to differential movement, such as a wall and a floor or two different floors, submit sealed calculations for relative displacements; including selection of sufficient flexible fittings to accommodate the relative displacement. Examples subject to relative displacement include vertical pipe or conduit risers; or a pump anchored to a floor and rigidly connected to piping anchored to the roof structure above.
- F. Welder certificates: Signed by Contractor certifying that welders comply with requirements specified under "Quality Assurance" Article.

- G. Maintenance data: For seismic supports and restraints for inclusion in Operating and Maintenance Manual specified in Division 01, Division 23 Section "Basic Mechanical Requirements" and Division 26 Section "Common Work Results for Electrical."
- H. Manufacturer Seismic Qualification Certification: Submit certification that all specified equipment will withstand seismic forces identified in "Performance Requirements" Article above. Include the following:
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations. 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.
- I. Contractor's Acknowledgement of Seismic Responsibility: Submit written contractor's statement of responsibility prior to commencement of the work, acknowledging an awareness of the seismic restraint requirements of the project, that control will be exercised to obtain conformance with the Construction Documents, listing procedures for exercising control over the seismic restraint installation, and identifying the responsible person(s) within their organization.

#### 1.8 QUALITY ASSURANCE

- A. Seismic-restraint devices shall have horizontal and vertical load testing and analysis performed according to OSHPD and shall bear anchorage preapproval "R" number, from OSHPD or 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. Testing and calculations must include both shear and tensile loads and one test or analysis at 45 degrees to the weakest mode.
- B. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code – Steel." Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

#### 1.9 REFERENCES

- A. Regulatory Requirements: Comply with applicable codes pertaining to product materials and installation of seismic supports and restraints.
- B. Referenced Codes and Standards: All work provided under this section shall comply with the requirements specified herein, and additionally as provided in the following Codes and Standards. In all cases where conflicting requirements are provided within these specifications, Codes and Standards, the most stringent requirement shall apply.



- C. IBC 2015: Comply with the International Building Code Sections 1613 and 1705.
- D. ASCE/SEI 7-10: Comply with *Minimum Design Loads for Buildings and Other Structures*, as issued by the American Society of Civil Engineers, 2010; Reston, Virginia.
- E. NFPA Compliance: Seismic supports and restraints shall comply with NFPA Standard 13 when used as a component of a fire protection system.
- F. UL and FM Compliance: Seismic supports and restraints shall be listed and labeled by UL and FM where used for fire protection piping systems.
- G. ANSI/SMACNA: All seismic restraints for piping and ductwork shall comply with ANSI/SMACNA Standard 001-2008 *Seismic Restraint Manual; Guidelines for Mechanical Systems*, as issued by the Sheet Metal and Air Conditioning Contractors National Association, Inc., 2008; Chantilly, Virginia; Third Edition. A seismic hazard level (SHL) shall be utilized as scheduled below.
  - 1. All Fire Protection/Suppression Piping: SHL - C
  - 2. All other ductwork not listed above: SHL - C
  - 3. All other Piping not listed above: SHL - C
- H. ANSI Standards and ASTM Publications: Seismic supports and restraints shall comply with American National Standards Institute, Inc. (ANSI) and the American Society for Testing and Materials (ASTM) Publications.
  - 1. B18.2.1-1981 Square and Hex Bolts and Screws Inch Series
  - 2. B18.2.2-1972 Square and Hex Nuts (R1983)
  - 3. A36-84a Structural Steel
  - 4. A307-86a Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
  - 5. A325-86a High-Strength Bolts for Structural Steel Joints
  - 6. A501-84 Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
  - 7. A576-87 Steel Bars, Carbon, Hot-Wrought, Special Quality
- I. Federal Specification: Seismic supports and restraints shall comply with Federal Specification RR-W-410D for Wire Rope and Strand.

#### 1.10 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into base. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

#### 1.11 EXTRA MATERIALS

- A. Furnish extra replacement neoprene inserts for all snubbers, which match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. California Dynamics Corp.
  2. Eaton; Cooper, B-Line, and Tolco brands.
  3. Kinetics Noise Control, Inc.
  4. Loos & Co., Inc.
  5. Mason Industries, Inc.
  6. Unistrut Corp.; division of Tyco International, Ltd.
  7. Vibration Eliminator Co., Inc.
  8. Vibro-Acoustics, Inc.
  9. The VMC Group; Amber/Booth, Korfund, and VMC brands.
- B. All seismic restraint devices of any one general group; raceways or suspended equipment, or switchgear or other floor mounted equipment, etc., shall be provided by a single manufacturer.

### 2.2 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A36.
- B. Bolts and Nuts: Square and hex bolts and nuts, ANSI B18.2.1 and B18.2.2, SAE Grade 5, and ASTM A307 or A325.
- 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.
- F. 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 E488. Minimum length of eight times diameter.
- G. 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 E488.
- H. Sway Brace: Material used for members listed in Table I of this specification, except for pipes, shall be structural steel conforming with ASTM A36. Steel pipes shall conform to ASTM A501. Note additional exception below.

1. Contractor's Option: In lieu of utilizing angles, rods, bars or pipes as noted in Table I, U-channel systems consisting of channels, fittings and accessories may be utilized. The u-channel system shall be manufactured as a complete system by one supplier and listed by the manufacturer for use in seismic restraint application. The system shall have the approval of OSHPD. The equipment shall provide multi-directional bracing of electrical conduit, cable tray and mechanical piping/ductwork systems.

<u>Type</u>	<u>Size (inches)</u>	<u>Maximum Length*</u>	<u>Allowable Concentric Load* (kips)</u>
Angles	1½ x 1½ x ¼	4'-10"	3.4
	2 x 2 x ¼	6'-6"	4.6
	2½ x 2½ x ¼	8'-2"	5.9
	3 x 3 x ¼	9'-10"	7.1
Rods	¾	3'-1"	2.2
	7/8	3'-7"	3.0
Pipes (40S)	1	6'-9"	2.4
	1¼	8'-8"	3.3
	1½	10'-1"	3.9
	2	12'-9"	5.3
	2½	15'-4"	8.4
	3	19'-0"	11.0

\*Based on the slenderness ratio of  $l/r = 200$ , and load applied concentrically to brace. The tabulated load values include a 33% stress increase as permitted for seismic loads. For non-concentric loading, allowable brace load is to be determined per the AISC Specification for Structural Steel Buildings / ASD 1989.

- I. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod. Reinforcing steel angle clamped to hanger rod is also acceptable.
- J. Restraining Cables: ASTM A603 galvanized steel aircraft cables of minimum diameter 1/8-inch, with end connections made of steel assemblies that swivel to final installation angle and utilize two clamping bolts for cable engagement. Cables shall conform to Fed. Spec RR-W-410 as follows:
  1. Less than 1/8-inch diameter Not Permitted
  2. 1/8 to 5/32 inch diameter Type V, Class 1
  3. 3/16 inch to 5/16 diameter Type V, Class 2
  4. 1/4 inch to 5/8 diameter Type I, Class 2

- K. Resilient Isolation Washers and Bushings: 1-piece, molded, bridge-bearing neoprene complying with AASHTO M 251 and having a durometer of 50, plus or minus 5, with a flat washer face.
- L. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.
- M. Flexible Couplings: Flexible couplings shall have same pressure ratings as adjoining pipe.
- N. Galvanizing Repair Paint: High-zinc-dust-content paint, with dry film containing not less than 94 percent zinc dust by weight.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas and equipment to receive seismic-control devices for compliance with requirements, installation tolerances, and other conditions affecting performance. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation. Examine substrates and conditions under which seismic supports and restraints are to be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 SEISMIC PROTECTION, GENERAL

- A. Attachments and supports for mechanical and electrical systems and components shall be designed to resist the seismic forces specified herein.
- B. Mechanical and electrical systems and components shall be designed by their manufacturer to consider dynamic effects of the equipment and its contents. Design, selection, and installation of seismic bracing for mechanical and electrical systems and components shall account for interaction between equipment and supporting structures, and the effect imposed by attached utility or service lines, and shall ensure that impact between components is avoided during a seismic event.
- C. Anchorage: Install seismic supports and restraints complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
  1. Friction resulting from gravity loads shall not be considered to provide resistance to seismic loads.
  2. All bolts, including fasteners and anchor bolts, used for attachment of anchors to components and to structure shall be sized for the seismic forces described in Part I but shall not be less than ½-inch diameter in any case.
  3. Powder-driven fasteners and shot pins shall not be permitted in tension load applications.
  4. Expansion anchors, other than undercut expansion anchors, shall not be permitted to anchor non-vibration isolated equipment rated over 10 horsepower.
  5. Anchorage Embedment Depth: Not less than eight times the anchorage diameter.

6. Anchorage Edge Distance: Place anchorage not less than ten times the anchorage diameter from edge of concrete housekeeping pad.
- D. Equipment Sway Bracing: Required for all items supported from overhead structures. Braces shall consist of angles, rods, bars, pipes, cables, or factory fabricated U-channel systems and secured at both ends with not less than ½-inch bolts. Braces shall conform to Table 1, or as recommended by U-channel systems fabricator. Bracing shall be provided in two planes of directions, 90 degrees apart, for each item of equipment. Details of all equipment bracing shall be submitted.
1. In lieu of bracing with vertical supports, these items may be supported with hangers inclined at 45 degrees directed up and radially away from equipment and oriented symmetrically in 90-degree intervals on the horizontal plane, bisecting the angles of each corner of the equipment, provided that supporting members are properly sized to support operating weight of equipment when hangers are inclined at a 45-degree angle.
  2. Exception: Components mounted in line with duct systems and which weigh less than 75 pounds, do not require dedicated equipment sway bracing. Instead, such components shall be considered a part of the duct system itself and braced as such.

### 3.3 PIPES AND DUCTS

- A. General: Select and install restraints for piping and ductwork in complete and strict accordance with ANSI/SMACNA Standard 001-2008 *Seismic Restraint Manual; Guidelines for Mechanical Systems*, as issued by the Sheet Metal and Air Conditioning Contractors National Association, Inc., 2008; Chantilly, Virginia; Third Edition; except where more stringent requirements are described herein.
- B. Fire protection sprinkler systems shall be seismically braced in accordance with NFPA 13; however, the seismic force calculated per NFPA 13, when multiplied by 1.4, shall not be less than that required by this Specification.
- C. Conduit: Restraints for piping shall also apply to conduit.
- D. Transverse Sway Bracing: Transverse sway bracing shall be provided at each horizontal turn of 45 degrees or more, at the end of each pipe/duct run, and otherwise at regular intervals spaced no further than required by the above Standard. Walls which ducts penetrate may be considered transverse braces. Sway bracing shall be provided at closer intervals if so recommended by U-channel manufacturer when using U-channel systems.
- E. Longitudinal Sway Bracing: Longitudinal sway bracing shall be provided at regular intervals spaced no further than required by the above Standard. Transverse bracing for one pipe/duct section may also act as longitudinal bracing for a pipe/duct section connected perpendicular to it, if the bracing is installed within 4 feet of the intersection, and if it is sized for the larger pipe/duct. Sway bracing shall be provided at closer intervals if so recommended by U-channel manufacturer when using U-channel systems.
- F. All equipment installed in line with ductwork, including but not limited to fans, humidifiers, heat exchangers, air terminal units, etc., and which have an operating weight greater than 75 pounds, shall be supported and sway braced independently of the duct system.

Appurtenances lighter than 75 pounds, including but not limited to diffusers, dampers, louvers, grilles, etc., shall be positively attached to the ducts with mechanical fasteners.

- G. Anchor Rods, Angles, and Bars: Anchor rods, angles, and bars shall be bolted to either pipe clamps or pipe flanges at one end and cast-in-place concrete or masonry insert or clip angles bolted to the steel structure on the other end. Rods shall be solid metal or pipe as required.
- H. Restraining Cables: Install restraining cables slightly slack. Install cables so they do not bend across sharp edges of adjacent equipment or building structure.
- I. Hanger Rod Reinforcement: Install steel angles or channel, sized to prevent buckling, clamped with ductile-iron clamps to hanger rods for trapeze and individual pipe and equipment hangers where required. Do not weld angles to rods.
- J. Clamps: Clamps on uninsulated pipes shall be applied directly to pipes. Insulated piping shall have clamps applied over insulation vapor barrier with high-density inserts and metal protection shields under each clamp. Vapor barrier shall not be punctured. At trapeze anchor locations, shackle or clamp piping to trapeze.
- K. Vertical Runs: Vertical runs of piping or ductwork shall be braced at each floor and roof level. Provide intermediate lateral braces at 13 foot maximum spacing where story height exceeds 13 feet.
- L. Spreaders: Required between racked or adjacent piping runs to prevent contact during seismic activity whenever pipe or insulated pipe surfaces are less than 4 inches (or four times the maximum displacement due to seismic force) apart. Spreaders shall be applied at same interval as sway braces. Spreaders shall be applied to surface of bare or insulated hot pipe, and over insulation utilizing high-density inserts and pipe protection shields where vapor-barrier-type insulation is employed.

### 3.4 ELECTRICAL EQUIPMENT

- A. Slide-out components in electrical control panels, computer equipment, etc. shall have a latching mechanism to hold contents in place.
- B. Cutouts in the lower shear panel of electrical cabinets are prohibited, unless one of the following exceptions is met:
  - 1. Factory cutouts made by the manufacturer.
  - 2. Cutouts supported by an analysis demonstrating that remaining cabinet strength is sufficient.
- C. Attachment of additional external items to electrical equipment is prohibited, unless one of the following exceptions is met:
  - 1. Items weighing less than 100 pounds.
  - 2. Items provided by the electrical equipment manufacturer.
  - 3. Items shown by analysis demonstrating their effects are supported by the design.

### 3.5 LIGHTING FIXTURES

- A. Lighting fixture supports shall be malleable iron unless specified to be of a higher quality (such as stainless steel, etc.) in other sections of these specifications.
- B. A supporting assembly that is intended to be mounted on an outlet box shall be designed to accommodate mounting features on 4-inch boxes, 3-inch plaster rings, and fixture studs.
- C. Wall-mounted emergency light unit shall be secured in a manner to hold the unit in place during a seismic disturbance.
- D. Recessed individual or continuous-row fixtures: Support by a seismic-resistant suspended ceiling support system. Except where restricted below, the fixtures shall be bolted, screwed, or riveted to the ceiling system runners at each corner of the fixture. In addition, provide with fixture support wires attached to the building structural members using two wires for individual fixtures and one wire per unit of continuous row fixtures.
  - 1. All lighting fixtures over 56 pounds in weight shall be attached to building structural members utilizing fixture support wires.
  - 2. All recessed fixtures 4 s.f. or more in area in the horizontal plane shall also be secured with two wires as described in Division 26 Section "Interior Lighting."

### 3.6 CEILING-MOUNTED COMPONENTS

- A. Definition: For the purpose of this section, a ceiling-mounted component includes but is not limited to lighting fixtures. In addition, ceiling components also include speakers, grilles and diffusers, fire alarm devices, occupancy detectors and the like.
- B. All ceiling-mounted components weighing 10 pounds (4.5 kg) or less shall have a #12 hanger wire attached to the component and to the structure above. The wire need not be taut. At the housing, loop the wire through an eye on the component housing and wrap a minimum of four times around itself. Install with a minimum of slack so that the wires do not exert significant pressure on the component and no pressure on the ceiling that would cause ceiling distortion.
- C. For ceiling-mounted components weighing more than 10 pounds (4.5 kg) but less than or equal to 56 pounds (25.4 kg), two #12 hanger wires shall be wire attached to the component and to the structure above. The wires need not be taut. At the housing, loop the wire through eyes on the component housing, one at each diagonal corner (for rectangular components) and wrap a minimum of four times around itself. Install with a minimum of slack so that the wires do not exert significant pressure on the component and no pressure on the ceiling that would cause ceiling distortion.
- D. For ceiling-mounted components weighing more than 56 pounds (25.4 kg), the component and any attachments shall be supported directly from the structure.

### 3.7 SEISMIC RELATIVE DISPLACEMENT

- A. Do not attach seismic anchorage or bracing for any one component to two or more elements of a structure subject to differential movement, such as a wall and a floor or

two different floors. Do not attach seismic anchorage or bracing for any one component to two or more separate structures or structural systems.

- B. Piping, conduit, ductwork, cable tray, etc. shall be designed to accommodate differential movement between components and structures when attached to structures that could displace relative to each other and where the components cross a seismic isolation interface. Examples include vertical pipe or conduit risers; or a pump anchored to a floor and rigidly connected to piping anchored to the roof structure above. Furnish and install sufficient flexible fittings to accommodate the relative displacement.

### 3.8 ADJUSTING

- A. Adjustment: Adjust supports and restraints to distribute loads equally on attachments. Adjust snubbers according to manufacturer's written recommendations. Adjust seismic restraints to permit free movement of equipment within normal mode of operation.
- B. Torque anchor bolts according to equipment manufacturer's written recommendations to resist seismic forces.

### 3.9 CLEANING

- A. After completing equipment installation, inspect seismic-control devices. Remove paint splatters and other spots, dirt, and debris.
- B. Paint Touch-Up: Immediately after installation of equipment, devices and seismic protection system; clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas per requirements in Division 09 painting sections.
- C. Galvanizing Touch-Up: Immediately after installation of equipment, devices and seismic protection system; clean field welds, bolted connections, and abraded areas of galvanizing. Apply galvanizing repair paint to comply with ASTM A780.

### 3.10 FIELD QUALITY CONTROL

- A. Review: Engage an authorized representative of the seismic restraint vendor to perform the following field quality control review:
  - 1. Examine all mechanical and electrical systems and equipment to confirm all seismic-restraint systems are installed properly and in compliance with these specifications and the submittals.
  - 2. Examine all seismic restraints and seismic snubbers for minimum clearances.
  - 3. Examine all cable bracing systems for proper installation, angle of slope, and tension or slack.
- B. Report: Submit a certification report of the authorized representative of the seismic restraint vendor to verify the above review and to include the following:
  - 1. Certify that all seismic-restraint systems are installed properly and in compliance with these specifications and the submittals.
  - 2. Identify those areas that require corrective measures or certify that no corrective measures are necessary.



3. Any changes to the originally submitted seismic restraint designs, such as those due to field coordination, shall be clearly defined and detailed in the report.

END OF SECTION 20 0800

## SECTION 21 0500 - **COMMON WORK RESULTS FOR FIRE SUPPRESSION**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Piping materials and installation instructions common to most piping systems.
  - 2. Sleeves.
  - 3. Escutcheons.
  - 4. Fire-suppression equipment and piping demolition.
  - 5. Supports and anchorages.

#### 1.3 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, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- 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. The following are industry abbreviations for rubber materials:
  - 1. EPDM: Ethylene-propylene-diene terpolymer rubber.
  - 2. NBR: Acrylonitrile-butadiene rubber.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

#### 1.5 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for fire-suppression installations.

- B. Coordinate requirements for access panels and doors for fire-suppression 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 21 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 21 piping Sections for special joining materials not listed below.

### 2.4 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.

### 2.5 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, Stamped-Steel Type: With set screw and chrome-plated finish (in finished areas exposed to view).
- C. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw, and chrome-plated finish (in finished areas exposed to view).

## PART 3 - EXECUTION

### 3.1 FIRE-SUPPRESSION 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 fire-suppression 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.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.
- D. Temporary sprinkler system or modifications to existing systems are required to maintain an active fire sprinkler system in areas of remodel. Temporary systems shall be coordinated with all trades and removed once the new sprinkler system is tested and activated.

### 3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 21 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. Select system components with pressure rating equal to or greater than system operating pressure.
- K. Install escutcheons for penetrations of walls, ceilings, and floors in finished areas exposed to view.
- L. Sleeves are not required for core-drilled holes.

- M. 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.
  - 2. 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.
  - 3. 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.
  
- N. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

### 3.3 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 21 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.

### 3.4 CUTTING AND PATCHING

- A. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay. Perform cutting and patching in accordance with the following:
- B. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.
- C. Perform cutting, fitting, and patching of fire protection equipment and materials required to:
  - 1. Uncover Work to provide for installation of ill-timed Work.
  - 2. Remove and replace defective Work.

3. Remove and replace Work not conforming to requirements of the Contract Documents.
  4. Install equipment and materials in existing structures.
- D. Cut, remove and legally dispose of selected fire protection equipment, components, and materials as indicated, including but not limited to removal of fire protection piping and other fire protection items made obsolete by the new Work.
  - E. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for fire protection installations. Perform cutting by skilled mechanics of trades involved.
  - F. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
  - G. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
  - H. Repair cut surfaces to match adjacent installations.
  - I. Repair any building insulation or building fireproofing materials, whether new or existing, that are removed or scraped away in order to make a fire protection installation, so as to maintain an equivalent insulation or fire rating as existed without said fire protection installation

END OF SECTION 21 0500

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## SECTION 21 1100 - **WATER-BASED FIRE-SUPPRESSION SYSTEMS**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Pipes, fittings, and specialties.
  - 2. Sprinklers.
  - 3. Wet-pipe sprinkler systems.

#### 1.3 DEFINITIONS

- A. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175 psig maximum.

#### 1.4 SYSTEM DESCRIPTION

- A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply through alarm valve. 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-Pressure Piping System Component: Listed for 175-psig minimum working pressure.
- B. Sprinkler System: Modify existing sprinkler system to provide coverage for building areas noted.
- C. The existing automatic sprinkler system within the area of work shall remain active and fully functional throughout the duration of construction. The contractor shall submit to the Owner for approval a temporary sprinkler system plan for installation and activation during each phase of construction of the project. A fire watch is not an acceptable alternative to a temporary sprinkler system installation.
- D. Delegated Design: Design sprinkler system(s), including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- E. Sprinkler system design shall be approved by authorities having jurisdiction.
  - 1. 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. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
  - e. Office and Public Areas: Light Hazard.
2. 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.
3. Maximum Protection Area per Sprinkler:
- a. Office Spaces: 225 sq. ft.
  - b. Storage Areas: 130 sq. ft.
  - c. Mechanical Equipment Rooms: 130 sq. ft.
  - d. Electrical Equipment Rooms: 130 sq. ft.
  - e. Other Areas: According to NFPA 13 recommendations unless otherwise indicated.
- F. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to the NFPA 13 and ASCE/SEI 7. See structural drawings for building classification, Seismic category, and importance factor requirements.
- 1.6 SUBMITTALS
- A. Product Data: For each type of product indicated.
  - B. Shop Drawings: For wet-pipe and dry-pipe sprinkler systems. Include plans, elevations, sections, details, and attachments to other work.
  - C. Delegated-Design Submittal: For sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation, licensed in the state of Missouri.
  - D. Coordination Drawings: Sprinkler systems, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
    - 1. Items penetrating finished ceiling include the following:
      - a. Lighting fixtures.
      - b. Air outlets and inlets.
  - E. Qualification Data: For qualified Installer and professional engineer.
  - F. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations.
  - G. Fire-hydrant flow test report.
  - H. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
  - I. Field quality-control reports.

- J. Operation and Maintenance Data: For sprinkler specialties to include in emergency, operation, and maintenance manuals.

#### 1.7 QUALITY ASSURANCE

##### A. Installer Qualifications:

- 1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
  - a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- C. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

- 1. NFPA 13, "Installation of Sprinkler Systems."

#### 1.8 PROJECT CONDITIONS

- A. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:

- 1. Notify Owner no fewer than two days in advance of proposed interruption of sprinkler service.
- 2. Do not proceed with interruption of sprinkler service without Owner's written permission.

#### 1.9 COORDINATION

- A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

#### 1.10 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

- 1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and 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 used on Project.

## PART 2 - PRODUCTS

### 2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

### 2.2 STEEL PIPE AND FITTINGS

- A. Standard Weight Schedule 40, Black-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.
- B. Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.
- C. Uncoated, Steel Couplings: ASTM A 865, threaded.
- D. Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
- E. Malleable- or Ductile-Iron Unions: UL 860.
- F. The following products are NOT acceptable:
  - 1. Threaded lightwall piping.
  - 2. Plain-end pipe fittings.
  - 3. Flexible sprinkler heads.
  - 4. Malleable fittings.
- G. Grooved-Joint, Steel-Pipe Appurtenances:
  - 1. Pressure Rating: 175 psig minimum.
  - 2. Uncoated, Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
  - 3. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213, rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.
- H. Provide Metraflex "Fireloop" on piping where crossing building expansion joints.

### 2.3 SPRINKLER SPECIALTY PIPE FITTINGS

- A. Branch Outlet Fittings:
  - 1. Standard: UL 213.
  - 2. Pressure Rating: 175 psig minimum.
  - 3. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
  - 4. Type: Mechanical-T and -cross fittings.
  - 5. Configurations: Bolted, ductile-iron housing with branch outlets.
  - 6. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
  - 7. Branch Outlets: Threaded.

B. Sprinkler Inspector's Test Fittings:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating: 175 minimum.
3. Body Material: Cast- or ductile-iron housing with sight glass.
4. Size: Same as connected piping.
5. Inlet and Outlet: Threaded.

C. Adjustable Drop Nipples:

1. Standard: UL 1474.
2. Pressure Rating: 250 minimum.
3. Body Material: Steel pipe with EPDM-rubber O-ring seals.
4. Size: Same as connected piping.
5. Length: Adjustable.
6. Inlet and Outlet: Threaded.

2.4 LISTED FIRE-PROTECTION VALVES

A. General Requirements:

1. Valves shall be UL listed or FM approved.
2. Minimum Pressure Rating for Standard-Pressure Piping: 175 psig.
3. Minimum Pressure Rating for High-Pressure Piping: 250 psig.

B. Ball Valves:

1. Standard: UL 1091 except with ball instead of disc.
2. Valves NPS 1-1/2 and Smaller: Bronze body with threaded ends.
3. Valves NPS 2 and NPS 2-1/2: Bronze body with threaded ends or ductile-iron body with grooved ends.
4. Valves NPS 3: Ductile-iron body with grooved ends.

C. Iron Butterfly Valves:

1. Standard: UL 1091.
2. Pressure Rating: 175 psig.
3. Body Material: Cast or ductile iron.
4. Style: Lug or wafer.
5. End Connections: Grooved.

D. Check Valves:

1. Standard: UL 312.
2. Pressure Rating: 250 psig minimum.
3. Type: Swing check.
4. Body Material: Cast iron.
5. End Connections: Flanged or grooved.

E. Iron OS&Y Gate Valves:

1. Standard: UL 262.
2. Pressure Rating: 250 psig minimum.
3. Body Material: Cast or ductile iron.

4. End Connections: Flanged or grooved.

F. Indicating-Type Butterfly Valves:

1. Standard: UL 1091.
2. Pressure Rating: 175 psig minimum.
3. Valves NPS 2 and Smaller:
  - a. Valve Type: Ball or butterfly.
  - b. Body Material: Bronze.
  - c. End Connections: Threaded.
4. Valves NPS 2-1/2 and Larger:
  - a. Valve Type: Butterfly.
  - b. Body Material: Cast or ductile iron.
  - c. End Connections: Flanged, grooved, or wafer.
5. Valve Operation: Integral electrical, 115-V ac, prewired, single-circuit, supervisory switch indicating device.

2.5 TRIM AND DRAIN VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating: 175 psig minimum.

2.6 SPECIALTY VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating:
  - a. Standard-Pressure Piping Specialty Valves: 175 psig minimum.
3. Body Material: Cast or ductile iron.
4. Size: Same as connected piping.
5. End Connections: Flanged or grooved.

B. Automatic (Ball Drip) Drain Valves:

1. Standard: UL 1726.
2. Pressure Rating: 175 psig minimum.
3. Type: Automatic draining, ball check.
4. Size: NPS 3/4.
5. End Connections: Threaded.

C. Dry-Pipe Valves: UL 260, differential type; with bronze seat with O-ring seals, single-hinge pin, and latch design. Include UL 1486, quick-opening devices, trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.

1. 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.
  2. Air Compressor: UL 753, fractional horsepower, 120-V ac, 60 Hz, single phase.
- D. Automatic or manual air vents for wet system in each zone, piped to drains. Automatic air vents shall be U.L. listed and /or F.M. approved. Drains to be piped to an Owner approved location.

## 2.7 SPRINKLERS

- 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. Tyco Fire & Building Products LP.
  2. Reliable Automatic Sprinkler Co., Inc.
  3. Viking Corporation.
- B. General Requirements:
1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
  2. Pressure Rating for Automatic Sprinklers: 175 psig minimum.
- C. Automatic Sprinklers with Heat-Responsive Element:
1. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.
- D. Sprinkler Finishes:
1. White.
  2. Brass.
- E. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
- F. Sprinkler Guards:
1. Standard: UL 199.
  2. Type: Wire cage with fastening device for attaching to sprinkler.

## 2.8 ALARM DEVICES

- A. Alarm-device types shall match piping and equipment connections.
- B. Water-Flow Indicators:
1. Standard: UL 346.

2. Water-Flow Detector: Electrically supervised.
3. Components: 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.
4. Type: Paddle operated.
5. Pressure Rating: 250 psig.
6. Design Installation: Horizontal or vertical.

C. Valve Supervisory Switches:

1. Standard: UL 346.
2. Type: Electrically supervised.
3. Components: Single-pole, double-throw switch with normally closed contacts.
4. Design: Signals that controlled valve is in other than fully open position.

2.9 PRESSURE GAGES

- A. Standard: UL 393.
- B. Dial Size: 3-1/2- to 4-1/2-inch diameter.
- C. Pressure Gage Range: 0 to 250 psig minimum.
- D. Water System Piping Gage: Include "WATER" or "AIR/WATER" label on dial face.
- E. Air System Piping: Include caption "AIR" or "AIR/WATER" on dial face.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.
- B. Report test results promptly and in writing.

3.2 PIPING INSTALLATION

- A. 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.
- B. Piping Standard: Comply with requirements for installation of sprinkler piping in NFPA 13.
- C. Install seismic restraints on piping. Comply with requirements for seismic-restraint device materials and installation in NFPA 13. See structural drawings for building classification, Seismic category, and importance factor requirements.

- D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- E. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.
- F. Install sprinkler piping with drains for complete system drainage.
- G. Install sprinkler zone control valves, test assemblies.
- H. Install alarm devices in piping systems.
- I. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.
- J. Install pressure gages on riser or feed main, and at each sprinkler test connection. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.
- K. Drain dry-pipe sprinkler piping.
- L. Pressurize and check dry-pipe sprinkler system piping and air-pressure maintenance devices and air compressors.
- M. Fill wet-pipe sprinkler system piping with water.
- N. Install sleeves for piping penetrations of walls, ceilings, and floors.
- O. Install escutcheons for piping penetrations of walls, ceilings, and floors.

### 3.3 JOINT CONSTRUCTION

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
- 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 pipes, tubes, 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.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- E. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.



- F. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

### 3.4 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels.

### 3.5 IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

### 3.6 PIPING SCHEDULE

- A. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.
- B. Standard-pressure, wet-pipe sprinkler system, NPS 2 and smaller, shall be the following:
  - 1. Schedule 40, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
- C. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 to NPS 4, shall be one of the following:
  - 1. Schedule 40, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
  - 2. Schedule 40, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
- D. Standard-Pressure, Dry-Pipe Sprinkler System, NPS 1-1/2 to NPS 2, shall be one of the following:
  - 1. Threaded-end, galvanized, standard-weight Schedule 40 steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
- E. Standard-Pressure, Dry-Pipe Sprinkler System, NPS 2-1/2 to NPS 4, shall be one of the following:
  - 1. Threaded-end, galvanized, standard-weight Schedule 40 steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
  - 2. Grooved-end, galvanized, standard-weight Schedule 40 steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

### 3.7 VALVE APPLICATIONS

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
  - 1. Listed Fire-Protection Valves: UL listed and FMG approved for applications where required by NFPA 13.
    - a. Shutoff Duty: Use ball or butterfly valves.

2. Unlisted General-Duty Valves: For applications where UL-listed and FMG-approved valves are not required by NFPA 13.
  - a. Shutoff Duty: Use ball or butterfly valves.
  - b. Throttling Duty: Use ball

### 3.8 VALVE INSTALLATION

- A. Install listed fire-protection valves, unlisted general-duty valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
- B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire department connections. Install permanent identification signs indicating portion of system controlled by each valve.

### 3.9 SPRINKLER SCHEDULE

- A. Refer to schedule on drawings for sprinkler types and finishes.

### 3.10 CONNECTIONS

- A. Install piping adjacent to equipment to allow service and maintenance.
- B. Connect piping to specialty valves, specialties, and accessories.
- C. Electrical Connections: Power wiring is specified in Division 26.
- D. Connect alarm devices to fire alarm.
- E. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- F. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- G. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

### 3.11 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
  1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
  2. Energize circuits to electrical equipment and devices.
  3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
  4. Coordinate with fire alarm tests. Operate as required.
- C. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.12 CLEANING AND PROTECTION

A. Clean dirt and debris from sprinklers.

B. Remove and replace sprinklers with paint other than factory finish.

C. Protect sprinklers from damage until Substantial Completion.

3.13 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specialty valves. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 21 1100

## 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.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Piping materials and installation instructions common to most piping systems.
  - 2. Dielectric fittings.
  - 3. Sleeves.
  - 4. Escutcheons.
  - 5. Plumbing demolition.
  - 6. Equipment installation requirements common to equipment sections.
  - 7. Painting and finishing.
  - 8. Supports and anchorages.

#### 1.3 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, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- 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.

#### 1.4 QUALITY ASSURANCE

- A. 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.

## 1.5 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.

## 1.6 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.
- B. 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. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
  - 2. 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. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

### 2.4 SLEEVES

- A. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

### 2.5 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, Cast-Brass Type: With set screw.
  - 1. Finish: Polished chrome-plated (in finished areas exposed to view).
- C. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
  - 1. Finish: Polished chrome-plated (in finished areas exposed to view).

## 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. Equipment to Be Removed: Disconnect and cap services and remove equipment.
  - 3. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
  - 4. 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 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 in finished areas exposed to view:
- M. Sleeves are not required for core-drilled holes.
- 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 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. 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.
  - 3. 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. 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.
- P. Verify final equipment locations for roughing-in.
- Q. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

### 3.3 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. 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.

### 3.4 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. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

### 3.5 PAINTING

- A. Painting of plumbing systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."

END OF SECTION 22 0500



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## 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 ball valves.
2. Iron, single-flange butterfly valves.
3. Bronze swing check valves.

##### B. Related Sections:

1. Division 22 Section "Identification for Plumbing Piping and Equipment".
2. Division 22 Section "Domestic Water Piping".
3. Division 22 Section "Sanitary Waste Piping Specialties".
4. Division 22 Section "Medical Gas and Vacuum 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. 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 ball and plug valves open to minimize exposure of functional surfaces.
  - 4. Set butterfly valves closed or slightly open.
  - 5. Block check valves in either closed or open position.
  
- B. Use the following precautions during storage:
  - 1. Maintain valve end protection.
  - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

## PART 2 - PRODUCTS

### 2.1 GENERAL REQUIREMENTS FOR VALVES

- A. 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. Handwheel: For valves other than quarter-turn types.
  - 2. Handlever: For quarter-turn valves NPS 6 and smaller.
- E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
  - 1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
  - 2. Butterfly Valves: With extended neck.
- F. Valve-End Connections:
  - 1. Flanged: With flanges according to ASME B16.1 for iron valves.
  - 2. Solder Joint: With sockets according to ASME B16.18.
  - 3. Threaded: With threads according to ASME B1.20.1.
- G. Valve Bypass and Drain Connections: MSS SP-45.

### 2.2 BRONZE BALL VALVES

- A. 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. Crane Co.; Crane Valve Group; Crane Valves.
- b. Hammond Valve.
- c. NIBCO 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.

2.3 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. Hammond Valve.
- b. Milwaukee Valve Company.
- c. NIBCO 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.

2.4 BRONZE SWING CHECK VALVES

A. Class 150, Bronze Swing 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; Stockham Division.
- b. Hammond Valve.
- c. NIBCO 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.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

### 3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install check valves for proper direction of flow and as follows:
  - 1. Swing Check Valves: In horizontal position with hinge pin level.

### 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: ball or butterfly valves.

- 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. Shutoff Service: Ball or butterfly valves.
  - 3. Butterfly Valve Dead-End Service: Single-flange (lug) type.
  - 4. Throttling Service: ball or butterfly valves.

### 3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:
  - 1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
  - 2. Ball Valves: Two piece, full port, bronze with stainless-steel trim.
  - 3. Bronze Swing Check Valves: Class 150, bronze disc.
- B. Pipe NPS 2-1/2 and Larger:
  - 1. Iron, Single-Flange Butterfly Valves: 200 CWP, EPDM seat, aluminum-bronze disc.

END OF SECTION 22 0523

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## SECTION 22 0529 - **HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  1. Metal pipe hangers and supports.
  2. Trapeze pipe hangers.
  3. Thermal-hanger shield inserts.

#### 1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of the Valve and Fittings Industry Inc.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

#### 1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.

### 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. Nonmetallic Coatings: Plastic coating, jacket, or liner.
  3. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
  4. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- B. Copper Pipe Hangers:
  1. Manufacturers' catalogs indicate that copper pipe hangers are small, typically NPS 4 (DN 100) or smaller, and types available are limited.
  2. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
  3. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated 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 THERMAL-HANGER SHIELD INSERTS

- 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. ERICO International Corporation.
  - 2. PHS Industries, Inc.
  - 3. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
  - 4. Piping Technology & Products, Inc.
  - 5. Rilco Manufacturing Co., Inc.
  - 6. Value Engineered Products, Inc.
- B. Insulation-Insert Material for Cold Piping: ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.
- C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-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.

## 2.4 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 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.

## PART 3 - EXECUTION

### 3.1 HANGER AND SUPPORT INSTALLATION

- A. 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.

- B. 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.
- C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- D. 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.
- 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 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
  - 3. 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.
4. 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.
- 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 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 nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- D. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
- E. Use thermal-hanger shield inserts for insulated piping and tubing.
- 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.
- 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 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.
- H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
- 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
  - 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.

3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
  4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
  5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
  2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-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. C-Clamps (MSS Type 23): For structural shapes.
  6. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
  7. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
  8. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
  9. Side-Beam Brackets (MSS Type 34): For sides of steel beams.
- J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
  2. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- K. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- L. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- M. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 22 0529

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## SECTION 22 0553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Pipe labels.
  - 2. Valve tags.

#### 1.3 REFERENCE STANDARDS

- A. ANSI/ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers; 2007.

#### 1.4 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.

#### 1.5 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 IDENTIFICATION APPLICATIONS

- A. Domestic Cold Water (DCW)
- B. Domestic Hot Water (DHW).
- C. Domestic Hot Water Return (DHWR).
- D. Sanitary Waste.

- E. Sanitary Vent.
- F. Storm and Overflow Storm.
- G. Medical Gas Systems.

## 2.2 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction. Contractor shall refer to UM CPDG for letter and background colors.
- 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.

## 2.3 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: Laminated three-layer plastic with engraved black letters on contrasting background color or 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.
  - 3. Valve tag size: minimum 1-1/2 inch diameter with smooth edges.
- 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.

## 2.4 VALVE AND DEVICE IDENTIFICATION CEILING TAGS

- A. Provide engraved plastic ceiling identification tags for plumbing valves and other above ceiling equipment components. In addition, label all above ceiling components at each location in accordance with the University of Missouri Standards.
- B. Color: Ceiling tags to be white background with black letters.
- C. Identification labels shall be engraved factory fabricated, flexible, semi-rigid plastic, fastener appropriate for ceiling material.

- D. Install ceiling identification tags per University of Missouri Standards.

### 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. 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.

#### 3.4 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; shutoff valves; faucets and; convenience hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

END OF SECTION 22 0553



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## 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, overflow roof drains, and rainwater leaders.

- B. Related Sections:

1. Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment".
2. Division 22 Section "Domestic Water Piping".

#### 1.3 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).

#### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

- B. 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.

- C. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

## 1.6 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

## 1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

## PART 2 - PRODUCTS

### 2.1 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping 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 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.
- G. Fiberglass, Preformed Pipe Insulation:
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Johns Manville; Micro-Lok.
    - b. Knauf Insulation.

- c. Owens Corning; Fiberglas Pipe Insulation.
- 2. 450 Deg F Materials: 1-piece rigid molded glass fiber. Comply with ASTM C 547, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

## 2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Aeroflex USA, Inc.; Aeroseal.
    - b. Armacell LLC; Armaflex 520 Adhesive.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
    - d. K-Flex USA; R-373 Contact Adhesive.
  - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 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. 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; 85-20.
    - 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).
  - 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."

## 2.3 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.

## 2.4 SEALANTS

- A. ASJ 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.
  - 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."

## 2.5 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
  - 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
  - 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

## 2.6 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.

## 2.7 SECUREMENTS

### A. Bands:

1. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  - a. ITW Insulation Systems; Gerrard Strapping and Seals.
  - b. RPR Products, Inc.; Insul-Mate Strapping and Seals.
2. Wing seals are primarily used for fastening bands together. Closed seals are occasionally used for large, 84-inch- (2130-mm-) diameter applications and where fastening bands are used with springs. Wing seals are reusable; closed seals are not.
3. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch thick, 1/2 inch wide with wing seal.
4. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal.

### B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

### C. Wire: 0.062-inch soft-annealed, stainless steel.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. C & F Wire.

## 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 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 2 inches o.c.

- a. For below-ambient services, apply vapor-barrier mastic over staples.
  4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
  5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- 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.
- Q. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- R. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

### 3.4 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. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

### 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.
- B. 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.
- C. 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.

### 3.6 INSTALLATION OF FIBERGLASS 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 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.

C. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

### 3.7 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.
- C. Cold Surfaces: For piping surfaces operating below surrounding ambient temperature, all piping surfaces including but not limited to pipe, flanges, fittings, valves of every kind, strainers, unions, and other appurtenances shall be insulated and shall include uninterrupted vapor barrier to avoid potential condensation.

### 3.8 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. NPS 1 and Smaller: Insulation shall be the following:
  - a. Flexible Elastomeric: 3/4 inch thick.
2. NPS 1-1/4 and Larger: Insulation shall be the following:
  - a. Flexible Elastomeric: 1 inch thick.

- B. Domestic Hot and Recirculated Hot Water:
  - 1. NPS 1-1/4 and Smaller: Insulation shall be one of the following:
    - a. Fiberglass, Preformed Pipe Insulation, Type I: 1 inch thick.
  - 2. NPS 1-1/2 and Larger: Insulation shall be one of the following:
    - a. Fiberglass, Preformed Pipe Insulation, Type I: 1-1/2 inch thick.
- C. Stormwater and Overflow:
  - 1. All Pipe Sizes: Insulation shall be one of the following:
    - a. Flexible Elastomeric: 1 inch thick.
- D. Roof Drain and Overflow Drain Bodies:
  - 1. All Pipe Sizes: Insulation shall be one of the following:
    - a. Flexible Elastomeric: 1 inch thick.

END OF SECTION 22 0719

## 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. Aboveground domestic water pipes, tubes, and fittings inside buildings.

- B. Related requirements:

- 1. Division 22 Section "General Duty Valves for Plumbing Piping".
  - 2. Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment".
  - 3. Division 22 Section "Identification for Plumbing Piping and Equipment".
  - 4. Division 22 Section "Plumbing Piping Insulation".

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product.
- B. System purging and disinfecting activities report.
- C. Field quality-control reports.

#### 1.4 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 Owner no fewer than two days in advance of proposed interruption of water service.
  - 2. Do not interrupt water service without Owner's written permission.

### 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 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

- B. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
- C. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- D. Copper Unions:
  1. MSS SP-123.
  2. Cast-copper-alloy, hexagonal-stock body.
  3. Ball-and-socket, metal-to-metal seating surfaces.
  4. Solder-joint or threaded ends.

## 2.3 PIPING JOINING MATERIALS

- A. Solder Filler Metals: ASTM B 32, lead-free alloys.
- B. Flux: ASTM B 813, water flushable.

## 2.4 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
  1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Jomar International.
    - b. Matco-Norca.
    - c. McDonald, A. Y. Mfg. Co.
    - d. Watts; a division of Watts Water Technologies, Inc.
    - e. Wilkins; a Zurn company.
  2. Standard: ASSE 1079.
  3. Pressure Rating: 150 psig minimum at 180 deg F.
  4. End Connections: Solder-joint copper alloy and threaded ferrous.

## PART 3 - EXECUTION

### 3.1 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 shutoff valve immediately upstream of each dielectric fitting.
- C. Install domestic water piping level and plumb.

- D. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- E. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- F. 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.
- G. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- H. Install piping to permit valve servicing.
- I. 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.
- J. Install piping free of sags and bends.
- K. Install fittings for changes in direction and branch connections.
- L. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- M. Install sleeves for piping penetrations of walls, ceilings, and floors.
- N. Install escutcheons for piping penetrations of walls, ceilings, and floors.

### 3.2 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. 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."
- E. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

### 3.3 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 couplings.

### 3.4 HANGER AND SUPPORT INSTALLATION

- A. 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.
- B. Support vertical piping and tubing at base and at each floor.
- C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- D. 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.
- E. Install supports for vertical copper tubing every 10 feet.
- F. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

### 3.5 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. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.

2. 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.

### 3.6 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification materials and installation in Division 22 Section "Identification for Plumbing Piping and Equipment."

### 3.7 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.

### 3.8 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. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
    - a. Adjust calibrated balancing valves to flows indicated.
  - 4. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
  - 5. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
  - 6. Check plumbing specialties and verify proper settings, adjustments, and operation.

### 3.9 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. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

### 3.10 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Aboveground domestic water piping, NPS 2 and smaller, shall be:
  - 1. Hard copper tube, ASTM B 88, Type L; cast or wrought copper, solder-joint fittings; and soldered joints.

### 3.11 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 or gate valves for piping NPS 2 and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 and larger.
  - 2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
  - 3. Drain Duty: Hose-end drain valves.
- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

END OF SECTION 22 1116

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## SECTION 22 1316 - **SANITARY WASTE AND VENT AND STORM 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 and fittings.
- B. Related Sections:
  - 1. Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment".
  - 2. Division 22 Section "Identification for Plumbing Piping and Equipment".

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
  - 1. Soil, Waste, and Vent and Storm Piping: 10-foot head of water.
- B. Seismic Performance: Soil, waste, vent, and storm water piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control reports.

#### 1.5 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

#### 1.6 PROJECT CONDITIONS

- A. Interruption of Existing Sanitary Waste and/or Storm Service: Do not interrupt service to occupied facilities 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 Owner no fewer than two days in advance of proposed interruption of sanitary waste service.
  - 2. Do not proceed with interruption of sanitary waste and/or storm service without Owner's written permission.

## 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 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service and Extra Heavy classes.
- B. Baskets: ASTM C 564, rubber.
- C. Tensile Strength: 21,000 psig minimum.
- D. Each length of pipe and each fitting shall be plainly marked with size, country of origin, and name of manufacturer, or manufacturer's registered trademark by which the manufacturer can be readily identified after installation.

### 2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute.
- B. Heavy-Duty, Hubless-Piping Couplings:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ANACO-Husky.
    - b. Clamp-All Corp.
    - c. MIFAB, Inc.
    - d. Mission Rubber Company; a division of MCP Industries, Inc.
    - e. Tyler Pipe.
  - 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 SPECIALTY PIPE FITTINGS

- A. Transition Couplings:
  - 1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
  - 2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
  - 3. Unshielded, Nonpressure Transition Couplings:
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1) Dallas Specialty & Mfg. Co.
  - 2) Fernco Inc.
  - 3) Mission Rubber Company; a division of MCP Industries, Inc.
  - 4) Plastic Oddities; a division of Diverse Corporate Technologies, Inc.
- b. Standard: ASTM C 1173.
  - c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
  - d. Sleeve Materials:
    - 1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
    - 2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
    - 3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
4. Shielded, Nonpressure Transition Couplings:
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) Cascade Waterworks Mfg. Co.
      - 2) Mission Rubber Company; a division of MCP Industries, Inc.
    - b. Standard: ASTM C 1460.
    - c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

## PART 3 - EXECUTION

### 3.1 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. Make changes in direction for soil and waste drainage, vent piping, and storm piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- K. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. 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.
- L. Install soil and waste drainage and vent piping, and storm piping at the following minimum slopes unless otherwise indicated:
  1. Horizontal Sanitary Drainage Piping: 2 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. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
  3. Horizontal Storm Drainage Piping: 1 percent downward in direction of flow.
- M. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- N. Plumbing Specialties:
  1. Install cleanout fittings with closure plug in sanitary drainage 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."
- O. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

### 3.2 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.

### 3.3 SPECIALTY PIPE FITTING INSTALLATION

- A. Transition Couplings:
  1. Install transition couplings at joints of piping with small differences in OD's.
  2. In Drainage Piping: Shielded, nonpressure transition couplings.

### 3.4 HANGER AND SUPPORT INSTALLATION

- A. 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 carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
  - 3. Vertical Piping: MSS Type 8 clamps.
- B. Support horizontal piping and tubing within 12 inches of each fitting and coupling.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
- E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
  - 2. NPS 3: 60 inches with 1/2-inch rod.
  - 3. 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. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- F. Install supports for vertical cast-iron soil piping every 15 feet.
- G. 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. 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 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 and storm 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. Aboveground, soil, waste and vent and storm piping shall be the following:
  1. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
- B. Underground, soil, waste and vent and storm piping shall be one of the following:
  1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
  2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.

END OF SECTION 22 1316

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## SECTION 22 1319 - **SANITARY WASTE AND STORM PIPING SPECIALTIES**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

##### A. Section Includes:

1. Cleanouts.
2. Floor drains.
3. Miscellaneous sanitary drainage piping specialties.
4. Flashing materials.

##### B. Related Requirements:

1. Division 22 Section "Sanitary Waste and Vent and Storm Piping".
2. Division 22 Section "Plumbing Fixtures".

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.

#### 1.4 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

### PART 2 - PRODUCTS

#### 2.1 CLEANOUTS

##### A. Exposed Metal Cleanouts:

1. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
2. Size: Same as connected drainage piping.
3. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
4. Closure: Countersunk, bronze plug.
5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

##### B. Cast-Iron Wall Cleanouts:

1. Standard: ASME A112.36.2M. Include wall access.
2. Size: Same as connected drainage piping.
3. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
4. Closure: Countersunk, bronze plug.
5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

6. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.

## 2.2 FLOOR DRAINS

### A. Cast-Iron Floor Drains:

1. Standard: ASME A112.6.3.
2. Pattern: Floor drain.
3. Body Material: Gray iron.
4. Seepage Flange: Required.
5. Anchor Flange: Required.
6. Clamping Device: Required.
7. Outlet: Bottom.
8. Top or Strainer Material: Nickel bronze.
9. Top Shape: Round.
10. Dimensions of Top or Strainer: 5 inch dia.

## 2.3 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

### A. 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.

### B. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

### C. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 1 inch above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

## 2.4 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. Copper Sheet: ASTM B 152/B 152M, of the following minimum weights and thicknesses, unless otherwise indicated:
  - 1. General Applications: 12 oz./sq. ft. thickness.
  - 2. Vent Pipe Flashing: 8 oz./sq. ft. thickness.
- C. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness, unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.
- D. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.
- E. Fasteners: Metal compatible with material and substrate being fastened.
- F. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- G. Solder: ASTM B 32, lead-free alloy.
- H. 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 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.
- F. 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.
- G. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- H. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- I. Install wood-blocking reinforcement for wall-mounting-type specialties.
- J. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

### 3.2 CONNECTIONS

- A. Comply with requirements in Division 22 Section "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

### 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.
  2. Copper Sheets: Solder joints of copper sheets.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
  1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.

2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
  3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
  - D. Secure flashing into sleeve and specialty clamping ring or device.
  - E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07 Section "Sheet Metal Flashing and Trim."
  - F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.
  - G. Fabricate and install flashing and pans, sumps, and other drainage shapes.
- 3.4 FIELD QUALITY CONTROL
- A. Perform tests and inspections and prepare test reports.
  - B. Tests and Inspections:
    1. Leak Test: After installation, charge system and test for leaks. Minimum test duration: 4 hours hydrostatic at 10-foot head of water. Repair leaks and retest until no leaks exist.
    2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- 3.5 PROTECTION
- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
  - B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 1319



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## SECTION 22 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 plumbing fixtures and related components:

1. Faucets for lavatories and sinks.
2. Flushometers.
3. Toilet seats.
4. Protective shielding guards.
5. Fixture supports.
6. Water closets.
7. Lavatories.
8. Sinks.

- B. Related Sections include the following:

1. Division 10 Section "Toilet, Bath, and Laundry Accessories."
2. Division 22 Section "Domestic Water Piping Specialties".
3. Division 22 Section "Sanitary Waste and Storm Piping Specialties".

#### 1.3 DEFINITIONS

- A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- B. Fitting: Device that controls the flow of water into or out of the plumbing fixture. 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.
- C. FRP: Fiberglass-reinforced plastic.
- D. PMMA: Polymethyl methacrylate (acrylic) plastic.
- E. PVC: Polyvinyl chloride plastic.
- F. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.
- G. Water Cooler: Electrically powered fixture for generating and delivering cooled drinking water.

#### 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.

#### 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" 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. ARI Standard: Comply with ARI's "Directory of Certified Drinking Water Coolers" for style classifications.
- G. ARI Standard: Comply with ARI 1010, "Self-Contained, Mechanically Refrigerated Drinking-Water Coolers," for water coolers and with ARI's "Directory of Certified Drinking Water Coolers" for type and style classifications.
- H. ASHRAE Standard: Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants," for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant, unless otherwise indicated.
- I. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- J. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
  - 1. Solid-Surface-Material Lavatories and Sinks: ANSI/ICPA SS-1.
  - 2. Stainless-Steel Commercial, Handwash Sinks: NSF 2 construction.
  - 3. Stainless-Steel Sinks: ASME A112.19.3.
  - 4. Vitreous-China Fixtures: ASME A112.19.2M.

- K. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:
  - 1. Faucets: ASME A112.18.1.
  - 2. Hose-Connection Vacuum Breakers: ASSE 1011.
  - 3. Hose-Coupling Threads: ASME B1.20.7.
  - 4. NSF Potable-Water Materials: NSF 61.
  - 5. Pipe Threads: ASME B1.20.1.
  - 6. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
  - 7. Supply Fittings: ASME A112.18.1.
  - 8. Brass Waste Fittings: ASME A112.18.2.
  
- L. 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. Manual-Operation Flushometers: ASSE 1037.
  - 4. Brass Waste Fittings: ASME A112.18.2.
  - 5. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.
  
- M. Comply with the following applicable standards and other requirements specified for miscellaneous components:
  - 1. Flexible Water Connectors: ASME A112.18.6.
  - 2. Floor Drains: ASME A112.6.3.
  - 3. Grab Bars: ASTM F 446.
  - 4. Hose-Coupling Threads: ASME B1.20.7.
  - 5. Hot-Water Dispensers: ASSE 1023 and UL 499.
  - 6. Off-Floor Fixture Supports: ASME A112.6.1M.
  - 7. Pipe Threads: ASME B1.20.1.
  - 8. Plastic Toilet Seats: ANSI Z124.5.
  - 9. Supply and Drain Protective Shielding Guards: ICC A117.1.

## PART 2 - PRODUCTS

### 2.1 LAVATORY FAUCETS

- A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water
  
- B. Lavatory Faucets:
  - 1. Description: AC powered electronic sensor operated faucet with 1.5 gpm outlet, plug-in transformer, and thermostatic mixing valve; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
    - a. Body Material: Commercial, solid brass.
    - b. Finish: Polished chrome plate.
    - c. Maximum Flow Rate: 0.5 gpm.
    - d. Mounting: Deck, exposed.
    - e. Inlets: NPS 3/8 tubing, with NPS 1/2 male adaptor.
    - f. Spout: Rigid/swing gooseneck type.

- g. Spout Outlet: Laminar flow.
  - h. Operation: Electronic sensor.
2. Description: Two-handle mixing valve. Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
- a. Body Material: Commercial, solid brass.
  - b. Finish: Polished chrome plate.
  - c. Maximum Flow Rate: See schedule on drawings.
  - d. Centers: See schedule on drawings.
  - e. Mounting: Deck.
  - f. Valve Handle(s): See schedule on drawings.
  - g. Inlet(s): NPS 3/8 tubing, with NPS 1/2 male adaptor.
  - h. Spout: Rigid/Swing, gooseneck type.
  - i. Spout Outlet: Laminar flow.
  - j. Operation: Quarter turn, manual.
  - k. Drain: See schedule on drawings.

## 2.2 SINK FAUCETS

- A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.
- B. Sink Faucets:
  - 1. Description: Two-handle mixing valve. Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
    - a. Body Material: Commercial, solid brass.
    - b. Finish: Polished chrome plate.
    - c. Type: Sink faucet.
    - d. Maximum Flow Rate: 1.5 gpm, unless otherwise indicated.
    - e. Mixing Valve: Two-lever handle.
    - f. Centers: 8 inches.
    - g. Mounting: Deck.
    - h. Handles: 4 inch wrist blades.
    - i. Temperature Indicators: Color-coded for hot water on left and cold water on right.
    - j. Inlets: NPS 3/8 tubing with NPS 1/2 male adapter.
    - k. Spout Type: Rigid/swing gooseneck.
    - l. Spout Outlet: Laminar flow.
    - m. Operation: Quarter-turn, manual.
    - n. Drain: Crumb-cup strainer.

## 2.3 FLUSHOMETERS

- A. Flushometers:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Sloan Valve Company.
    - b. Zurn Plumbing Products Group; Commercial Brass Operation.

2. Description: Ligature-resistant flushometer for water-closet-type fixture. Include brass body with corrosion-resistant internal components, non-hold-open feature, control stop with check valve, vacuum breaker, copper or brass tubing, and polished chrome-plated finish on exposed parts.
  - a. Internal Design: Diaphragm operation.
  - b. Style: Concealed.
  - c. Inlet Size: NPS 1.
  - d. Trip Mechanism: Push button.
  - e. Consumption: 1.6 gal./flush.
  - f. Tailpiece Size: NPS 1-1/4.
  
3. Description: Flushometer valve for water-closet or urinal type fixture. Include brass body with corrosion-resistant internal components, non-hold-open feature, control stop with check valve, vacuum breaker, copper or brass tubing, and polished chrome-plated finish on exposed parts.
  - a. Internal Design: Diaphragm operation.
  - b. Style: Exposed.
  - c. Inlet Size: See schedule on drawings.
  - d. Trip Mechanism: Oscillating, lever-handle.
  - e. Consumption: See schedule on drawings.
  - f. Tailpiece Size: See schedule on drawings.

## 2.4 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. Sanderson Plumbing Products, Inc.; Beneke Div.
  
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: Stainless steel, self-sustaining, check.
  - e. Class: Heavy-duty commercial.
  - f. Color: White.

## 2.5 PROTECTIVE SHIELDING GUARDS

### A. Protective Shielding Pipe Covers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Insul-Tect Products Co.; a Subsidiary of MVG Molded Products.
  - b. Plumberex Specialty Products Inc.
  - c. TRUEBRO, Inc.

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 Enclosure:

1. Manufacturers: Subject to compliance with requirements, provide product by the following:
  - a. TRUEBRO, Inc.
2. Description: Pre-manufactured full, under-lavatory plastic shield for covering plumbing fixture hot and cold water supplies and trap and drain piping. Top of shield shall have contour matching underside of lavatory. Comply with Americans with Disabilities Act (ADA) requirements. Shield shall be secured to wall with stainless steel tamper-proof screws and wall anchors

## 2.6 FIXTURE SUPPORTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Josam Company.
2. Smith, Jay R. Mfg. Co.
3. Tyler Pipe; Wade Div.
4. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
5. Zurn Plumbing Products Group; Specification Drainage Operation.

B. Lavatory Supports:

1. Description: 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.

## 2.7 WATER CLOSETS

A. Water Closets:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. American Standard.
  - b. Kohler.
2. Description: Floor mounting, floor-outlet, vitreous-china fixture designed for flushometer valve operation.
  - a. Style: One piece.
    - 1) Bowl Type: Elongated with siphon-jet design. Include bolt caps matching fixture.
    - 2) Height: Standard or Accessible; see schedule on drawings.
    - 3) Design Consumption: See schedule on drawings.
    - 4) Color: White.

- b. Flushometer: See schedule on drawings.
- c. Toilet Seat: See schedule on drawings.

## 2.8 LAVATORIES

### A. Wall Hung Lavatories:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. American Standard.
  - b. Kohler.
2. Description: Accessible, wall-mounting, vitreous-china fixture.
  - a. Type: With back ledge.
  - b. Size: See schedule on drawings.
  - c. Faucet Hole Punching: See schedule on drawings.
  - d. Faucet Hole Location: Top.
  - e. Color: White.
  - f. Faucet: See schedule on drawings.
  - g. Supplies: NPS 3/8 chrome-plated copper with stops.
  - h. Drain: See schedule on drawings.
  - i. Drain Piping: NPS 1-1/4 chrome-plated, cast-brass P-trap with cleanout; 17 gauge tubular brass waste to wall; and wall escutcheon.
  - j. Protective Shielding Enclosure.
  - k. Fixture Support: See schedule on drawings.

## 2.9 SINKS

### A. Countertop Sinks:

1. Sink basin, countertop mounted:
  - a. Material: Stainless steel.
  - b. Manufacturers: subject to compliance with requirements, provide products by the following: Elkay.
  - c. Faucet: See schedule on drawings.
  - d. Supplies: NPS 3/8 chrome-plated copper with loose key stops.
  - e. Drain: See schedule on drawings.
  - f. Drain Piping: NPS 1-1/2 chrome-plated cast brass P-trap with cleanout and tubular brass waste to wall; and wall escutcheon.
  - g. Exam room sinks to have a minimum depth of 10" per UMHC Standards.

## 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 without waste fitting for fixtures with tubular waste piping.
  - 2. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
- C. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
- D. Install wall-mounting fixtures with tubular waste piping attached to supports.
- E. Install counter-mounting fixtures in and attached to casework.
- F. Install fixtures level and plumb according to roughing-in drawings.
- G. 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.
- H. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- I. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
- J. Install flushometer valves for accessible water closets with actuator mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.
- K. Install traps on fixture outlets.
  - 1. Exception: Omit trap on fixtures with integral traps.
  - 2. Exception: Omit trap on indirect wastes, unless otherwise indicated.
- L. 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 "Escutcheons for Plumbing Piping."
- M. 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."
- N. Exposed Sanitary Drains and P-traps and Domestic Cold and Hot Water Supplies for Accessible Plumbing Fixtures shall be provided with Protective Shielding Pipe Covers.

### 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.

### 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.

### 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 22 4000

## SECTION 23 0100 – BASIC MECHANICAL REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes general administrative and procedural requirements for mechanical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 01:
1. Submittals.
  2. Material and Equipment Selection.
  3. Coordination drawings.
  4. Record documents.
  5. Maintenance manuals.

#### 1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this and the other sections of Division 23.

#### 1.3 CONTRACTOR'S SUBMITTAL RESPONSIBILITIES

- A. General: Follow the procedures specified in Division 01. In addition to the requirements specified in Division 01, comply with the following:
1. Increase by two (2) the quantity of print copies required by Division 01 for submittals, if paper submittals are used. (Paperless electronic submittals are preferred.)
  2. Electronic Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number. Transmit via email. Include PDF transmittal form. Include information in email subject line as to project name, project number, submittal number, and applicable specification section number.
  3. Submit line-by-line specification verification for equipment other than the "basis of design" as further described in the following article "Material and Equipment Selection".
- B. General: Submittals are not requested for all products covered in the specifications. Submit only the data requested under the submittals portion of each specification section or where indicated in a Submittal Log, if included within Division 01. Un-requested submittals will not be processed, reviewed, or returned and the contractor will be notified that the submittal will not be reviewed by the engineer of record.
1. Non-requirement of submittals, when so noted, is not to be construed as an allowance for substitutions and does not relieve the contractor from full compliance with the plans and specifications.
  2. Any deviation from specified items is considered a substitution. If the contractor desires to use other than specified items, then a formal request for substitution must be submitted prior to bid date (no exceptions), in accordance with the procedures and time limitations set forth in Division 01. Where not defined in Division 01, requests

for substitutions shall be submitted no less than ten (10) working days prior to bid date. Review of substitution requests by the Engineer shall be done at the expense of the contractor. Charges for this substitution review shall be calculated based on the Engineer's standard hourly rates, as defined in their contract with the Owner.

- C. It is the responsibility of the Contractor to ensure that all submittals have been reviewed for total completeness and accuracy as to the requirements of the specifications and drawings before being submitted to the Engineer for review.
1. One comprehensive submittal shall be provided for each individual specification section. All required submittal information called for in each individual specification section shall be included in the submittal.
  2. The Engineer of Record shall not be responsible for informing the contractor on items that have not been included and are necessary for a complete review of the required submittal information for a specification section.
  3. The Engineer of Record shall have the option of returning any submittal, unmarked, if all required documentation called for in the specifications has not been provided in the submittal.
  4. The Engineer of Record shall review each submittal no more than two (2) times and return to the contractor with the appropriate disposition.
  5. If the Engineer of Record is required to review a submittal a second time, it shall be limited to review of the changed information, clearly highlighted by the submitter, and/or confirmation of documentation only and it shall be returned to the contractor with the appropriate disposition.
  6. If the submittal is required to be reviewed a third time, it shall be done at the expense of the contractor. Charges for this additional submittal review shall be calculated based on the Engineer's standard hourly rates, as defined in their contract with the Owner.
- D. Operation and Maintenance Manuals: All items required for insertion into each Operation and Maintenance (O&M) Manual are called out in the submittals portion of each specification section or in a Submittal Log, if included within Division 01. It is the responsibility of the Contractor to ensure that the O&M submittal has been reviewed and includes all the requirements of the specifications. The Engineer of Record shall review the submittal for the Operation and Maintenance Manual one (1) time and return to the contractor with the appropriate disposition.
1. If the submittal is required to be reviewed a second time, it shall be done at the expense of the contractor. Charges for this additional submittal review shall be calculated based on the Engineer's standard hourly rates, as defined in their contract with the Owner.
  2. Submittals for the Operation and Maintenance Manual must be original documentation.
  3. Photo copies of marked up Operations and Maintenance submittals are not acceptable.
- E. Coordination Drawings: Prepare and submit Coordination Drawings as further described herein and as indicated in the Special Conditions. The Engineer shall receive one copy of all coordination drawings supplied to the Owner as required in this specification. It is the responsibility of the Contractor to coordinate the work as outlined herein. Receipt by the Engineer of a copy of the coordination drawings is to verify conformance to the

submittal requirements set forth in this specification section. It is not an admission by the Engineer as to the accuracy or completeness of the coordination proposed.

- F. Refer to Division 01 and each individual Division 23 Section for additional submittal requirements.

#### 1.4 REFERENCED STANDARDS

- A. American Society of Heating, Refrigerating and Air-Conditioning Engineers. Guideline 4-2008 (RA 2013) *Preparation of Operating and Maintenance Documentation for Building Systems*. Atlanta, GA: ASHRAE, 1993.

#### 1.5 MATERIAL AND EQUIPMENT SELECTION

- A. Product Options: The specification of each item of major mechanical equipment required for the project may include a list of manufacturers, with one "basis of design" manufacturer, type, and model identified by virtue of their listing in the equipment schedule on the Drawings. Where several manufacturers in addition to the "basis of design" manufacturer are listed in the specifications, it shall be understood that the words "or approved equal by" are implied to precede each of the other manufacturer's names.
  1. The manufacturers other than the "basis of design" may be furnished at the contractor's option in lieu of the "basis of design" product, provided that the selected manufacturer's product is equal in all material and functional respects. In addition to submittal requirements that may be specified in this section, submit a line-by-line written verification of the applicable specification section(s) identifying compliance with or variations from the specified features, materials, performance, capacities, weight, size, durability, energy consumption and efficiency, warranty, and visual impact (if exposed to view by other than maintenance persons). The burden of proof of manufacturer/product equality is on the contractor.
  2. Where a product is not scheduled on the drawings and, therefore, where no "basis of design" is indicated, selection among all of the listed manufacturers and products is at the contractor's option, subject to the requirements of the Contract Documents.
  3. Products of manufacturers not listed in the Contract Documents are considered Substitutions and are not permitted, except as provided under the General and Supplementary Conditions and Division 01 Specifications. Full compliance with Division 01 section "Product Substitutions" is mandatory for acceptance of products or manufacturers not listed.
- B. Listing of a manufacturer does not imply approval of that manufacturer's standard product or products. Rather, listing of a manufacturer indicates only a general acceptance of that manufacturer's name and reputation. Final approval is subject to full compliance with these Contract Documents.
- C. Model numbers identified on the Drawings notwithstanding, all equipment must comply with the requirements of these Contract Documents. Do not assume that a manufacturer's standard product is acceptable as is. For example, one or more custom modifications, custom colors or finishes, manufacturer's options, and/or accessories may be required to meet the specified requirements.

- D. Where drawings indicate sizes, profiles, connections, and dimensional requirements of material and equipment, these are based on the "basis of design" manufacturer, type and model indicated. In the event that equipment of power, dimensions, capacities, layout, connections, and/or ratings differing from the "basis of design" are selected by the contractor and approved by the Owner's representative, any necessary adjustments are the contractor's responsibility. All connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, pipe and duct sizes, pipe and duct layout, and the like shall be adjusted by the contractor to suit the equipment provided. No additional costs will be approved for these changes. Should revisions to the design because of contractor's selection of manufacturer, type, or model other than the "basis of design" require additional review and/or redesign by an Architect or Engineer, the contractor shall reimburse the Owner for Owner's added professional fee expenses.
- E. Where two or more materials are listed in the "Part 2 – Products" subsection of any Division 23 section, do not assume that the selection of materials is the contractor's option. Refer to "Part 3 – Execution" subsection of that same Division 23 section for an explanation of which specific material(s) shall be used for which specific application(s). For example, Part 2 may list several types and grades of piping, and Part 3 will describe which type and grade of pipe to use for a given application.

#### 1.6 COORDINATION DRAWINGS

- A. Prepare project coordination drawings to a scale of 1/4" = 1'0" or larger. Detail major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Indicate if sequence and coordination of installations are important to efficient flow of the Work. Include the following:
  - 1. Planned piping layout, including valve and specialty locations and valve-stem movement. Include all piping including but not limited to HVAC piping, plumbing piping, and fire protection piping. Include ceiling and wall-mounted access doors and panels required to provide access to valves and other operating devices.
  - 2. Planned ductwork layout, including terminal units, dampers and specialty locations, with terminal unit and damper operator clearances. Include ceiling and wall-mounted access doors and panels required to provide access to dampers and other operating devices.
  - 3. Clearances for installing and maintaining insulation.
  - 4. Clearances for servicing and maintaining equipment, accessories, and specialties, including space for disassembly required for periodic maintenance.
  - 5. Equipment and accessory service connections and support details.
  - 6. Fire-rated wall and floor penetrations.
  - 7. Sizes and location of required concrete pads and bases.
  - 8. Scheduling, sequencing, movement, and positioning of large equipment into building during construction.
  - 9. Floor plans, elevations, and details to indicate penetrations in floors, walls, ceilings and roofs, and their relationship to other penetrations and installations.
  - 10. Ceiling plans showing coordination of mechanical, electrical, structural, ceiling suspension assembly, lighting, security, communications, fire alarm, plumbing, and fire protection work within allotted space.

11. Reflected ceiling plans to coordinate and integrate installation of air outlets and inlets, light fixtures, communication system components, sprinklers, access panels, special moldings, and other ceiling-mounted items.
12. Floor plans and sections of fan rooms and mechanical rooms; show layout and relationships between components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate and certify field measurements.

#### 1.7 ELECTRONIC MEDIA AND FILES

- A. Electronic media files of the contract drawings in AutoCAD or PDF format and copies of the specifications in PDF format may be requested.
- B. Complete and return a signed "Electronic File Transmittal" form provided by Ross & Baruzzini upon request for electronic media.
- C. Obtain approval from the appropriate Design Professional for use of their part of the documents if the information requested includes information prepared by other than Ross & Baruzzini.
- D. The electronic contract documents may be used for preparation of shop drawings and record drawings only. The information may not be used in whole or in part for any other project.
- E. The drawings prepared by Ross & Baruzzini for bidding purposes may not be used directly for raceway layout drawings or coordination drawings.
- F. The use of these documents does not allow relief from the responsibility for coordination of work with other trades and verification of space available for the installation.
- G. The information is provided to expedite the project with no guarantee by Ross & Baruzzini as to the accuracy or correctness of the information provided. Ross & Baruzzini accepts no responsibility or liability for the use of the provided information.

#### 1.8 RECORD DOCUMENTS

- A. Prepare record documents in accordance with the requirements in Division 01. In addition to the requirements specified in Division 01, indicate the following installed conditions:
  1. Ductwork mains and branches, size and location, for both exterior and interior; locations of dampers and other control devices; filters, boxes, and terminal units requiring periodic maintenance or repair.
  2. Mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.). Indicate actual inverts and horizontal locations of all underground piping.
  3. Valve location diagrams, complete with valve tag chart. Refer to Division 23 Section "Basic Mechanical Materials and Methods."
  4. Equipment locations (exposed and concealed), dimensioned from prominent building lines.



5. Approved substitutions, Contract Modifications, and actual equipment and materials installed.

#### 1.9 MAINTENANCE MANUALS

- A. Prepare maintenance manuals in accordance with Division 01. In addition to the requirements specified in Division 01, include the following information for equipment items:
  1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
  2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
  3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
  4. Servicing instructions and lubrication charts and schedules.
  5. Facsimiles or photo copies are not allowed as submittals for operating and maintenance manuals. Submittals for operating and maintenance manuals must be on original manufacturer printed stock.
- B. In addition to the above, comply with ASHRAE Guideline 4-2008 (RA 2013) *Preparation of Operating and Maintenance Documentation for Building Systems*.

#### PART 2 - PRODUCTS (NOT APPLICABLE)

#### PART 3 - EXECUTION

##### 3.1 GENERAL INSTALLATION

- A. During construction, meet or exceed the recommended Design Approaches of SMACNA *IAQ Guideline for Occupied Buildings under Construction*.
- B. Protect stored on-site or installed absorptive materials from moisture damage. Materials directly exposed to moisture via precipitation, water leaks, or condensation shall be removed from the jobsite and replaced.

END OF SECTION 23 0100

## SECTION 23 0500 – BASIC MECHANICAL MATERIALS AND METHODS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes the following basic mechanical materials and methods to complement other Division 23 Sections:
1. Materials and installation instructions common to mechanical systems.
  2. Pipe joining materials and methods.
  3. Dielectric fittings.
  4. Flexible pipe connectors.
  5. Pipe sleeves.
  6. Escutcheons.
  7. Penetration firestopping of fire-resistance-rated assemblies and/or smoke barriers by mechanical piping, conduit, or ductwork
  8. Labeling and identifying mechanical systems and equipment.
  9. Coordination with Structural work.
  10. Selective Demolition.
  11. Cutting and patching.

#### 1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 20 0800 "Seismic Protection" and Section 23 0100 "Basic Mechanical Requirements" apply to the work of this Section as if fully repeated herein.
- C. Pipe and pipe fitting materials are specified in individual Division 23 piping system Sections.

#### 1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- 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 duct shafts.
- E. The following abbreviations are used throughout Division 23 Specification Sections:
1. CR: Chlorosulfonated polyethylene synthetic rubber.
  2. EPDM: Ethylene propylene diene terpolymer rubber.

3. NBR: Acrylonitrile-butadiene rubber.

#### 1.4 SUBMITTALS

- A. Product Data: For dielectric fittings, transition couplings, modular sleeve seals, and identification materials and devices.
- B. Coordination Drawings: For access panel and door locations.

#### 1.5 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 prevent entrance of dirt, debris, and moisture. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor if stored thereupon. Protect fittings, and piping specialties from moisture and dirt.
- B. Protect ductwork interiors from the elements and foreign materials throughout construction. Deliver ducts with shop-applied impervious protective covering over all open ends. Maintain protective end coverings through shipping, storage, and handling to prevent entrance of dirt, debris, and moisture. Elevate stored ducts above grade. As ductwork is installed, remove protective end covering as each successive segment is connected, but with protective end covering maintained over open ends remaining exposed.
- C. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

#### 1.6 SEQUENCING AND SCHEDULING

- A. Coordinate mechanical equipment installation with other building components.
- B. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.
- C. Coordinate installation of required supporting devices and other structural components, as they are constructed.
- D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work.
- E. Coordinate requirements for access panels and doors if mechanical items requiring access are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Panels."
- F. Coordinate installation of identifying devices after completing covering and painting, if devices are applied to surfaces. Install identifying devices before installing acoustical ceilings and similar concealment.
- G. Coordinate connection of electrical services.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Transition Couplings:
    - a. Dresser Industries, Inc.
    - b. or approved equal.
  2. Flexible Pipe Connectors:
    - a. Anvil International.
    - b. Flexicraft Industries, Inc.
    - c. Hyspan Precision Products, Inc.
    - d. Mason Industries, Inc.
    - e. The Metraflex Company
    - f. Proco Products, Inc.
  3. Identifying Devices and Labels:
    - a. Brady USA, Inc., Signmark Div.
    - b. Brimar Industries, Inc.
    - c. Kolbi Industries, Inc.
    - d. Panduit Corp.
    - e. Seton Name Plate Co.

### 2.2 PIPE AND PIPE FITTINGS

- A. Refer to individual Division 23 piping Sections for pipe and fitting materials and joining methods.

### 2.3 JOINING MATERIALS

- A. Refer to individual Division 23 piping Sections for special joining materials not listed below.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.
- C. Solder Filler Metals: ASTM B32 lead-free alloys. Include water-flushable flux according to ASTM B813.
- D. 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.
- E. Transition Couplings: Iron-body sleeve assembly, fabricated to match OD of plain-end, pressure pipes.
1. Sleeve: ASTM A126, Class B, gray iron.
  2. Followers: ASTM A47 (ASTM A47M) malleable iron or ASTM A536 ductile iron.

3. Gaskets: Rubber.
4. Bolts and Nuts: AWWA C111.
5. Finish: Enamel paint.

## 2.4 DIELECTRIC FITTINGS

- A. Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face type. Components shall include EPDM gasket, phenolic or polyethylene bolt sleeves designed to prevent any metal-to-metal contact across mating flanges; phenolic washers, and steel backing washers. Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures. Copper pipe flange shall be soldered-on companion flange in sizes ¾-inch and larger; steel pipe flange shall be threaded-on in sizes ¾-inch to 2-inch. Other flanges and flange bolting kits are specified in "Joining Materials" subsection above.

## 2.5 FLEXIBLE PIPE CONNECTORS

- A. General: Fabricated from materials suitable for system fluid and that will provide equipment-pipe connections.
- B. Flexible Pipe Connectors for Copper Piping: Corrugated bronze inner tubing covered with interwoven bronze wire braid. Include copper-tube ends, brazed to hose.
- C. Flexible Pipe Connectors for Steel Piping: Corrugated stainless-steel inner tubing covered with interwoven stainless-steel wire braid.
- D. Performance Rating Requirements:
  1. Misalignment: Rated for ¾-inch (20-mm) permanent lateral offset.
  2. Length: As needed to allow offset rating above, but not less than 9-inches (230 mm).
  3. Design Working Pressure: 150 psig (1035 kPa) at 300°F (149°C).
- E. Schedule of End Connections:
  1. 2-Inch NPS (DN50) and Smaller, Copper Pipe: Copper tube end connections suitable for soldering to adjacent piping; except that brazed end connections are required for refrigerant service.
  2. 2-Inch NPS (DN50) and Smaller, Steel Pipe: Threaded-end carbon steel nipples welded to hose; except that stainless-steel ends are required for natural gas service or where mated to stainless steel piping.
- F. Flexible pipe connectors specified herein are for use at the piping connection to a piece of mechanical equipment, including but not limited to pumps.

## 2.6 PIPE SLEEVES

- A. The following sleeve materials are for wall, floor, slab, and roof penetrations.
- B. Steel Pipe: ASTM A53, Type E, Grade A, Schedule 40, galvanized, plain ends.

## 2.7 ESCUTCHEONS AND FLOOR PLATES

- A. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners. Use only for piping with a fitting or sleeve protruding from wall.
- B. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.
- C. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed hinge, and spring-clip fasteners.
- D. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.
- E. Split-Casting Floor Plates: Cast brass with concealed hinge.

## 2.8 IDENTIFYING DEVICES AND LABELS

- A. General: Manufacturer's standard products of categories and types required for each application as referenced in other Division 23 Sections. If more than one type is specified for application, selection is installer's option, but provide one selection for each product category.
- B. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.
- C. Equipment Nameplates: Metal nameplate with operational data engraved or stamped; permanently fastened to equipment; furnished and factory-installed by original equipment manufacturer.
  - 1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data.
  - 2. Location: Accessible and visible location.
- D. Pressure-Sensitive Pipe Markers: Manufacturer's standard preprinted, permanent adhesive, color-coded, pressure-sensitive vinyl, complying with ASME A13.1.
  - 1. Nomenclature: Heating Water Supply, Heating Water Return, Chilled Water Supply, Chilled Water Return, Natural Gas, etc. as required per service. Match name to the name given on Drawings (full names, not abbreviations).
  - 2. Color: Per ASME A13.1 Standard per service, unless noted otherwise.
  - 3. Flow Direction: Indicate flow direction via arrows on each label.
  - 4. Pipe Size: Indicate nominal pipe size, in inches, on each label.
  - 5. Example: ←2" CHILLED WATER RETURN←
- E. Plastic Duct Markers: Manufacturer's standard color-coded, laminated plastic. Comply with the following color code:
  - 1. Green: Cold air.
  - 2. Yellow: Hot air.
  - 3. Yellow/Green or Green: Supply air.
  - 4. Blue: Exhaust, outside, return, and mixed air.
  - 5. Nomenclature: Include direction of airflow and duct service.

6. Example: ←RETURN AIR←
- F. Engraved Plastic-Laminate Signs: ASTM D709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated.
    1. Fabricate in sizes required for message.
    2. Engraved with engraver's standard letter style, of sizes and with wording to match equipment identification.
    3. Punch for mechanical fastening.
    4. Thickness: 1/16-inch (1.6 mm), for units up to 20 sq. in. (130 sq. cm) or 8 inches (200 mm) long; 1/8-inch (3.2 mm) for larger units.
    5. Fasteners: Self-tapping stainless-steel screws or contact-type permanent adhesive.
  - G. Valve Tags: Photo-anodized barcode tags with 1/4-inch (6-mm) letters and numbers. Include 5/32-inch (4-mm) hole for fastener.
    1. Material: 0.032-inch (0.8-mm) thick anodized aluminum.
    2. Color: Silver background with black characters.
    3. Printed Nomenclature: Piping system abbreviation and sequenced number; e.g., CWS-23 for chilled water supply valve #23; HWR-12 for hot water return valve #12.
    4. Barcode: Two-dimensional Data Matrix ECC 200 barcode symbology. QR Code is also acceptable. Prior to manufacture, obtain valve tag information from owner's property manager for encoding into the barcode. Include valve number, piping system, system abbreviation, 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.
  - H. Valve Tag Fasteners: Brass, wire-link chain or stainless steel beaded chain.
  - I. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in mechanical identification, with corresponding designations indicated. Use numbers, lettering, and wording indicated for proper identification and operation/maintenance of mechanical systems and equipment.
    1. Multiple Systems: If multiple systems of same generic name are indicated, provide identification that indicates individual system number and service such as "Boiler No. 3," "Air Supply No. 1H," or "Standpipe F12."

## PART 3 - EXECUTION

### 3.1 GENERAL MECHANICAL INSTALLATION REQUIREMENTS

- A. Verify all dimensions by field measurements.
- B. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
- C. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown

only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.

- D. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
- E. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.
- F. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

### 3.2 PIPING SYSTEM INSTALLATION REQUIREMENTS

- A. General: Install piping as described below, unless piping Sections specify otherwise. Individual Division 23 piping Sections specify unique piping installation requirements.
- B. General Locations and Arrangements: 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 components with pressure rating equal to or greater than system operating pressure.
- D. Install piping at indicated slope, and free of sags and bends.
- E. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal. Install piping to allow application of insulation plus 1-inch (25-mm) clearance around insulation.
- F. Locate groups of pipes parallel to each other, arranged and spaced to permit valve servicing.
- G. Install fittings for changes in direction and branch connections. Install couplings according to manufacturer's written instructions.
- H. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.
- I. Electrical Equipment Spaces: Route piping to avoid passing through transformer vaults and electrical equipment spaces and enclosures.
- J. Piping Support: As specified in Division 23 Section "Hangers and Supports."



### 3.3 PIPING JOINING REQUIREMENTS

- A. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping specification Sections.
- 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 B813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B32.
- 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 pipefittings and valves as follows:
  - 1. Note internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
  - 2. Apply appropriate tape or thread compound to external pipe threads, unless dry seal threading is specified.
  - 3. Align threads at point of assembly.
  - 4. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
  - 5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Piping Connections: Make connections according to the following, unless otherwise indicated.
  - 1. Install unions, in piping 2-inch NPS (DN50) and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch NPS (DN50) or smaller threaded pipe connection.
  - 2. Install dielectric flanges to connect piping materials of dissimilar metals.
  - 3. Valve Caps: Any valve that represents a termination or the end of a run (e.g., blowdown or drain valve, hose-end valve, etc.) shall be fitted with a permanent but removable cap, plug, or blind flange matching the valve construction, to minimize risk in the event the valve is accidentally opened under pressure.

### 3.4 PIPE-PENETRATION INSTALLATION REQUIREMENTS

- A. Except as noted otherwise, install escutcheons for both insulated and bare piping in the following cases:
  - 1. New piping of penetrations of newly-constructed walls, ceilings, and floors.
  - 2. New piping penetrations of existing walls, ceilings, and floors.
  - 3. Existing piping which penetrates newly-constructed walls, ceilings, and floors.

- B. Escutcheons are not required in the following cases. Note that some form of closure of the annular or overcut opening (for reasons of acoustics, fire/smoke, sight, etc.) may still be required by other provisions of these documents.
1. Existing piping which penetrates existing walls, ceilings, and floors.
  2. Wall penetrations in an unfinished cavity above a finished ceiling.
  3. Penetrations of a wall or partition dividing one unfinished space from another unfinished space, such as service spaces, storage rooms, and equipment rooms.
- C. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening. Use one-piece type for new piping and split-plate type for existing piping as specified in Part 2 of this section.
- D. Install floor plates for piping penetrations of unfinished floors in service spaces and equipment rooms. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening. Use one-piece floor-plate type for new piping and split-casting floor-plate type for existing piping as specified in Part 2 of this section.
- E. Install sleeves for pipes passing through concrete and masonry walls, and concrete floor slabs.
- F. Cut sleeves to length for mounting flush with both surfaces. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
- G. Build sleeves into new walls and slabs as work progresses.
- H. Install sleeves large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
1. Steel Pipe Sleeves: For pipes smaller than 6-inch NPS (DN150).
  2. Seal space outside of sleeve fittings with non-shrink, non-metallic grout.
- I. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants. Refer to Division 07 Section "Joint Sealants" for materials. Use Type S, Grade NS, Class 25, Use O, neutral-curing silicone sealant, unless otherwise indicated.
- J. Sleeves are not required for core-drilled holes.
- K. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

### 3.5 EQUIPMENT INSTALLATION REQUIREMENTS

- A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected. Refer to equipment specifications in Division 23 and Division 26 for rough-in requirements.

- B. Install equipment to provide maximum possible headroom if mounting heights are not indicated.
- C. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Architect.
- D. Positive attachment and anchorage of all equipment to the structure or floor is required. Do not rely on friction or gravity as a means of attachment.
- E. Install flexible pipe connectors at the following locations. Install on equipment side of shutoff valves.
  - 1. Inlet and outlet of each pump.

### 3.6 LABELING AND IDENTIFYING

- A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow. Use plastic markers, with application systems.
  - 1. Install on insulation segment if required for hot, uninsulated piping.
  - 2. Install directional arrows around the pipe on both ends of pipe identification label, overlapping label slightly to help secure label to pipe.
  - 3. If directional arrows are not applicable, install adhesive tape matching pipe or insulation color on both ends to help secure pipe identification label.
- B. Locate pipe markers as follows if piping is exposed in finished spaces, machine rooms, and accessible maintenance spaces, such as attics, and plenums:
  - 1. Near each valve and control device.
  - 2. Near each branch, excluding short takeoffs for fixtures and terminal units. Mark each pipe at branch, if flow pattern is not obvious.
  - 3. Near locations where pipes pass through walls, floors, ceilings, or enter non-accessible 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 of 50-foot (15-m) intervals along each run. Reduce intervals to 25 feet (7.5 m) in congested areas of piping and equipment.
  - 7. On piping above removable acoustical ceilings, except omit intermediately spaced markers.
- C. Equipment: Install engraved plastic-laminate sign on or near each major item of mechanical equipment.
  - 1. Lettering Size: Minimum ¼-inch- (6.4-mm-) high lettering for name of unit if viewing distance is less than 24 inches (610 mm), ½-inch- (12.7-mm-) high lettering for distances up to 72 inches (1800 mm), and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.
  - 2. Text of Signs: Provide name of identified unit. Include text to distinguish between multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

- D. Duct Systems: Identify ducts with duct markers showing duct system as follows.
  - 1. Ductwork shall be labeled with flow direction and type (general exhaust, contaminated exhaust, kitchen hood exhaust, supply, return, etc.).
  - 2. Labeling shall be placed every 15 feet, within 5 feet of all elbows and tees, and on both sides of wall penetration within 3 feet of the penetration.
  - 3. Labeling shall include source equipment information (AHU#, EF-#, etc.).
  - 4. Labeling shall be installed on each floor of duct risers, mechanical rooms and locations where multiple duct systems share a location or identification is ambiguous.
- E. Adjusting: Relocate identifying devices as necessary for unobstructed view in finished construction.
- F. Install valve tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, plumbing fixture supply stops, faucets, and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units.

### 3.7 COORDINATION WITH STRUCTURAL WORK

- A. Supported Slab: Do not suspend loads exceeding 500 pounds within any 100 square feet of contiguous area from concrete supported slab. Suspend such loads from structural steel only. Any "sub-framing" required is responsibility of Contractor or sub-contractor installing material requiring support.
  - 1. Openings in concrete floor slabs not shown on structural drawings, such as openings required for stacks, pipes, ducts, plumbing vents, etc., shall be the responsibility of the trade requiring openings. Form blockouts in the slab, reinforcing deck, and cut openings after concrete has reached specified strength.
  - 2. Where openings larger than 12-inches are required but not shown on structural drawings, secure written approval from Architect/Engineer prior to cutting deck.

### 3.8 SELECTIVE DEMOLITION

- A. Disconnect, demolish, and remove mechanical work as indicated on the Drawings, and as required for installation of new work shown. Coordinate with Division 26 for disconnection of power to electrically-powered equipment prior to demolition.
- B. Remove accessible work in its entirety. Repair cut surfaces to match adjacent surfaces. Abandon in place embedded or buried work, unless noted otherwise.
  - 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. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
  - 3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
- C. Removal: Unless otherwise indicated, remove demolished pipe, duct and equipment from the Project site. Handle and dispose of in accordance with National, State, and Local regulations.

1. Relocation: Remove, store, clean, reinstall, reconnect, and make operational all work indicated for relocation.
  2. Salvage: Remove and deliver to Owner all work indicated for salvage.
- D. Refer to Division 01 Sections "Selective Demolition" and/or "Selective Structure Demolition" for additional requirements.

### 3.9 CUTTING AND PATCHING

- A. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay. Perform cutting and patching in accordance with the following:
- B. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.
- C. Perform cutting, fitting, and patching of mechanical equipment and materials required to:
1. Uncover Work to provide for installation of ill-timed Work.
  2. Remove and replace defective Work.
  3. Remove and replace Work not conforming to requirements of the Contract Documents.
  4. Install equipment and materials in existing structures.
- D. Cut, remove and legally dispose of selected mechanical equipment, components, and materials as indicated, including but not limited to removal of mechanical piping, pumps, and other mechanical items made obsolete by the new Work.
- E. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of trades involved.
- F. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
- G. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
- H. Repair cut surfaces to match adjacent installations.
- I. Repair any building insulation or building fireproofing materials, whether new or existing, that are removed or scraped away in order to make a mechanical installation, so as to maintain an equivalent insulation or fire rating as existed without said mechanical installation.
- J. Refer to Division 01 Sections "Execution" and/or "Cutting and Patching" for additional requirements.

END OF SECTION 23 0500

## SECTION 23 0513 – **MOTORS**

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes basic requirements for factory-installed motors associated with mechanical equipment specified elsewhere in Division 23.
- B. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small, and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

#### 1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 20 0800 "Seismic Protection," applies to the work of this Section as if fully repeated herein.
- C. Related Sections include all other Division 23 Sections for application of motors and reference to specific motor requirements for motor-driven equipment.

#### 1.3 DEFINITIONS

- A. Factory-Installed Motor: A motor installed by motorized-equipment manufacturer as a component of equipment.
- B. ECM: Electrically-commutated motor.
- C. ODP: Open drip-proof.
- D. TEAO: Totally-enclosed, air-over.
- E. TEFC: Totally-enclosed, fan-cooled.

#### 1.4 SUBMITTALS

- A. Product Data: Submit motor product data with each associated equipment submittal. Show nameplate data and ratings; characteristics; mounting arrangements; size and location of winding termination lugs, conduit entry, and grounding lug; and coatings.

#### 1.5 QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. UL Listing: Motors specified in this Section must be listed and labeled by Underwriters Laboratories and bear the UL logo.

## 1.6 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices and features that comply with the following:
  - 1. Compatible with magnetic controllers, multi-speed controllers, and/or reduced-voltage controllers where applicable.
  - 2. Designed and labeled for use with variable frequency controllers where applicable and suitable for use throughout speed range without overheating.
  - 3. Matched to torque and horsepower requirements of the load.
  - 4. Matched to ratings and characteristics of supply circuit and required control sequence.
- B. Coordinate motor support with requirements for driven load; access for maintenance and motor replacement; installation of accessories, belts, belt guards; and adjustment of sliding rails for belt tensioning.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide motors by one of the following:
  - 1. Baldor Electric Co.
  - 2. Century Electric Co.
  - 3. General Electric Co.
  - 4. MagneTek
  - 5. Marathon Electric Mfg. Co.
  - 6. Reliance Electric Co.
  - 7. Siemens Energy & Automation, Inc.

### 2.2 BASIC MOTOR REQUIREMENTS

- A. Basic requirements apply to all types of mechanical equipment motors, unless otherwise indicated.
  - 1. Motors ½ HP and Larger: Polyphase.
  - 2. Motors Smaller than ½ HP: Single phase.
  - 3. Frequency Rating: 60 Hz.
- B. Voltage Rating: NEMA standard voltage selected to operate on nominal voltage of circuit to which motor is connected.
- C. Service Factor: According to NEMA MG 1, unless otherwise indicated, but at least 1.15 polyphase motors and 1.35 for single-phase motors.
- D. Duty: Continuous duty at ambient temperature of 104°F (40°C) and at altitude of 3300 feet (1000 meters) above sea level.
- E. Capacity and Torque Characteristics: Rated for continuous duty and sufficient to start, accelerate, and operate connected loads at designated speeds, in indicated

environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

- F. Enclosure: ODP, unless otherwise indicated.

## 2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design E, medium induction motor, unless otherwise indicated.
  - 1. Stator: Copper windings, unless otherwise indicated.
  - 2. Rotor: Random-wound, squirrel cage, unless otherwise indicated.
  - 3. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
  - 4. Temperature Rise: Match insulation rating, unless otherwise indicated.
  - 5. Insulation: Class F, unless otherwise indicated.
- B. Code Letter Designation: Motors 15 HP and larger shall be NEMA starting Code F or Code G. Motors under 15 HP shall have manufacturer's standard starting characteristics.
- C. Enclosure: Cast iron for motors 7½ HP and larger; rolled steel for motors smaller than 7½ HP; with enamel finish.
- D. Efficiency: Motor efficiencies for motors one horsepower and greater shall in no case shall be less efficient than "Premium Efficiency" as defined in NEMA MG 1-2014 *Motors and Generators*. Motors shall be tested and labeled in accordance with NEMA MG 1-2014 Standard. Motor nameplate labeling shall include both the minimum and nominal efficiency.
- E. Motors Used with Reduced-Inrush Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- F. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
  - 1. Designed with critical vibration frequencies outside operating range of controller output.
  - 2. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
  - 3. Temperature Rise: Matched to rating for Class B insulation.
  - 4. Insulation: Class F or H.
  - 5. Motor shall be inverter-duty or inverter-ready and shall not require the use of external cooling fans.
- G. Shaft Grounding Ring: On any and all motors to be controlled by a Variable Frequency Motor Controller, include an engineered ring consisting of two or more rows of circumferential conductive microfibers to redirect shaft current and provide a low-impedance path from shaft to frame, bypassing the motor bearings. Factory-install on the motor shaft by sliding the ring over either end, and lock it in place with mechanically-fastened mounting brackets. Motors over 100 nameplate horsepower



shall be provided with an insulated bearing on the non-drive end and a shaft grounding ring on the drive end of the motor. Product shall be "Aegis SGR" by Electro Static Technology, no substitutions.

- H. Multispeed Motors: Variable torque.
  - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
  - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- I. Source Quality Control: Perform the following routine tests according to NEMA MG 1:
  - 1. Measurement of winding resistance.
  - 2. No-load readings of current and speed at rated voltage and frequency.
  - 3. Locked rotor current at rated frequency.
  - 4. High-potential test.
  - 5. Alignment.

## 2.4 SINGLE-PHASE MOTORS

- A. Type: As indicated or selected by manufacturer from one of the following, to suit starting torque and other requirements of specific motor application.
  - 1. Permanent-split capacitor.
  - 2. Split-phase start, capacitor run.
  - 3. Capacitor start, capacitor run.
- B. Shaded-Pole Motors: Do not use, unless motors are smaller than 1/20 hp.
- C. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- D. Thermal Protection: Where indicated or required, internal protection shall automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal protection device shall automatically reset when motor temperature returns to normal range, unless otherwise indicated.
- E. Bearings: Ball-bearing type for belt-connected motors and other motors with high radial forces on motor shaft. Sealed, pre-lubricated sleeve bearings for other single-phase motors.

## 2.5 ELECTRICALLY-COMMUTATED MOTORS

- A. General: Electrically-Commutated Motors are required wherever indicated in other Division 23 Specifications and/or notations on the Drawings.
- B. Motor: Motor shall be ECM, variable-speed, DC type, brushless motor designed for fan applications with heavy duty permanently lubricated ball bearings and electric commutation. It shall contain internal circuitry that converts single phase power into a DC signal. Motor shall be designed for direct-drive applications.
- C. Speed Control: The ECM shall be speed-controllable down to 10% of full speed via exterior-mounted field-adjustable potentiometer dial or DDC control signal input.

- D. Efficiency: Minimum 70% at all speeds.
- E. Voltage: Single-phase 115-V, 208-V, or 277-V as indicated.
- F. Rotor: Synchronous; permanent magnet type; built-in soft start.
- G. Thermal Protection: Where indicated or required, internal protection shall automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal protection device shall automatically reset when motor temperature returns to normal range, unless otherwise indicated.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION, ALL MOTORS

- A. Use adjustable motor mounting bases for belt-driven motors. Align motors, bases, shafts, pulleys, and belts. Tension belts according to manufacturer's written instructions. Verify bearing lubrication.
- B. Run each motor with its controller. Demonstrate correct rotation, alignment, and speed at motor design load. Test interlocks and control and safety features for proper operation. Verify that current and voltage for each phase comply with nameplate rating and NEMA MG 1 tolerances.
- C. Correct malfunctioning motors on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new motors and retest.

END OF SECTION 23 0513

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## SECTION 23 0519 – METERS AND GAGES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes manually-read and locally-read meters and gages listed below. Electronic meters that connect to a digital control system are specified in Division 23 Section "HVAC Instrumentation and Controls."
  - 1. Liquid-in-glass thermometers.
  - 2. Thermowells.
  - 3. Pressure gages.
  - 4. Test plugs.

#### 1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 20 0800 "Seismic Protection," Section 23 0100 "Basic Mechanical Requirements," and Section 23 0500 "Basic Mechanical Materials and Methods" all apply to the work of this Section as if fully repeated herein.
- C. Thermometers and gages furnished as part of factory-fabricated equipment are specified as part of the equipment assembly in other Division 23 Sections.
- D. This Section does not include meters and gages associated with a building energy management or control system; those devices are specified in Division 23 Section "Control Systems."

#### 1.3 SUBMITTALS

- A. Product Data: Submit product data for each type of meter, gage, and fitting specified. Include scale range, ratings, and calibrated performance curves. Submit a meter and gage schedule showing manufacturer's figure number, scale range, location, and accessories for each meter and gage.
- B. Product Certificates: For each type of meter and gage, from manufacturer.
- C. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

#### 1.4 QUALITY ASSURANCE

- A. Comply with applicable portions of American Society of Mechanical Engineers (ASME) and Instrument Society of America (ISA) standards pertaining to construction and installation of thermometers and gages.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Thermometers and Pressure Gages:
    - a. Ernst Gage Co.
    - b. Marsh Bellofram.
    - c. Miljoco Corp.
    - d. H.O. Trerice Co.
    - e. Weiss Instruments, Inc.
    - f. Weksler Glass Thermometer Corp.
  2. Test Plugs:
    - a. Flow Design, Inc.
    - b. Miljoco Corporation.
    - c. Peterson Equipment Co., Inc. ("Pete's Plugs")
    - d. Sisco Manufacturing Company, Inc.
    - e. H.O. Trerice Co.
    - f. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
    - g. Weiss Instruments, Inc.

### 2.2 THERMOMETERS

- A. Liquid-In-Glass Thermometers: ASME B40.200.
1. Case: Cast aluminum; 9-inch (229-mm) nominal size unless otherwise indicated.
  2. Case Form: Adjustable angle; 180-degree adjustment in vertical plane, 360-degree adjustment in horizontal plane, with locking device
  3. Tube: Glass with magnifying lens and blue organic mineral spirit fill.
  4. Tube Background: Non-reflective aluminum with enameled scale markings graduated in both degrees F and degrees C.
  5. Window: Glass, acrylic, or Lexan.
  6. Stem: Stainless steel for separable socket, and of length to suit installation.
  7. Connector: 1¼ inches (32 mm), with ASME B1.1 screw threads.
  8. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.
  9. Scale range, Heating Hot Water: 30°F to 240°F, with 2-degree scale divisions
  10. Scale range, Chilled Water: 0°F to 100°F, with 1-degree scale divisions.
  11. Scale range, Condenser-Water Piping: 30°F to 130°F, with 1-degree scale divisions.
  12. Scale range, Steam and Steam-Condensate Piping: 50 to 400°F, with 5-degree scale divisions.
  13. Design for Thermowell Installation: Bare stem.
- B. Thermowells: ASME B40.200; Pressure-tight, socket-type fitting with protective dry well made for insertion into piping threaded tee fitting.
1. Material for Use with Copper Tubing: Brass.
  2. Material for Use with Steel Piping: Stainless steel.

3. Type: Stepped shank unless straight or tapered shank is indicated.
4. External Threads: NPS ½, NPS ¾, or NPS 1, (DN 15, DN 20, or DN 25) ASME B1.20.1 pipe threads.
5. Internal Threads: ½, ¾, and 1 inch (13, 19, and 25 mm), with ASME B1.1 screw threads.
6. Bore: Diameter required to match thermometer bulb or stem.
7. Insertion Length: Length required to match thermometer bulb or stem, to extend to center of pipe.
8. Lagging Extension: Nominal thickness of 2 inches, but not less than thickness of insulation. Omit extension neck for wells for piping not insulated.
9. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.
10. Cap: Threaded, with chain permanently fastened to socket.
11. Heat-Transfer Medium: Oil, conductive jelly, or mixture of graphite and glycerin.

## 2.3 PRESSURE GAGES

- A. Description: ASME B40.1, Grade A phosphor-bronze Bourdon-tube pressure gage with bottom connection; dry type, unless liquid-filled-case type is indicated.

1. Pressure gages serving pump differential measurement shall be liquid-filled.
2. Case: Drawn steel, brass, or aluminum with 4½-inch-diameter glass lens.
3. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
4. Pressure Connection: Brass, with NPS ¼ (DN 8), ASME B1.20.1 pipe threads.
5. Movement: Mechanical, with link to pressure element and connection to pointer.
6. Dial: Non-reflective aluminum with enameled scale markings graduated in dual units of psi and kPa.
7. Pointer: Dark-colored metal.
8. Window: Glass, acrylic, or Lexan lens.
9. Ring: Brass or Stainless steel.
10. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.
11. Range (Fluids under Pressure): 0 to 160 psi.

- B. Gage Attachments:

1. Snubbers: ASME B40.100, brass; with NPS ¼ (DN 8), ASME B1.20.1 pipe threads and porous-metal-type surge-dampening device of material suitable for system fluid and working pressure. Include extension for use on insulated piping.
2. Siphons: Loop-shaped section of brass or stainless-steel pipe with NPS ¼ (DN 8) pipe threads.
3. Valves: Brass or stainless-steel needle-type, with NPS ¼ (DN 8), ASME B1.20.1 pipe threads. Ball valves are not acceptable.

## 2.4 TEST PLUGS

- A. Description: Test-station fitting made for insertion into piping tee fitting.

1. Body: Brass or stainless steel with core inserts. Include extended stem on units to be installed in insulated piping, with length as required to extend beyond insulation
2. Test-Plug Cap: Gasketed and threaded cap, with retention chain.
3. Thread Size: NPS ½ (DN 15), ASME B1.20.1 pipe thread.
4. Minimum Pressure and Temperature Rating: 500 psig at 200°F (3450 kPa at 93°C).

- B. Core Inserts: Two (2) EPDM self-sealing rubber valve types, suitable for inserting a 1/8-inch outside-diameter probe from a dial thermometer or pressure gage.
- C. Furnish one test-plug kit(s) containing two thermometer(s), one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.
  - 1. Low-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- (25- to 51-mm-) diameter dial and tapered-end sensing element. Dial range shall be at least 25 to 125°F (minus 4 to plus 52°C).
  - 2. High-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- (25- to 51-mm-) diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220°F (minus 18 to plus 104°C).
  - 3. Pressure Gage: Small, Bourdon-tube insertion type with 2- to 3-inch- (51- to 76-mm-) diameter dial and probe. Dial range shall be at least 0 to 200 psig (0 to 1380 kPa).
  - 4. Carrying Case: Metal or plastic, with formed instrument padding.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install thermowells in vertical position in piping tees. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes. Install thermowells with extension on insulated piping. Fill thermowells with heat-transfer medium. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- B. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
- C. Install valve and snubber in piping for each pressure gage for fluids (except steam).
- D. Install valve and siphon fitting in piping for each pressure gage for steam.
- E. Install test plugs in piping tees where indicated, located on pipe at most readable position. Secure cap.
- F. Install thermometers in the following locations:
  - 1. Inlet and outlet of each hydronic coil in air-handling units.
- G. Install pressure gages in the following locations:
  - 1. Multiple points at each pump as detailed on Drawings. Pressure gages serving pump differential measurement shall be liquid-filled and shall include snubber.
  - 2. Where indicated on Drawings.
- H. Install gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

- I. Adjust faces of thermometers and gages to proper angle for best visibility.

END OF SECTION 23 0519



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## SECTION 23 0523 – VALVES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes the following general-duty valves common to Division 23 mechanical piping systems:
1. Ball valves.
  2. Check valves.
  3. Gate valves.
  4. Globe and angle valves.

#### 1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 20 0800 "Seismic Protection," Section 23 0100 "Basic Mechanical Requirements," and Section 23 0500 "Basic Mechanical Materials and Methods" all apply to the work of this Section as if fully repeated herein.
- C. The following Sections contain requirements that relate to this Section:
1. Division 21 fire-suppression piping and fire pump Sections for fire-protection valves.
  2. Division 23 Section "Basic Mechanical Materials and Methods" for valve tags and charts.
  3. Division 23 Section "HVAC Control Systems" for control valves and actuators.
  4. Division 23 piping Sections for specialty valves applicable to those Sections only.

#### 1.3 DEFINITIONS

- A. The following are standard abbreviations for valves used in this Section:
1. CWP: Cold working pressure (formerly WOG – Water, Oil, Gas working pressure).
  2. EPDM: Ethylene-propylene-diene terpolymer rubber.
  3. IBBM: Iron body, bronze-mounted.
  4. OS&Y: Outside screw and yoke
  5. PTFE: Polytetrafluoroethylene plastic.
  6. SWP: Steam working pressure.
  7. TFE: Tetrafluoroethylene plastic.
  8. Class 125: Minimum 125-psig (860-kPa) SWP and minimum 200-psig (1380-kPa) CWP ratings.
  9. Class 150: Minimum 150-psig (1035-kPa) SWP and minimum 300-psig (2070-kPa) CWP ratings.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections;

arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

- B. Maintenance Data: For each type of valve, to include in the operation and maintenance manual specified in Division 01. Include detailed manufacturer's instructions on adjusting, servicing, disassembling, and repairing.

#### 1.5 QUALITY ASSURANCE

- A. ASME Compliance: ASME B31.9 for building services piping valves.
- B. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.
- C. NSF Compliance: NSF 61 for valve materials for potable-water service.
- D. MSS Compliance: Comply with the various MSS Standard Practice documents referenced herein.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
  - 1. Protect internal parts against rust and corrosion.
  - 2. Protect threads.
  - 3. Set angle, gate, and globe valves closed to prevent rattling.
  - 4. Set ball valves open to minimize exposure of functional surfaces.
  - 5. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
  - 1. Maintain valve end protection.
  - 2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. General: Subject to compliance with requirements, provide gate valves, globe valves, and swing check valves by one of the following:
  - 1. Crane Co.; Crane Valve Group; Crane, Jenkins, & Stockham brands.
  - 2. Grinnell Corporation.
  - 3. Hammond Valve.
  - 4. Milwaukee Valve Company.
  - 5. NIBCO Inc.
  - 6. Red-White Valve Corp.
  - 7. Watts Industries, Inc.; Water Products Div.

- B. Ball Valves: Subject to compliance with requirements, provide ball valves by one of the following:
  1. Any of the manufacturers listed under the "General" subheading above.
  2. Conbraco Industries, Inc.; Apollo Div.
  3. Jamesbury, Inc.
- C. Wafer and Lift-Disc Check Valves: Subject to compliance with requirements, provide butterfly-style dual-plate wafer check valves and piston-style lift-disc check valves by one of the following:
  1. Any of the manufacturers listed under the "General" subheading above.
  2. Metraflex Co.

## 2.2 VALVES, COMMON REQUIREMENTS

- A. General: Refer to Part 3 "Valve Applications Schedule" Article for application schedule of valves, end connections, and actuator types.
- B. Valve Sizes: Same as upstream pipe size, unless otherwise indicated.
- C. Valve Threaded Ends: With threads according to ASME B1.20.1.
- D. Valve Bypass and Drain Connections: MSS SP-45.
- E. Material Substitution: Ductile iron is acceptable anywhere cast iron is specified, but cast iron is not acceptable where ductile iron is specified.
- F. Class Substitution: If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.
- G. Chainwheel Operators: Where required, provide valve actuation assembly with ductile iron sprocket rim, brackets, and hot-dip galvanized steel chain; of type, number, size and fasteners as required for the host valve.
- H. For piping systems required to be insulated, valve stems shall be extended to accommodate insulation. Refer to other Division 23 Sections for piping systems required to be insulated.

## 2.3 BALL VALVES

- A. Steam or Liquid Service, Size NPS 2 (DN 50) and smaller:
  1. General: Valve shall conform to MSS SP-110.
  2. Minimum SWP rating: 150-psig (1035-kPa).
  3. Minimum CWP rating: 600-psig (4140-kPa).
  4. Body: ASTM B584 bronze, two-piece construction.
  5. Ball: Type 316 stainless steel, full port for NPS 1 (DN 25) and smaller, regular port otherwise.
  6. Stem: Blowout-proof Type 316 stainless steel.
  7. Seat/Packing: PTFE or TFE.
  8. Ends: Threaded.
  9. Handle: Vinyl-covered steel lever with memory stop; and zinc-plated steel nut.

## 2.4 CHECK VALVES

- A. Bronze Swing Check Valve, NPS 2 (DN50) and smaller: Valve shall conform to MSS SP-80.
  - 1. Minimum pressure rating: Class 150.
  - 2. Body: ASTM B62 bronze body, y-pattern.
  - 3. Bonnet: ASTM B62 bronze, threaded, removable for regrinding.
  - 4. Disc and seat: Renewable; ASTM B62 bronze with bronze-alloy hinge pin.
  - 5. Hardware: Bronze or bronze alloy.
  - 6. Ends: Threaded.

## 2.5 GATE VALVES

- A. NPS 2 (DN50) and smaller: Valve shall conform to MSS SP-80.
  - 1. Minimum pressure rating: Class 150.
  - 2. Body: ASTM B62 bronze body and bronze-fitted.
  - 3. Bonnet: ASTM B62 bronze union-ring.
  - 4. Disc: ASTM B62 bronze solid wedge.
  - 5. Stem: Bronze alloy rising-type.
  - 6. Packing: Non-asbestos packing with bronze packing nut and gland.
  - 7. Ends: Threaded.
  - 8. Handle: Ferrous-alloy handwheel.

## 2.6 GLOBE AND ANGLE VALVES

- A. Flow Pattern: Straight or angle pattern at Contractor's option, to accommodate piping layout and route.
- B. NPS 2 (DN50) and smaller: Valve shall conform to MSS SP-80.
  - 1. Minimum pressure rating: Class 150.
  - 2. Body: ASTM B62 bronze body and bronze-fitted.
  - 3. Bonnet: ASTM B62 bronze union-ring.
  - 4. Disc: Nonmetallic.
  - 5. Stem: Bronze alloy rising-type.
  - 6. Packing: Non-asbestos packing with bronze packing nut and gland.
  - 7. Ends: Threaded.
  - 8. Handle: Ferrous-alloy handwheel.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Examine valve interior 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. 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 general arrangement of piping, fittings, and specialties.
- C. Install isolation valves 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. Install valves in horizontal piping with stem at or above center of pipe. Install valves in position to allow full stem movement.
- E. Any valve that represents a termination or the end of a run (e.g., blowdown or drain valve, hose-end valve, etc.) shall be fitted with a permanent but removable cap, plug, or blind flange matching the valve construction, to minimize risk in the event the valve is accidentally opened under pressure.
- F. Install check valves for proper direction of flow and as follows:
  - 1. Swing Check Valves: In horizontal position with hinge pin level, or vertical with upward flow.
  - 2. Lift Check Valves: With stem upright and plumb.

### 3.3 JOINT CONSTRUCTION

- A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.
- B. Threaded Connections: Note the internal length of threads in valve ends and proximity of valve internal seat or wall to determine how far pipe should be threaded into valve.
  - 1. Align threads at point of assembly.
  - 2. Apply appropriate tape or thread compound to the external pipe threads, except where dry seal threading is specified.
  - 3. Assemble joint, wrench tight. Wrench on valve shall be on the valve end into which the pipe is being threaded.

### 3.4 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.

### 3.5 VALVE APPLICATIONS SCHEDULE

- A. General: Refer to piping Sections and Drawings for specific valve applications. If no specific valve type is indicated, use the valve types indicated in the following schedules.
- B. HVAC Chilled Water, Condenser Water, Hydronic Heating Water Piping, HVAC Makeup Water and Drain Piping: Use the following types of valves. Choices are contractor's option unless a specific type of valve is specifically called out by name on the Drawings.
  - 1. For shutoff duty, NPS 2 (DN 50) and smaller, use ball valves.
  - 2. For throttling duty, NPS 2 (DN 50) and smaller, use ball valves or globe valves.
  - 3. For pump discharge protection, NPS 2 (DN 50) and smaller, use swing check valves.
  - 4. For one-way flow control other than at pump discharge, use swing check valves in all sizes.
- C. Steam and Steam Condensate Piping: Use the following types of valves. Choices are contractor's option unless a specific type of valve is specifically called out by name on the Drawings.
  - 1. For shutoff duty, NPS 2 (DN 50) and smaller, use ball valves or gate valves.
  - 2. For throttling duty, NPS 2 (DN 50) and smaller, use ball valves or globe valves.
  - 3. For one-way flow control and for pump discharge protection, use swing check valves.

END OF SECTION 23 0523

## SECTION 23 0529 – HANGERS AND SUPPORTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes hangers and supports for mechanical system piping and equipment, including but not limited to the following:
  - 1. Metal pipe hangers and supports.
  - 2. Trapeze pipe hangers.
  - 3. Metal framing systems.
  - 4. Thermal-hanger shield inserts.
  - 5. Fastener systems.

#### 1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 20 0800 "Seismic Protection," Section 23 0100 "Basic Mechanical Requirements," and Section 23 0500 "Basic Mechanical Materials and Methods" all apply to the work of this Section as if fully repeated herein.
- C. The following Sections contain requirements that relate to this Section:
  - 1. Division 20 Section "Seismic Protection" for seismic restraint requirements.
  - 2. Division 21 Section "Standpipe and Sprinkler Systems" for fire-suppression pipe hangers.
  - 3. Division 23 Section "Metal Ducts" for duct hangers and supports.

#### 1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.
- B. Terminology: As defined in *MSS SP-90 Guidelines on Terminology for Pipe Hangers and Supports*.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. If contractor elects to apply channel support systems and/or heavy-duty steel trapezes to support multiple pipes, in lieu of individual supports, then contractor is responsible for design of same capable of supporting combined weight of supported systems, system contents, and test water. Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- C. Do not suspend pipe hangers and supports from roof deck. Suspend such loads from structural steel only, and provide structural steel sub-framing as required.



- D. Do not suspend piping loads exceeding 500 pounds within any 100 square feet of contiguous area from supported concrete floor slabs. Suspend such loads from structural members only, and provide structural steel sub-framing as required.
- E. Structural Performance: Hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

## 1.5 QUALITY ASSURANCE

- A. ANSI/MSS Standard SP-58-2018 *Pipe Hangers and Supports – Materials, Design, Manufacture, Selection, Application, and Installation* including Amendment 1 Issued October 17, 2019, is hereby incorporated by reference. This Standard establishes:
  - 1. Minimum requirements for materials, allowable stresses, product design, testing, and load ratings for pipe hanger and support assemblies for standard and unique pipe hangers and supports.
  - 2. Inspection criteria for the manufacture and installation of pipe hangers and supports.
  - 3. Required procedures for packing, marking, shipping, receiving, and storage of pipe hangers and supports.
  - 4. Minimum requirements for pipe hanger and support assembly drawings.
  - 5. Field practices for installation, adjustment, testing, and inspection of pipe hangers and supports.
  - 6. Terminology and identification of pipe hangers and supports, along with recommended contractual relationship structures.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Manufactured Pipe Hangers:
    - a. Anvil International, Inc.
    - b. Cooper B-Line, Inc.
    - c. Carpenter & Patterson, Inc.
    - d. Erico International Corp.
    - e. PHD Manufacturing, Inc.
    - f. Tolco division of Cooper B-Line, Inc.
  - 2. Metal Framing Systems:
    - a. Anvil International, Inc.
    - b. Cooper B-Line, Inc.
    - c. Erico / Michigan Hanger Co.
    - d. Thomas & Betts Corporation.
    - e. Tolco division of Cooper B-Line, Inc.
    - f. Unistrut Corporation; Tyco International, Ltd.

3. Thermal-Hanger Shield Inserts:
  - a. Carpenter & Paterson, Inc.
  - b. Erico International Corp.
  - c. PHS Industries, Inc.
  - d. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
4. Powder-Actuated Fastener Systems:
  - a. Hilti, Inc.
  - b. ITW Ramset/Red Head.
  - c. Simpson Manufacturing Co.; Strong-Tie Anchor Systems Div.

## 2.2 METAL PIPE HANGERS AND SUPPORTS

- A. Application: Refer to "Hanger and Support Applications" Article in Part 3 for where to use specific hanger and support types, including special padding or coatings where required.
- B. Carbon-Steel Pipe Hangers and Supports: MSS SP-58, Types 1 through 58, factory-fabricated components with pre-galvanized or hot dipped galvanized coatings. Include continuous-thread hanger rods, nuts, and washer made of carbon steel unless noted otherwise.
- C. Trapeze Pipe Hangers: 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. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes, according to Standard MFMA-4. Galvanized steel construction if located indoors; stainless steel construction if located outdoors.
- B. Channels: Continuous slotted steel channel with inturred lips.
- C. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
- D. Hanger Rods: As specified for Metal Pipe Hangers and Supports above.
- E. Coatings: Manufacturer's standard finish.

## 2.4 THERMAL-HANGER SHIELD INSERTS

- A. Insulation-Insert Material: ASTM C552, Type II cellular glass with 100-psig (688-kPa) or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength and vapor barrier.
- B. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- C. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

- D. Insert Length: Extend 2-inches (50 mm) 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, 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 and Miscellaneous Steel: As specified in Division 23 Section "Basic Mechanical Materials and Methods."

# PART 3 - EXECUTION

## 3.1 HANGER AND SUPPORT SCHEDULE OF APPLICATIONS

- A. Comply with MSS SP-58 for pipe hanger and trapeze selections and applications that are not specified in this Section.
- B. Comply with MFMA-102 for metal framing system 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. Horizontal-Piping Hangers and Supports for individual pipe runs less than 20 feet long and all piping 2-inch diameter or smaller, regardless of length: Unless otherwise indicated, choose among the following types:
  - 1. Adjustable Steel Clevis Hangers (MSS Type 1).
  - 2. Yoke-Type Pipe Clamps (MSS Type 2): For pipes NPS 4 and larger.
  - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3).
  - 4. Steel Pipe Clamps (MSS Type 4).
- E. Horizontal-Piping Hangers and Supports for individual uninsulated pipe runs of any size or length: Unless otherwise indicated, choose among the following types:
  - 1. Adjustable Steel Clevis Hangers (MSS Type 1).
  - 2. Yoke-Type Pipe Clamps (MSS Type 2): For pipes NPS 4 and larger.
  - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3).
  - 4. Steel Pipe Clamps (MSS Type 4).
  - 5. Adjustable Steel Band Hangers (MSS Type 7): For pipes up to NPS 2 only.
  - 6. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For pipes up to NPS 2 only.
  - 7. U-Bolts (MSS Type 24).

- F. Vertical-Piping Hangers and Supports for individual pipe runs less than 20 feet long and all piping 2-inch diameter or smaller, regardless of length: Unless otherwise indicated, choose among the following types:
  - 1. Extension Pipe or Riser Clamps (MSS Type 8). Use pre-engineered riser clamp with TPO insert for insulated copper piping as specified in Part 2 of this Section.
  - 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): Where longer ends are required.
  
- G. Vertical-Piping Hangers and Supports for individual uninsulated pipe runs of any size or length: Unless otherwise indicated, choose among the following types:
  - 1. Extension Pipe or Riser Clamps (MSS Type 8).
  - 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): Where longer ends are required.
  
- H. Hanger-Rod Attachments: Unless otherwise indicated, choose among the following types:
  - 1. Steel Turnbuckles (MSS Type 13).
  - 2. Steel Clevises (MSS Type 14).
  - 3. Malleable-Iron Sockets (MSS Type 16).
  - 4. Steel Weldless Eye Nuts (MSS Type 17).
  
- I. Building Attachments: Unless otherwise indicated, choose among the following types:
  - 1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to concrete ceiling.
  - 2. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
  - 3. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams.
  - 4. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
  - 5. Light Welded-Steel Brackets (MSS Type 31): For support of pipes from below or for suspending from above up to 750 lb. by using clip and rod.
  - 6. Medium Welded-Steel Brackets (MSS Type 32): For support of pipes from below or for suspending from above up to 1500 lb. by using clip and rod.
  - 7. Heavy Welded-Steel Brackets (MSS Type 33): For support of pipes from below or for suspending from above up to 3000 lb. by using clip and rod.
  - 8. Side-Beam Brackets (MSS Type 34): For sides of steel beams.
  - 9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

### 3.2 HANGER AND SUPPORT MAXIMUM SPACING AND MINIMUM ROD SIZE

- A. Install hangers and supports with the following maximum spacing and minimum rod sizes.
  
- B. Threaded Steel Piping for any Liquid-service piping systems:
  - 1. NPS  $\frac{3}{4}$  (DN 20): Maximum span, 7 feet (2.1 m); minimum rod size, 3/8-inch (10 mm).
  - 2. NPS 1 (DN 25): Maximum span, 7 feet (2.1 m); minimum rod size, 3/8-inch (10 mm).
  - 3. NPS  $1\frac{1}{4}$  (DN 32): Maximum span, 7 feet (2.1 m); minimum rod size, 3/8-inch (10 mm).

4. NPS 1½ (DN 40): Maximum span, 9 feet (2.7 m); minimum rod size, 3/8-inch (10 mm).
5. NPS 2 (DN 50): Maximum span, 10 feet (3 m); minimum rod size, 3/8-inch (10 mm).

C. Threaded Steel Piping for Steam piping systems:

1. NPS ¾ (DN 20): Maximum span, 9 feet (2.7 m); minimum rod size, 3/8-inch (10 mm).
2. NPS 1 (DN 25): Maximum span, 9 feet (2.7 m); minimum rod size, 3/8-inch (10 mm).
3. NPS 1¼ (DN 32): Maximum span, 9 feet (2.7 m); minimum rod size, 3/8-inch (10 mm).
4. NPS 1½ (DN 40): Maximum span, 12 feet (3.7 m); minimum rod size, 3/8-inch (10 mm).
5. NPS 2 (DN 50): Maximum span, 13 feet (4 m); minimum rod size, 3/8-inch (10 mm).

D. Drawn-Temper Copper Piping for any liquid-service piping systems:

1. NPS ¾ (DN 20): Maximum span, 5 feet (1.5 m); minimum rod size, 3/8-inch (10 mm).
2. NPS 1 (DN 25): Maximum span, 6 feet (1.8 m); minimum rod size, 3/8-inch (10 mm).
3. NPS 1¼ (DN 32): Maximum span, 6 feet (1.8 m); minimum rod size, 3/8-inch (10 mm).
4. NPS 1½ (DN 40): Maximum span, 8 feet (2.4 m); minimum rod size, 3/8-inch (10 mm).
5. NPS 2 (DN 50): Maximum span, 8 feet (2.4 m); minimum rod size, 3/8-inch (10 mm).

E. Support vertical runs at each floor and at 10-foot (3-m) intervals between floors.

F. Rod diameters may be reduced one size for double-rod hangers, with 3/8-inch (10 mm) minimum rods.

G. Hanger and support spacing for piping and tubing not listed above shall be according to MSS SP-58 and piping manufacturer's written instructions.

### 3.3 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-58 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Field fabricate from ASTM A36/A36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M. Comply with MSS SP-58 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers. Support pipes of various sizes together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Required for insulated piping NPS 4 and larger if piping operates below surrounding ambient air temperature.

- 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.
- G. Install lateral bracing with pipe hangers and supports to prevent swaying.
- H. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- I. 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.
- J. Install building attachments within concrete slabs or attach to structural steel.
- K. Repair any building insulation or building fireproofing materials, whether new or existing, that are removed or scraped away in order to attach hangers and supports, so as to maintain an equivalent insulation or fire rating as existed without said hanger or support attachment.
  - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4-inches (100 mm) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
  - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

### 3.4 PROTECTION OF INSULATED PIPING:

- A. Attach clamps and spacers to piping.
  - 1. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
  - 2. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
- B. Do not exceed pipe stress limits according to ASME B31.9.
- C. Piping Operating above Ambient Air Temperature: Clevis- and clamp-type supports shall project through insulation, with pipe support making direct contact with pipe and with insulation applied in a manner that encapsulates the clevis or clamp. For piping on roller-type supports, install MSS SP-58, Type 39 protection saddles, and fill interior voids with insulation that matches adjoining insulation.
  - 1. Contractor's Option: In lieu of the above paragraph, contractor has the option of complying with the same specifications as for "Piping Operating below Ambient Air Temperature" in the following paragraphs.
- D. Piping Operating below Ambient Air Temperature: Clevis- and clamp-type supports shall be sized for the outside diameter of the insulation including jacket. Install MSS SP-58, Type 40 protective metal shields. Shields shall span an arc of 180 degrees.

### 3.5 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and/or equipment supports. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

### 3.6 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe. Trim excess length of continuous-thread hanger and support rods to 1½-inches (40 mm).

END OF SECTION 23 0529

## SECTION 23 0593 – TEST-ADJUST-BALANCE

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Special Conditions apply to this section.

#### 1.2 DESCRIPTION OF WORK

- A. This scope of services specifies the requirements and procedures for mechanical systems testing, adjusting, and balancing. Requirements include measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications, and recording and reporting the results. The test and balance work will be performed by the Owner's personnel. It is the Contractor's responsibility to assist as outlined below.

- B. Test, adjust and balance the following mechanical systems which are shown in the construction documents.

1. Supply air systems, all pressure ranges, including variable volume and constant volume systems.
2. Exhaust air systems.
3. Hydronic systems.
4. Steam distribution systems.
5. Verify temperature control system operation.

- C. The contractor's responsibilities are as follows:

1. Notify the Owner's Representative fourteen (14) days prior to the schedule date for balancing the system.
2. Schedule a two (2) week allowance for the testing and balancing firm to complete the testing and balancing work when scheduling completion of all work required of the Contractor by the contract documents.
3. Cooperate with the testing and balancing firm and shall make all necessary preparations for the TAB efforts.
4. Complete the following work prior to requesting the TAB effort.
  - a. Clean and flush all piping systems.
  - b. Leak test and make tight all piping systems.
  - c. Fill all piping systems with clean water.
  - d. Clean and seal all ductwork systems.
  - e. Service and tag all equipment.
  - f. Set and align all motors and drives.
  - g. Start up and prove all equipment and systems.
  - h. Make preliminary settings on all control devices and have all systems operational.
  - i. Operate all systems successfully for twenty-four (24) hours minimum.
5. Lubricate all motors and bearings.
6. Check fan belt tension.



7. Check fan rotation.
8. Patch insulation, ductwork and housing, using materials identical to those removed.
9. Seal ducts and piping, and test for and repair leaks.
10. Seal insulation to re-establish integrity of the vapor barrier.
11. Attend a coordination meeting prior to the balancing of the system and a coordination meeting following the balancing of the system.
12. Provide a complete set of as-built drawings prior to the TAB effort.
13. Provide craftsmen of the proper trade to work with the TAB firm to make adjustments, and installation changes as required.
14. Change out fan sheaves when and if required by the TAB firm.
15. Dedicate the resources to accommodate all changes identified by the test and balance firm in a timely manner.
16. If a significant rebalance (Owner's determination) of the HVAC system is required due to the Contractor's failure to properly install and check out the HVAC system, the cost of rebalancing the system shall be borne by the Contractor.

#### 1.3 PRE-BALANCING CONFERENCE

- A. Prior to beginning of the testing, adjusting and balancing procedures, a conference with the Owner's representative, Engineer and the Test and Balance Agency's representative will be held. The objective of the conference is final coordination and verification of system operation and readiness for testing, adjusting and balancing.

#### 1.4 SEQUENCING AND SCHEDULING OF SERVICES

- A. Test, adjust and balance the air conditioning systems during summer season and heating systems during winter season. This includes at least a period of operation at outside conditions within 5 deg. F wet bulb temperature of maximum summer design condition, and within 10 deg. F dry bulb temperature of minimum winter design conditions. Take final temperature readings during seasonal operation.

### PART 2 - PRODUCTS

#### 2.1 PRODUCTS (Not applicable)

### PART 3 - PART 3 – EXECUTION

#### 3.1 GENERAL (Not applicable)

END OF SECTION 23 0593

## SECTION 23 0700 - **MECHANICAL INSULATION**

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes mechanical insulation for ductwork, equipment, piping, appliance breechings and other installations, including the following:
  - 1. Insulation Materials: Flexible elastomeric, mineral fiber.
  - 2. Insulating cements, adhesives, mastics, and sealants.
  - 3. Factory-applied jackets.
  - 4. Field-applied jackets.
  - 5. Tapes and securements.

#### 1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 20 0800 "Seismic Protection," Section 23 0100 "Basic Mechanical Requirements," and Section 23 0500 "Basic Mechanical Materials and Methods" all apply to the work of this Section as if fully repeated herein.

#### 1.3 DEFINITIONS

- A. ASJ: All-service jacket.
- B. FSK: Foil, scrim, kraft paper.
- C. SSL: Self-sealing lap.
- D. Thermal Resistivity: "R-values" represent the reciprocal of thermal conductivity (k-value). Thermal conductivity is the rate of heat flow through a homogenous material exactly 1-inch thick. Thermal resistivities are expressed by the temperature difference in degrees F between two exposed faces required to cause one BTU to flow through one square foot of material, in one hour, at a given mean temperature.
- E. VOC: Volatile Organic Compound as defined by LEED v4 Credit EQc2.
- F. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.
- G. Exposed Installations: Exposed to view. Examples include finished occupied spaces without ceilings, mechanical equipment rooms, courtyards and rooftop locations.
- H. Concealed Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings or within duct shafts.
- I. Conditioned Space: Spaces that are served by both a mechanical heating and mechanical cooling system are conditioned spaces. Heating-only spaces are not

conditioned spaces. The space above a ceiling is considered conditioned space if the space directly below that ceiling is conditioned space. A vertical shaft is considered conditioned space if the spaces on all sides surrounding the shaft are conditioned spaces.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated, identify thermal conductivity, thickness, and jackets (both factory and field applied, if any).
- B. MSDS (Material Safety Data Sheet) for each adhesive, mastic, sealant, and cement furnished.

#### 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. Fire-Test-Response Characteristics: Insulation and related materials shall have flame-spread index of 25 or less, and smoke-developed index of 50 or less, as determined by testing identical products per ASTM E84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
  - 1. Exception: Flame-spread index of 25 or less, and smoke-developed index of 150 or less; is acceptable for insulation not installed in an air-handling duct, plenum, space above ceilings if used as a return air plenum.

#### 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 size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports."
- B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

#### 1.8 SCHEDULING

- A. Schedule insulation application after pressure testing systems 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 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:
  - 1. Flexible Elastomeric Insulation:
    - a. Aeroflex USA Inc.; Aerocel.
    - b. Armacell LLC; AP/Armaflex.
    - c. K-Flex USA; Insul-Lock® Seam-Seal.
    - d. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.
  - 2. Mineral Fiber Insulation:
    - a. CertainTeed Corp.
    - b. Johns Manville.
    - c. Knauf Insulation.
    - d. Manson Insulation Inc.
    - e. Owens Corning.
  - 3. Insulating Cements: Same as insulation manufacturer, or
    - a. Insulco, Division of MFS, Inc.
    - b. P. K. Insulation Mfg. Co., Inc.
    - c. Rock Wool Manufacturing Company.
  - 4. Sealants, Adhesives and Mastics: Same as insulation manufacturer, or
    - a. H.B. Fuller Construction Products Inc. (Childers and/or Foster brands)
    - b. ITW TACC, Division of Illinois Tool Works.
    - c. Marathon Industries, Inc.
    - d. Mon-Eco Industries, Inc.
    - e. Vimasco Corporation.
  - 5. Field-Applied Jackets: Same as insulation manufacturer, or
    - a. P.I.C. Plastics, Inc.
    - b. PABCO Metals Corporation.
    - c. Pittsburgh Corning Corporation.
    - d. Polyguard Products, Inc.
    - e. Proto PVC Corporation.
    - f. RPR Products, Inc.
    - g. Speedline Corporation.
  - 6. Tapes: Same as insulation manufacturer, or
    - a. Avery Dennison Corporation, Specialty Tapes Division.

- b. Compac Corp.
  - c. Ideal Tape Co., Inc., an American Biltrite Company.
  - d. Polyguard Products, Inc.
  - e. Venture Tape.
7. Bands and Wire: Same as insulation manufacturer, or
- a. ACS Industries, Inc.
  - b. C & F Wire.
  - c. Childers Products.
  - d. PABCO Metals Corporation.
  - e. RPR Products, Inc.
8. Insulation Pins and Hangers: Same as insulation manufacturer, or
- a. AGM Industries, Inc.
  - b. GEMCO.
  - c. Midwest Fasteners, Inc.
  - d. Nelson Stud Welding.

## 2.2 INSULATION MATERIALS

- A. Refer to Schedule in Part 4 for requirements about where insulating materials shall be applied.
- B. Restrictions: Products shall not contain asbestos, lead, mercury, or mercury compounds. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- C. Adhesives shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- D. Product manufacturers and/or their product numbers notwithstanding, each adhesive, mastic, sealant, and cement shall have a VOC content not greater than the maximum allowable under LEED v4 Credit EQc2 regardless of whether or not this project is seeking LEED certification.
- E. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C534, Type I for tubular materials and Type II for sheet materials.
  - 1. Thermal Conductivity: 0.28 average maximum at 75°F mean temperature using test method ASTM C177 or C518.
  - 2. Water Vapor Permeability: Maximum 0.1 perm-inch using test method ASTM E96 Procedure A.
  - 3. Water Absorption: Maximum 0.2% by volume using test method ASTM C209.
  - 4. Product shall pass mold growth, fungi resistance, and bacterial resistance tests per UL 181, ASTM G21, G22, and C1338.
  - 5. Adhesive: Comply with MIL-A-24179A, Type II, Class I; VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

- F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C553, Type II and ASTM C1290, Type III with factory-applied jacket.
  - 1. Thermal Conductivity: 0.26 average maximum at 75°F mean temperature.
  - 2. Density: 1.5 lb/cf (24-kg/cu. m) minimum.
  - 3. Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II.
  
- G. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C612, Type IA or Type IB.
  - 1. Thermal Conductivity: 0.26 average maximum at 75°F mean temperature.
  - 2. Density: 2.0 lb/cf (32-kg/cu. m) minimum.
  - 3. Jacket (Ducts): Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II.
  - 4. Jacket (Equipment): White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.
  
- H. Mineral-Fiber, Preformed Pipe Insulation: Type I, 850°F (454°C); mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C547, Type I, Grade A, with factory-applied jacket.
  - 1. Thermal Conductivity: 0.26 average maximum at 75°F mean temperature.
  - 2. Jacket: White, polypropylene-coated kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I; with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip. Example of acceptable product is Owens-Corning ASJ Max-SSL or Johns Manville Micro-Loc HP Ultra.
  - 3. Adhesive: Water-based and complying with ASTM C916 Type II; equal to Foster 85-60 and/or Childers CP-127.

### 2.3 CEMENTS AND MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates. Comply with ASTM C755-19 *Standard Practice for Selection of Water Vapor Retarders for Thermal Insulation Table 2*, for the selection of vapor retarder systems.
  
- B. Insulating Cements: Select one or more of the following at contractor's option.
  - 1. Mineral-Fiber Insulating Cement: Comply with ASTM C195.
  - 2. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C196.
  - 3. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C449.
  
- C. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below-ambient services, for applications on seams, punctures, penetrations, and terminations of vapor retarder membranes. Equal to Foster 30-80 or Childers CP-35 or Vimasco 749.
  - 1. Water-Vapor Permeance, Piping and Equipment: ASTM E96-16, Procedure A (desiccant method), 0.15 perms.
  - 2. Water-Vapor Permeance, HVAC Ducts: ASTM E96-16, Procedure A (desiccant method), 1.0 perms.
  - 3. Service Temperature Range: -20 to +180°F (-29 to +82°C).

4. Solids Content: ASTM D1644, 59 percent by volume and 71 percent by weight.
  5. Color: White.
- D. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services. Equal to Foster 46-50 or Childers CP-10/11 or Vimasco WC-5.
1. Water-Vapor Permeance: ASTM F1249, 3 perms (2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
  2. Service Temperature Range: -20 to +200°F (-29 to +93°C).
  3. Solids Content: 63 percent by volume and 73 percent by weight.
  4. Color: White.

## 2.4 SEALANTS

- A. Joint Sealants: Permanently flexible, elastomeric sealant. Materials shall be compatible with insulation materials, jackets, and substrates.
1. Service Temperature Range: -100 to +200°F (-73 to +94°C).
  2. Color: White, tan, or gray.
  3. VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. FSK and Metal Jacket Flashing Sealants: Fire- and water-resistant, flexible, elastomeric sealant. Materials shall be compatible with insulation materials, jackets, and substrates.
1. Service Temperature Range: -40 to +250°F (-40 to +121°C).
  2. Color: Aluminum.
  3. VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants: Fire- and water-resistant, flexible, elastomeric sealant. Materials shall be compatible with insulation materials, jackets, and substrates.
1. Service Temperature Range: -40 to +250°F (-40 to +121°C).
  2. Color: White.
  3. VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.5 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C921, Type I, unless otherwise indicated.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D1784, Class 16354-C; thickness 30 mils (0.8 mm); roll stock ready for shop or field cutting and forming.
1. Adhesive: Compatible with PVC, as recommended by jacket material manufacturer.
  2. Color: White.
  3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

4. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
  5. Factory-fabricated tank heads and tank side panels.
- C. Metal Jackets: Sheet and roll stock ready for shop or field sizing. Factory pre-cut and rolled to size is also acceptable.
1. Aluminum Jacket: Comply with ASTM B209, Alloy 3003, 3005, 3105 or 5005, Temper H-14. Finishes and thickness as follows:
    - a. Indoor Ducts and Plenums: Smooth, 0.016-inch (0.41 mm) thick.
    - b. Indoor Equipment: Stucco Embossed, 0.016-inch (0.41 mm) thick.
    - c. Outdoor Ducts, Equipment, and Piping: Stucco embossed, with Z-shaped locking seam, 0.024-inch (0.61 mm) thick.
  2. Moisture Barrier for Indoor Applications: 1-mil- (0.025-mm-) thick, heat-bonded polyethylene and kraft paper.
  3. Factory-Fabricated Fitting Covers: Same material, finish, and thickness as jacket; provide as required for preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows, tee covers, flange and union covers, end caps, beveled collars, and valve covers.
  4. Field-fabricate fitting covers only if factory-fabricated fitting covers are not available.

## 2.6 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136 and UL listed.
1. Width: 3-inches (75 mm).
  2. Thickness: 11.5 mils (0.29 mm).
  3. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
  4. Elongation: 2 percent.
  5. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
  6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C1136 and UL listed.
1. Width: 3-inches (75 mm).
  2. Thickness: 6.5 mils (0.16 mm).
  3. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
  4. Elongation: 2 percent.
  5. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
  6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.
1. Width: 2-inches (50 mm).
  2. Thickness: 6 mils (0.15 mm).
  3. Adhesion: 64 ounces force/inch (0.7 N/mm) in width.



4. Elongation: 500 percent.
5. Tensile Strength: 18 lbf/inch (3.3 N/mm) in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive and UL listed.

1. Width: 2-inches (50 mm).
2. Thickness: 3.7 mils (0.093 mm).
3. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
4. Elongation: 5 percent.
5. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.

## 2.7 SECUREMENTS

A. Bands:

1. Stainless Steel: ASTM A167 or ASTM A240, Type 304; 0.015-inch (0.38 mm) thick, ½-inch (13 mm) wide with wing or closed seal.
2. Aluminum: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020-inch (0.51 mm) thick, ½-inch (13 mm) wide with wing or closed 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, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.
2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated with integral 1½-inch (38-mm) galvanized carbon-steel washer.
3. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch (0.41-mm) thick, aluminum or stainless-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1½-inches (38 mm) in diameter. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

C. Staples: Outward-clinching insulation staples, nominal ¾-inch- (19-mm-) wide, stainless steel or Monel.

D. Wire: 0.062-inch (1.6-mm) soft-annealed, stainless steel.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application. Verify that systems and equipment to be insulated have been tested and are free of defects. Verify that surfaces to be insulated are clean and dry. 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. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

### 3.3 COMMON INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs. Install multiple layers of insulation with longitudinal and end seams staggered.
- E. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- F. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer. Install insulation with least number of joints practical.
- H. 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.
- I. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
  - J. Install insulation with factory-applied jackets as follows:
    1. Draw jacket tight and smooth.
    2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4-inches (100 mm) o.c.
    3. Overlap jacket longitudinal seams at least 1½-inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2-inches (50 mm) o.c.
    4. For below ambient services, apply vapor-barrier mastic over staples.
    5. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
    6. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.
  - K. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
  - L. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
  - M. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4-inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
  - N. At the following locations, omit jacket and provide a separate cutaway removable segment of insulation clearly labeled "Access." For below-ambient services, provide a design that allows access but maintains vapor barrier.
    1. Vibration-control devices.
    2. Testing agency labels and stamps.
    3. Nameplates and data plates.
    4. Manholes.
    5. Handholes.
    6. Cleanouts.

### 3.4 PENETRATIONS

- A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

B. Insulation Installation at Fire-Rated Wall and Partition Penetrations:

1. Install pipe insulation continuously through pipe penetrations of fire-rated walls and partitions.
2. Install duct insulation continuously through duct penetrations of fire-rated walls and partitions, for cases where no fire or smoke damper is required.
3. Terminate duct insulation at fire or smoke damper sleeves for cases where fire or smoke dampers are used, but overlap duct insulation at least 2-inches (50 mm) onto sleeve.
4. Firestopping and fire-resistive joint sealers are specified in Division 07 Section "Penetration Firestopping."

C. Insulation Installation at Floor Penetrations:

1. Duct: Install insulation continuously through floor penetrations that are not fire rated. For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2-inches (50 mm).
2. Pipe: For below-ambient piping services, install insulation continuously through floor penetrations. For above-ambient piping services, either do the same as for below-ambient piping, or it is acceptable to install uninsulated piping through the slab and butt the pipe insulation tight to the slab on both the top side and the underneath side.
3. Seal penetrations through fire-rated assemblies according to Division 07 Section "Penetration Firestopping."

### 3.5 DUCT INSULATION INSTALLATION

A. See Part 4 Insulation Schedules for specific requirements.

B. The following ductwork items need not be insulated, unless noted otherwise:

1. Factory-insulated plenums, casings, fan housings, and air terminal units.
2. Flexible connectors.
3. Vibration-control devices.
4. Factory-insulated access panels and doors.

C. Secure all insulation on ducts and plenums with insulation pins. 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:

1. On duct sides with dimensions 18-inches (450 mm) and smaller, pins may be omitted.
2. On duct sides with dimensions 18-inches (450 mm) and larger, place pins along longitudinal centerline of duct. Space 3-inches (75 mm) maximum from insulation end joints, and 16-inches (400 mm) o.c.
3. On duct sides with dimensions larger than 36-inches (900 mm), place pins 16-inches (400 mm) o.c. each way, and 3-inches (75 mm) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
4. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
5. Do not over-compress insulation during installation.

6. If using blanket insulation, impale insulation over pins and attach speed washers.
  7. 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.
- D. 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 (50 mm) from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with ½-inch (13-mm) outward-clinching staples, 1-inch (25 mm) o.c. Complete the vapor barrier by applying FSK tape specified in Part 2, or vapor-barrier mastic and sealant, at all joints, seams, and protrusions.
1. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
  2. Install vapor stops for ductwork and plenums operating below 50°F (10 C) at 18-foot (5.5-m) 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 2 times the insulation thickness but not less than 3-inches (75 mm).
- E. If using blanket insulation, overlap unfaced blankets a minimum of 2-inches (50 mm) on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18-inches (450 mm) o.c.
- F. Unless factory-insulated, install duct insulation continuously and unbroken over duct-mounted accessories such as fans, coils, terminal units, humidifier housings, damper housings, airflow measuring station housings, etc.
- G. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. If using board insulation, groove and score insulation to fit as closely as possible to outside and inside radius of elbows.
- H. Install insulation on round duct elbows with individually mitered gores cut to fit the elbow.
- I. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- (150-mm-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6-inches (150 mm) o.c.

### 3.6 PIPE INSULATION INSTALLATION

- A. See Part 4 Insulation Schedules for specific requirements.
- B. Requirements in this Article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- C. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of insulation to pipe with tape or bands and tighten without deforming insulation materials. If furnished in half sections, orient longitudinal joints at 3 and 9 o'clock positions on the pipe.
  2. All insulation shall be tightly butted and free of voids and gaps at all joints.
  3. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.

4. For insulation with factory-applied jackets on above ambient services, secure laps with outward clinched staples at 6-inches (150 mm) o.c.
5. For insulation with factory-applied jackets on below ambient services, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant. Vapor barrier must be continuous.

D. 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 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.
3. Cut sectional pipe insulation to fit. 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.

E. Insulation Installation on Valves, Strainers, Unions, and Specials:

1. 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.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation over valves, strainers, flanges, mechanical couplings, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
4. 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.
5. Insulate 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.
6. 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.
7. 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.

8. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.
- F. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, 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.
  - G. Install removable insulation covers at locations indicated. Installation shall conform to the following:
    1. Make removable union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
    2. When union covers are made from sectional pipe insulation, extend insulation from union long at least two times the insulation thickness over adjacent pipe insulation on each side union. Secure cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
    3. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Extend insulation at least 2-inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between 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.
    4. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.
  - H. Special Requirements for Flexible Elastomeric Insulation Installation: Seal all transverse seams, longitudinal seams, end joints, and section joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

### 3.7 FIELD-APPLIED JACKET INSTALLATION

- A. See Part 4 Insulation Schedules for specific requirements.
- B. Where PVC jackets are indicated, install with 1-inch (25-mm) overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- C. Where metal jackets are indicated, install with 2-inch (50-mm) 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 (300 mm) o.c. and at end joints.

### 3.8 FINISHES

- A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

## PART 4 - SCHEDULES

### 4.1 INSULATION SCHEDULES

- A. Furnish and install duct and piping insulation as specified above and in accordance with the schedules below. All insulation thicknesses and pipe sizes in the following tables are given in nominal inches. Where more than one type of allowable material or more than one type of field jacket is listed, the choice is contractor's option.
- B. Hot Surfaces: For piping, ductwork services denoted as 105°F or greater, all piping surfaces including but not limited to pipe, duct, fittings, valves of every kind, dampers, strainers, unions, steam traps, and other appurtenances shall be insulated to avoid potential for personnel injury via contact with hot surface.
- C. Cold Surfaces: For piping and ductwork surfaces operating below surrounding ambient temperature, all surfaces including but not limited to pipe, duct, fittings, valves of every kind, pumps, dampers, strainers, unions, and other appurtenances shall be insulated and shall include uninterrupted vapor barrier to avoid potential condensation.



DUCT INSULATION	Duct	Duct	Minimum	Allowable	Insulation	Field	Keyed
Service	Shape	Location	R-Value	Materials	Thickness	Jacket	Notes
Supply Air Service	Round	ICC,ICN	R-3.5	FGBK	1.50	---	(5)
		IEC,IEN	R-3.5	FGBK	1.50	AL	(3) (5)
	Rectangular	ICC,ICN	R-3.5	FGBK	1.50	---	(5)
		IEC,IEN	R-3.5	FGBD	1.50	---	(5)
		Outdoors	R-8	FGBD,	2.00	AL,SS	(5)
Outdoor Air Service (prior to being heated or cooled)	Round	ICC,ICN	R-3.5	FGBK	1.50	---	(5)
		IEC,IEN	R-3.5	FGBK	1.50	AL	(3) (5)
		Outdoors	---	---	---	---	
	Rectangular	ICC,ICN	R-3.5	FGBK	1.50	---	(5)
		IEC,IEN	R-3.5	FGBD	1.50	---	(5)
		Outdoors	---	---	---	---	
KEYED NOTES:							
<p>(1) Insulate only if the exhaust is routed to an energy-recovery device.</p> <p>(2) Insulate only between final isolation damper and penetration of building exterior.</p> <p>(3) The specified field jacket is required only if less than 84-inches AFF.</p> <p>(4) For boilers, furnaces, water heaters, and engine exhaust, if not factory-insulated.</p> <p>(5) Omit insulation if duct is expressly called out to be internally lined.</p> <p>(6) Thickness as required to achieve 2-hour fire rating.</p>							
LEGEND:							
ICC	Indoor, Concealed, in Conditioned space	CS	Calcium Silicate				
ICN	Indoor, Concealed, in Non-conditioned space	FRW	Fire-Rated Wrap				
IEC	Indoor, Exposed, in Conditioned space	AL	Aluminum				
IEN	Indoor, Exposed, in Non-conditioned space	SS	Stainless Steel				
FGBK	Fiberglass Insulation, 1.5-lb density, Blanket						
FGBD	Fiberglass Insulation, 1.5-lb density, Board						
FE	Flexible Elastomeric						

PIPE INSULATION	Temperature	Size	Location	Allowable	Thick-	Field	Keyed	
Services	Range °F	Range		Materials	ness	Jacket	Notes	
Coil condensate	below 60	¾ to 6	Indoors	FE	0.50	---		
		8 & up	Indoors	MF	0.50	PVC	(3)	
	above 105	All	All	MF	1.00	AL,SS	(2)	
Chilled water piping (supply and return)	40 and up	¾ to 1¼	Indoors	FE	1.00	---		
			Outdoors	FE	2.00	AL,SS		
		1½ to 6	Indoors	FE	1.50	---		
			Outdoors	FE	2.00	AL,SS		
		8 & up	Indoors	CG,MF	1.50	PVC	(3)	
			Outdoors	CG,PI,MF	2.00	AL,SS		
Heating Hot Water Piping (supply and return)  Steam Supply Steam Condensate Return	140 and  below	¾ to 1¼	Indoors	FE,MF	1.00	---		
		1½ & up	Indoors	FE,MF	1.50	---		
		Any	Outdoors	FE,MF	2.00	AL,SS		
	141-200	¾ to 1¼	Indoors	MF	1.50	---		
			Outdoors	MF	2.00	AL,SS		
		1½ & up	All	MF	2.00	AL,SS	(2)	
	201-250 HW, ≤15#Steam, & all SCR	¾ to 3½	All	MF	2.50	AL,SS	(2)	
		4 & up	All	MF	3.00	AL,SS	(2)	
	KEYED NOTES:							
	(1) <i>Insulate condenser water piping only if used as part of a water-side economizer, or if freeze-protected (e.g., heat-traced) outdoors.</i>							
(2) <i>The specified field jacket is required only if outdoors.</i>								
(3) <i>The specified field jacket is required on fittings only.</i>								
LEGEND:								
AFF Above Finished Floor				CG Cellular Glass				
FE Flexible Elastomeric				PI Polyisocyanurate				
MF Mineral Fiber				AL Aluminum				
SCR Steam Condensate Return				HW Hot Water				
PVC Polyvinyl Chloride				SS Stainless Steel				
				# psig				

END OF SECTION 23 0700

## SECTION 23 0900 - **CONTROL SYSTEMS**

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. University of Missouri Controls Specification.
- B. This section contains requirements for electric and digital control systems as indicated on the contract drawings.
- C. Contractor is responsible for providing, installing, and connecting all sensors, control valves, control dampers, electrical components, and all interconnecting electrical wiring between these devices and up to the Direct Digital Controller (DDC).
- D. DDC systems consist of Johnson Controls METASYS controllers. Contractor shall install owner provided control enclosures. Owner will provide and install controllers. After all equipment has been installed, wired and piped, owner will be responsible for all termination connections at the DDC controller's and for checking, testing, programming and start-up of the control system. Contractor must be on site at start-up to make any necessary hardware adjustments as required.
- E. Once each mechanical system is completely operational under the new control system, contractor shall make any final connections and adjustments. For controls renovation jobs, contractor shall remove all unused sensors, operators, panels, wiring, tubing, conduit, etc. Owner shall have the option of retaining any removed pneumatic controls.

#### 1.2 RELATED SECTIONS

- A. Drawings and general provisions of Contract, including General and Special Conditions apply to work of this section.

#### 1.3 QUALITY ASSURANCE

- A. Contractor's Qualifications:
  - 1. Contractor shall be regularly engaged in the installation of digital control systems and equipment, of types and sizes required. Contractor shall have a minimum of five years' experience installing digital control systems. Contractor shall supply sufficient and competent supervision and personnel throughout the project in accordance with General Condition's section 3.4.1 and 3.4.4.
- B. Codes and Standards:
  - 1. Electrical Standards: Provide electrical components of control systems which have been UL-listed and labeled, and comply with NEMA standards.
  - 2. NEMA Compliance: Comply with NEMA standards pertaining to components and devices for control systems.
  - 3. NFPA Compliance: Comply with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems" where applicable to controls and control sequences.

4. NFPA Compliance: Comply with NFPA 70 "National Electric Code."

#### 1.4 SUBMITTALS

- A. Shop Drawings: Submit shop drawings for each control system, containing the following information:
  1. Product data for each damper, valve, and control device.
  2. Schematic flow diagrams of system showing fans, pumps, coils, dampers, valves, and control devices.
  3. Label each control device with setting or adjustable range of control.
  4. Indicate all required electrical wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.
  5. Include written description of sequence of operation.
  6. Provide wiring diagrams of contractor provided interface and I/O panels.
  7. Provide field routing of proposed network bus diagram listing all devices on bus.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS AND EQUIPMENT

- A. Air Piping:
  1. Copper Tubing: Seamless copper tubing, Type M or L, ASTM B 88; wrought-copper solder-joint fittings, ANSI B16.22; except brass compression-type fittings at connections to equipment.
  2. Flex Tubing: Virgin Polyethylene non-metallic tubing, ASTM D 2737, with flame-retardant harness for multiple tubing. Use compression or push-on polyethylene fittings. Tubing used above plenum ceilings to be plenum rated per NFPA 90A. See section 3.1.b for locations where flex tubing can be used.
  3. Copper to polyethylene connections shall be compression barbed fittings or solder barbed fittings.
- B. Conduit and Raceway:
  1. Electrical Metallic Tubing: EMT and fittings shall conform to ANSI C80.3.
  2. Surface Metal Raceway and Fittings: Wiremold 500, Ivory, or approved equal.
  3. Flexible Metal Conduit: Indoors, per National Electric Code for connection to moving or vibrating equipment.
  4. Liquidtight Flexible Conduit: Outdoors, per National Electric Code for connection to moving or vibrating equipment.
- C. Control Valves: Provide factory fabricated electric control valves of type, body material, and pressure class as indicated on the drawings. Butterfly style control valves are not acceptable except for two position applications. Equip control valves with heavy-duty actuators, with proper shutoff rating for each individual application.
  1. Steam and Hot Water
    - a. Manufacturer: Do not allow KMC valves and manufacturers.
    - b. Water Service Valves: Equal percentage characteristics.
    - c. Steam Service Valves: Equal percentage characteristics.

- d. Single Seated Valves: Cage type trim, providing seating and guiding surfaces for plug on "top and bottom" guided plugs.
  - e. Valve Trim and Stems: Polished stainless steel.
  - f. Packing: Spring-loaded Teflon, self-adjusting.
  - g. Control valves should have a minimum 100 psi close-off rating for chilled water applications.
2. Hydronic Chilled Water and Heating Hot Water
- a. At minimum, hydronic control valves shall be pressure independent. High performing energy monitoring control valves may be considered depending on the project. The flow through the valve shall not vary more than +/- 5% due to system pressure fluctuations across the valve in the selected operating range. The control valve shall accurately control the flow from 1 to 100% full rated flow.
  - b. The valve bodies shall be of cast iron, steel or bronze and rated for 150 PSI working pressure. All internal parts shall be stainless steel, steel, Teflon, brass, or bronze.
  - c. DeltaP Valves manufactured by Flow Control Industries, Belimo, Danfoss Series, or approved equal.
  - d. The valves shall have pressure taps across the valve for measuring the pressure drop across the valve. The pressure taps shall have ½-inch extensions for accessibility.
  - e. Control valves shall be installed with unions or flanges as necessary for easy removal and replacement.
  - f. Valve Tag shall include the model number, AHU being served, design flow, and maximum flow for that valve.
  - g. The control valves shall be delivered preset to the scheduled design flow and should be capable of reaching 110% of the design flow to allow for field adjustment for capacity changes.
- D. Control Dampers: Ruskin CD-50 or approved equal.
- 1. Provide dampers with parallel blades for 2- position control.
  - 2. Provide opposed blades for modulating control.
  - 3. Dampers shall be low leakage design with blade and edge seals.
  - 4. Provide multiple sections and operators as required by opening size and sequence of operations, as indicated on the contract drawings.
- E. Electric Actuators: Johnson Controls, Bray, Belimo, TAC or approved equal. KMC actuators are not approved. Size electric actuators to operate their appropriate dampers or valves with sufficient reserve power to provide smooth modulating action or 2-position action as specified. Control signal shall be 0 to 10 VDC unless otherwise specified on drawings. Actuators with integral damper end switch are acceptable. For VAV reheat valves, actuators shall have a manual override capability to aid in system flushing, startup, and balancing.
- F. Air and Hot Water Electronic Temperature Sensors:
- 1. All electronic temperature sensors shall be compatible with Johnson METASYS systems.
  - 2. Sensors shall be 1,000 ohm platinum, resistance temperature detectors (RTDs) with two wire connections. Duct mounted sensors shall be averaging

- type. Contractor may install probe type when field conditions prohibit averaging type, but must receive permission from Owner's Representative.
3. Coordinate thermowell manufacturer with RTD manufacturer. Thermowells that are installed by the contractor, but are to have the RTD installed by owner, must be Johnson Controls Inc. series WZ-1000.
- G. Fan/Pump Status: Status points for fan or pump motors with a VFD must be connected to the terminal strip of the VFD for status indication.  
 Current switches: Current switches are required for fan and pump statuses that are not connected to a VFD. The switches must have an adjustable trip setpoint with LED indication and be capable of detecting broken belts or couplings. Units shall be powered by monitored line, UL listed and CE certified, and have a five year warranty.
1. Kele, Hawkeye or approved equal.
- H. Relays Used for Fan and Pump Start/Stop: Must have LED indication and be mounted externally of starter enclosure or VFD.
1. Kele, RIBU1C or approved equal.
- I. Power Supply Used to Provide Power to Contractor-Provided Control Devices: Shall have adjustable DC output, screw terminals, overload protection and 24 VAC and 24 VDC output.
1. Kele, DCPA-1.2 or approved equal.

## 2.2 FILTER PRESSURE GAUGE

- A. Description: Microprocessor type with LCD display, pushbutton auto-zero and span, bidirectional pressure and digital input; Setra Model MRG or approved equal.
1. Range: 0- to  $\pm 2.5$ -inch wg.
  2. Housing: Stainless steel with acrylic cover.
  3. Mounting bracket for surface mounting.
  4. Overpressure Rating: 10 psi.
  5. Accuracy:  $\pm 1\%$  of full scale throughout range.
  6. Output signal: 4-20 mA.
  7. Power Requirements: 30mA maximum (2 wire).
- B. Required Accessories: Static pressure connections, polyethylene tubing, conduit fitting for wiring, and mounting brackets.

## 2.3 ROOM PRESSURE MONITOR

- A. A room pressure monitor system shall be furnished and installed to measure and display the measured room pressurization independent of supply and exhaust flow volumes. The system shall ensure that the air pressure of the space is positive with respect to the corridor.
1. Unit shall be Triatek Model FMS-1655M.
    - a. Accuracy: 0.5% of full scale.
    - b. Range: + / - 0.2500" w.c.

- c. Output signal: 4-20 mA.
  - d. Power Requirements: 30 VA.
- B. Provide manufacturers step down isolation transformer.
  - C. The monitor shall be capable of displaying room mode and alarm status.
  - D. Local audible and visual alarms and relay contacts shall be enabled whenever either measured room pressure differential falls below its user configurable low alarm set point or rises above its user configurable high alarm set point, after a configurable delay. The primary, second and third pressure sensors shall have individual alarm set points for high and low alarms. A mute function shall temporarily silence the audible alarm for a user configured delay. Manual or automatic reset of the alarms shall be configurable.
  - E. The room pressure monitor shall have the ability to communicate with the building Energy Management Control System (EMCS) via BACnet® MS/TP communication protocols. Communication shall be native to the monitor device and not require an external interface or gateway.
  - F. Pressure monitors shall be flush mounted.

## PART 3 - EXECUTION

### 3.1 INSTALLATION OF CONTROL SYSTEMS

- A. General: Install systems and materials in accordance with manufacturer's instructions, roughing-in drawings and details shown on drawings.
- B. Control Air Piping:
  - 1. All control air piping shall be copper. Exception: Flexible Tubing may be used for a maximum of two (2) feet at connections to equipment except for steam control valves and inside control cabinets.
  - 2. Provide copper tubing with a maximum unsupported length of 3'-0".
  - 3. Pressure Test control air piping at 30 psi for 24 hours. Test fails if more than 5 psi loss occurs.
  - 4. Fasten flexible connections bridging cabinets and doors, neatly along hinge side, and protect against abrasion. Tie and support tubing neatly.
  - 5. Number-code or color-code tubing, except local individual room control tubing, for future identification and servicing of control system.
  - 6. All control tubing at control panel shall be tagged and labeled during installation to assist Owner in making termination connections at control panel.
  - 7. Provide pressure gages on each output device.
  - 8. Paint all exposed control tubing to match existing.
- C. Raceway: Raceway is to be installed in accordance with the National Electric Code. Use of flexible metal conduit or liquid-tight flexible conduit is limited to 36" to connect from EMT to devices subject to movement. Flexible raceway is not to be used to compensate for misalignment of raceway during installation.



- D. Control Wiring: Install control wiring in raceway, without splices between terminal points, color-coded. Install in a neat workmanlike manner, securely fastened. Install in accordance with National Electrical Code.
1. Install circuits over 25-volt with color-coded No. 12 stranded wire.
  2. Install electronic circuits and circuits under 25-volts with color-coded No. 18 stranded twisted shielded pair type conductor.
  3. N2 communications bus wire shall be 18 AWG, plenum rated, stranded twisted shielded, 3 conductor, with blue outer casing, described as 18-03 OAS STR PLNM NEON BLU JK distributed by Windy City Wire, constructed by Cable-Tek, or approved equivalent.
    - a. Metastat wiring shall be minimum 20 AWG, plenum rated, stranded, 8 conductor stranded wire.
  4. FC communications bus wire shall be 22 AWG, plenum rated, stranded twisted shielded, 3 conductor, with blue outer casing, described as 22-03 OAS STR PLNM NEON BLU JK distributed by Windy City Wire, constructed by Cable-Tek, or approved equivalent.
    - a. Network sensor wiring (SA Bus) shall be 22 gauge plenum rated stranded twisted wire, 4 conductor.
  5. All control wiring at control panel shall be tagged and labeled during installation to assist owner in making termination connections at control panel. Label all control wires per bid documents.
- E. All low voltage electrical wiring shall be run as follows:
1. Route electrical wiring in concealed spaces and mechanical rooms whenever possible.
  2. Provide EMT conduit and fittings in mechanical rooms and where indicated on drawings.
  3. Low voltage electrical wiring routed above acoustical ceiling is not required to be in conduit, but wire must be plenum rated and properly supported to building structure.
  4. Provide surface raceway, fittings and boxes in finished areas where wiring cannot be run in concealed spaces. Route on ceiling or along walls as close to ceiling as possible. Run raceway parallel to walls. Diagonal runs are not permitted. Paint raceway and fittings to match existing conditions. Patch/repair/paint any exposed wall penetrations to match existing conditions.
- F. All devices shall be mounted appropriately for the intended service and location.
1. Adjustable thermostats shall be provided with base and covers in occupied areas and mounted 48" above finished floor to the top of the device. Tubing and/or wiring shall be concealed within the wall up to the ceiling wherever possible. Surface raceway may only be used with approval of Owners Representative. Wall mounted sensors such as CO2, RH, and non-adjustable temperature sensors shall be mounted 54" above finished floor. Duct mounted sensors shall be provided with mounting brackets to accommodate insulation. Mounting clips for capillary tubes for averaging sensors are required.

2. All control devices shall be tagged and labeled for future identification and servicing of control system.
  3. All field devices must be accessible, or access panels must be installed.
- G. Install magnehelic pressure gage across each air handling unit filter bank. If the air handling unit has a prefilter and a final filter, two magnehelic pressure gages are required.

### 3.2 ADJUSTING AND START-UP

- A. Start-Up: Temporary control of Air Handling Units shall be allowed only if approved by the owner's representative to protect finishes, etc., AHUs may be run using caution with temporary controls installed by contractor early in the startup process. All safeties including a smoke detector for shut down must be operational. Some means of discharge air control shall be utilized and provided by the contractor such as a temporary temperature sensor and controller located and installed by the Contractor.
- B. The start-up, testing, and adjusting of digital control systems will be conducted by owner. Once all items are completed by the Contractor for each system, Contractor shall allow time in the construction schedule for owner to complete commissioning of controls before project substantial completion. This task should be included in the original schedule and updated to include the allotted time necessary to complete it. As a minimum, the following items are required to be completed by the Contractor for Owner to begin controls commissioning.
1. Process Control Network
    - a. The control boards and enclosures need to be installed in the mechanical rooms.
    - b. The fiber optic conduit and box for the process control network needs to be installed. Once in place, Owner needs to be contacted so the length of the owner provided fiber cable can be determined and ordered, if required. Coordinate with Owner to schedule the pull in and termination of the fiber cable. Power should be in place at that time. (Fiber for the process control network is required to allow metering of utilities prior to turn on.)
  2. VAVs-First Pass
    - a. Power, (FC bus), and control wire installed before owner can make first commissioning pass. First pass includes installation of VAV controller, termination of power, control and network communication wiring.
  3. Air Handlers
    - a. Prior to owner commissioning, at a minimum, the following items shall be complete: Power wiring, motor rotation check, fire/smoke dampers open, control wiring including all safeties, IO cabinet, air handler cleaned, and filters installed as required.
  4. VAVs-Second Pass
    - a. After the air handlers are running and under static pressure control and the heating water system is operating, a second pass can be made on the VAVs to download the control program and commission controllers to verify

the VAV dampers, thermostat, and reheat control valves are working properly.

5. Some balance work can be done alongside the control work as long as areas are mostly complete and all diffusers are in place.

### 3.3 CLOSEOUT PROCEDURES

- A. Contractor shall provide complete diagrams of the control system including flow diagrams with each control device labeled, a diagram showing the termination connections, and an explanation of the control sequence. The diagram and sequence shall be framed and protected by glass and mounted next to controller.
- B. Contractor shall provide as built diagram of network bus routing listing all devices on bus, once wiring is complete prior to scope completion.

END OF SECTION 23 0900

## SECTION 23 2113 – HYDRONIC PIPING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes pipe and fitting materials, joining methods, special-duty valves, and specialties for the following:
  - 1. Hot-water heating piping.
  - 2. Chilled-water piping.
  - 3. Condensate-drain piping.
  - 4. Air-vent piping.

#### 1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 20 0800 "Seismic Protection," Section 23 0100 "Basic Mechanical Requirements," and Section 23 0500 "Basic Mechanical Materials and Methods" all apply to the work of this Section as if fully repeated herein.
- C. The following Sections contain requirements that relate to this Section:
  - 1. Division 07 Section "Penetration Firestopping" for materials and methods for sealing pipe penetrations through fire and smoke barriers.
  - 2. Division 23 Section "Basic Mechanical Materials and Methods" for general piping materials and installation requirements, and for labeling and identifying hydronic piping.
  - 3. Division 23 Section "Hangers and Supports" for pipe supports, product descriptions, and installation requirements. Hanger and support spacing is specified in this Section.
  - 4. Division 23 Section "Valves" for general-duty gate, ball, and check valves.
  - 5. Division 23 Section "Meters and Gages" for thermometers and pressure gages.
  - 6. Division 23 Section "Hydronic Pumps" for pumps, motors, and accessories for hydronic piping.
  - 7. Division 23 Section "Control Systems" for temperature-control valves and sensors.

#### 1.3 DEFINITIONS

- A. The following definitions apply to the work of this Section. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for additional definitions.
  - 1. CWP: Cold working pressure (formerly WOG – Water, Oil, Gas working pressure).
  - 2. DZR Brass: Brass alloy containing not more than 15% zinc by weight.
  - 3. EPDM: Ethylene-propylene-diene terpolymer rubber.
  - 4. PTFE: Polytetrafluoroethylene.
  - 5. SWP: Steam working pressure.
  - 6. Pipe sizes used in this Specification are Nominal Pipe Size (NPS).
  - 7. Class 125: Minimum 125-psig (860-kPa) SWP and minimum 200-psig (1380-kPa) CWP ratings.

8. Class 150: Minimum 150-psig (1035-kPa) SWP and minimum 300-psig (2070-kPa) CWP ratings.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature:
  1. Hot-Water Heating Piping: 150 psig (1030 kPa) at 200°F (93°C).
  2. Chilled-Water Piping: 150 psig (1030 kPa) at 200°F (93°C).
  3. Condensate-Drain Piping: 150°F (66°C).
  4. Air-Vent Piping: 200°F (93°C).

#### 1.5 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 active flow-limiting valves.
  2. Air control devices.
  3. Hydronic specialties.
- B. Qualification Data: For Installer.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For air control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.

#### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications:
- B. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air/dirt separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- C. Comply with NFPA 70 – National Electrical Code. Do not route piping directly above electric panelboards and switchboards, or other prohibited locations.

#### 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 fitting pressure classes with products specified in related Sections.
- C. Coordinate installation of pipe sleeves for penetrations through floor assemblies. Coordinate with requirements for firestopping specified in Division 07 Section "Penetration Firestopping" for fire and smoke wall and floor assemblies.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Manual Air Vents:
    - a. Amtrol, Inc.
    - b. Armstrong Pumps, Inc.
    - c. Bell & Gossett; a Xylem Brand.
    - d. Taco.
  - 2. Strainers:
    - a. Armstrong Machine Works.
    - b. Eaton Filtration.
    - c. Hoffman Specialty ITT; Fluid Handling Div.
    - d. Metraflex Co.
    - e. Nibco Inc.
    - f. Spirax Sarco.
    - g. Watts Regulator Co.

### 2.2 PIPING MATERIALS

- A. General: Refer to Part 3 "Piping Applications" Article for applications of pipe and fitting materials, including a schedule of which types of piping to use in which application.

### 2.3 COPPER TUBE AND FITTINGS

- A. Drawn-Temper Copper Tubing: ASTM B88, Type K (ASTM B88M, Type B).
- B. DWV Copper Tubing: ASTM B306, Type DWV.
- C. Wrought-Copper Fittings and Unions: ASME B16.22.
- D. Solder Filler Metals: ASTM B32, 95-5 tin antimony.

### 2.4 STEEL PIPE AND FITTINGS

- A. Steel Pipe, NPS 2 (DN 50) and smaller: ASTM A53/A53M, black steel with plain ends; Type F (furnace butt-welded), Grade A, Schedule 40; unless otherwise indicated in Part 3 "Piping Applications" Article.
- B. Steel Pipe Nipples: ASTM A733, made of ASTM A53/A53M black steel, Grade B, Schedule 40; unless otherwise indicated in Part 3 "Piping Applications" Article.
- C. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150 or 300 as indicated in Part 3 "Piping Applications" Article.
- D. Malleable-Iron Unions: ASME B16.39; Class 150, 250, or 300 as indicated in Part 3 "Piping Applications" Article.

- E. Wrought-Steel Fittings: ASTM A234/A234M, wall thickness to match adjoining pipe. All elbows shall be long-radius type.

## 2.5 SPECIALTIES

- A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for joining materials, transition fittings, and dielectric fittings. Those requirements apply to the work of this Section as if fully reproduced herein.

## 2.6 GENERAL-PURPOSE VALVES

- A. Refer to Division 23 Section "Valves" for Gate, Check, and Ball Valves, whose requirements apply to the work of this Section as if fully reproduced herein.
- B. Refer to Division 23 Section "Control Systems" for Automatic Temperature-Control Valves, Actuators, and Sensors, whose requirements apply to the work of this Section as if fully reproduced herein.
- C. Refer to Part 3 "Valve Applications" Article elsewhere within this Section for applications of each type of valve and service.

## 2.7 AIR CONTROL DEVICES

- A. Manual Air Vents: Bronze body, nonferrous internal parts, operated via manual screwdriver or thumbscrew. NPS ½ (DN 15) inlet connection and NPS 1/8 (DN 6) discharge connection. CWP rating shall be 150 psig (1035 kPa) and rated operating temperature shall be 225°F (107 C).

## 2.8 HYDRONIC PIPING SPECIALTIES

- A. Y-Pattern Strainers, 2-inch and Smaller:
  - 1. Body (for use in Copper piping): ASTM B584 C84400 or ASTM B-62 C83600 bronze body, with threaded bronze cover and brass drain plug.
  - 2. Body (for use in Steel piping): ASTM A126, Class B, cast iron with threaded cap and bottom drain connection.
  - 3. End Connections: Threaded ends.
  - 4. Strainer Screen: 20-mesh, Type 304 stainless steel.
  - 5. Pressure and Temperature Rating: Same as piping in which it will be installed, as specified in Part 1 of this Section.
- B. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for Flexible Pipe Connectors, whose requirements apply to the work of this Section as if fully reproduced herein.

## PART 3 - EXECUTION

### 3.1 PIPING SCHEDULE OF APPLICATIONS

- A. Hot-water heating piping, Chilled-water piping, aboveground, NPS 2 (DN 50) and smaller, shall be Type K (C), drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

1. Contractor's Option: Schedule 40 steel pipe; Class 150, malleable-iron fittings; cast-iron flanges and flange fittings; and threaded joints will be acceptable.
- B. Cooling Coil Condensate-Drain Piping: Type DWV, drawn-temper copper tubing, wrought-copper fittings, and soldered joints; or Schedule 40 PVC plastic pipe and fittings and solvent-cemented joints.
- C. Air-Vent Piping: Same materials and joining methods as for piping specified for the service in which air vent is installed.

### 3.2 VALVE APPLICATIONS

- A. Install valves where indicated on Drawings and where indicated in Division 23 Section "Valves."
- B. Install specialty valves where indicated on Drawings.
- C. Install drain valves at all low points, and manual air vents at all high points, in mains, risers, branch lines and elsewhere as required for system drainage.
- D. Any valve that represents a termination or the end of a run (e.g., blowdown or drain valve, hose-end valve, etc.) shall be fitted with a permanent but removable cap, plug, or blind flange matching the valve construction, to minimize risk in the event the valve is accidentally opened under pressure.

### 3.3 PIPING INSTALLATIONS

- A. General: General piping installation is specified in Division 23 Section "Basic Mechanical Materials and Methods," whose requirements apply to the work of this Section as if fully repeated herein.
- B. Install drains, consisting of a tee fitting, NPS ¾ (DN 20) ball valve, and short NPS ¾ (DN 20) threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- C. In closed systems, install horizontal piping at a uniform grade of 0.2 percent upward in direction of flow.
- D. For cooling coil condensate-drain piping, install horizontal piping at a uniform grade of 1.0 percent downward in the direction of flow.
- E. Bull-head tees prohibited: Do not use tee fittings in such a way that the flow through the branch leg equals the sum of the flows through two main legs.
- F. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- G. Contractor has the option, without further approval from the Engineer, to install piping of larger (but not smaller) nominal diameter from that shown on the Drawings. For example, if 5-inch NPS is shown on the Drawings, contractor may furnish and install 6-inch NPS piping at no additional cost to the Owner; but may NOT furnish and install 4-inch NPS piping if 5-inch is indicated.



- H. Install branch connections to mains using tee fittings in main pipe, with the branch connected to the top of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.
- I. Changes of direction, branches, tees, etc. shall be accomplished with the appropriate factory or foundry fitting meeting the requirements of these specifications. Mechanically-formed extruded tee outlets or field-fabricated tee branches and/or elbows are not acceptable.
  - 1. Integrally Reinforced Forged Branch Outlet Fittings will be accepted only for pipe main sizes of 2½-inch and larger with a branch nominal diameter not greater than 50% of the run nominal diameter (not greater than a 4-inch branch for an 8-inch run, for example). Install per manufacturer's written instructions.
- J. All elbows shall be long-radius type.
- K. Install valves according to Division 23 Section "Valves."
- L. Install unions in piping NPS 2 (DN 50) and smaller, at final connections of equipment and elsewhere as indicated.
- M. Install strainers on inlet side of each control valve, in-line pump, and elsewhere as indicated. Install NPS ¾ (DN 20) nipple and ball valve in blowdown connection of strainers NPS 2 (DN 50) and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2 (DN 50).
- N. Install and anchor piping to allow for proper length and direction of expansion and contraction.
- O. Connect risers and branch connections to mains with at least five pipe fittings, including tee in main. Connect mains and branch connections to terminal units with at least four pipe fittings, including tee in main.
- P. Identify piping as specified in Division 23 Section "Basic Mechanical Materials and Methods."
- Q. Hang, support, and anchor all piping as specified in Division 23 Section "Hangers and Supports."
- R. Restrain all piping against seismic forces as specified in Division 20 Section "Seismic Protection."

### 3.4 PIPE JOINT CONSTRUCTION

- A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for joint construction requirements for soldered joints in copper tubing and threaded joints in steel piping.

### 3.5 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.

### 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, but outside the service area. For example, control valve shall be as close to hydronic coil as practical, but not within the coil pull space and/or access door swing space.
- C. Install ports for pressure gages and thermometers at coil inlet and outlet connections according to Division 23 Section "Meters and Gages."

### 3.7 FIELD QUALITY CONTROL

- A. Prepare hydronic piping according to ASME B31.9 and as follows:
  - 1. Leave joints uninsulated and exposed for examination during test.
  - 2. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
  - 3. 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.
- 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. Do not pressure test with air.
  - 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 "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
  - 5. Minimum duration of test shall be four (4) hours. During the final hour of the hydrostatic test, 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. Inspect air vents at high points of system and determine if all are installed and operating freely, bleed air completely (manual type).
  - 4. Set temperature controls so all coils are calling for full flow.
  - 5. Verify lubrication of motors and bearings.

### 3.8 CLEANING AND ADJUSTING

- A. Mark calibrated nameplates of pump discharge valves after hydronic system balancing has been completed, to permanently indicate final balanced position.
- B. Flush hydronic piping systems with clean water. Remove and clean or replace strainer screens. After cleaning and flushing hydronic piping systems, but before balancing, remove disposable fine-mesh strainers in pump suction diffusers.

END OF SECTION 23 2113

## SECTION 23 3113 – METAL DUCTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes metal ducts and plenums for supply, outside, and exhaust air-distribution systems in pressure classes from minus 2- to plus 10-inch wg (minus 500 to plus 2500 Pa). Metal ducts include the following:
1. Single-wall rectangular ducts and fittings.
  2. Single-wall round ducts and fittings.
  3. Sheet metal materials.
  4. Sealants and gaskets.
  5. Hangers and supports.
  6. Seismic-restraint devices.

#### 1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 20 0800 "Seismic Protection," Section 23 0100 "Basic Mechanical Requirements," and Section 23 0500 "Basic Mechanical Materials and Methods" all apply to the work of this Section as if fully repeated herein.
- C. The following Sections contain requirements that relate to this Section:
1. Division 07 Sections "Penetration Firestopping" for fire-resistant sealants for use around duct penetrations and fire-damper installations in fire-rated floors, partitions, and walls.
  2. Division 23 Section "Mechanical Insulation."
  3. Division 23 Section "Duct Accessories" for dampers, duct-mounting access doors and panels, and turning vanes.
  4. Division 23 Section "Air Terminals" for temperature control terminal units.
  5. Division 23 Section "Diffusers, Registers and Grilles."
  6. Division 23 Section "Control Systems" for automatic control dampers and actuators.
  7. Division 23 Section "Testing, Adjusting and Balancing" for air balancing and final adjusting of manual volume dampers.

#### 1.3 DEFINITIONS

- A. Thermal Conductivity and Apparent Thermal Conductivity (k-Value): As defined in ASTM C168.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Duct system design, as indicated, has been used to select size and type of air-moving and distribution equipment and other air system components. Changes to layout or configuration of duct system must be specifically approved in writing by the design professional. Accompany requests for layout modifications with calculations showing

that proposed layout will provide original design results without increasing system total pressure.

- B. Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA *HVAC Duct Construction Standards – Metal and Flexible* and performance requirements and design criteria indicated in Part 3 of this Section.
- C. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA *HVAC Duct Construction Standards – Metal and Flexible* and SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems." Seismic force factors are specified in Division 20 Section "Seismic Protection."
- D. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2016.

#### 1.5 SUBMITTALS

- A. Product Data: For each type of the following products:
  - 1. Liners and adhesives.
  - 2. Sealants and gaskets.
  - 3. Seismic-restraint devices.
  - 4. Manufactured ductwork and duct fittings (if applicable).
  - 5. MSDS (Material Safety Data Sheet) for each adhesive and sealant furnished.
  - 6. Sheet metal thicknesses.
  - 7. Joint and seam construction and sealing.
  - 8. Reinforcement details and spacing.
  - 9. Materials, fabrication, assembly, and spacing of hangers and supports.
- B. Coordination Drawings: Comply with Division 23 Section "Basic Mechanical Requirements" for Coordination Drawings. Include reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on 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 and ceiling suspension assembly members.
  - 3. Other systems installed in same space as ducts.
  - 4. Structural members to which duct will be attached.
  - 5. Size and location of initial access modules for acoustical tile.
  - 6. Ceiling- and wall-mounting access doors and panels required to provide access to dampers and other operating devices.
  - 7. Penetrations of smoke barriers and fire-rated construction.
  - 8. Ceiling-mounting items and/or items penetrating finished ceiling, including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
- C. Field quality-control test reports: Indicate and interpret test results for compliance with performance requirements.

- D. Record Drawings: Indicate actual routing, fitting details, reinforcement, support, and installed accessories and devices.

#### 1.6 QUALITY ASSURANCE

- A. NFPA Compliance: Comply with NFPA 90A-2018 *Standard for the Installation of Air Conditioning and Ventilating Systems*.
- B. AMCA Compliance: All spiral ducts shall bear the AMCA Certified Ratings Program seal for Air Leakage.
- C. ASHRAE Compliance: Applicable requirements in ASHRAE Standard 62.1-2016, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."
- D. ASHRAE Compliance: Applicable requirements in ASHRAE Standard 90.1-2016, Section 6.4.4 - "HVAC System Construction and Insulation."

#### 1.7 REFERENCES

- A. ANSI/SMACNA Standard 001-2008 *Seismic Restraint Manual; Guidelines for Mechanical Systems*, as published by the Sheet Metal and Air Conditioning Contractors National Association. 3<sup>rd</sup> ed. Chantilly, VA: SMACNA, 2008. All references to this document throughout this Section refer to this specific edition.
- B. ANSI/SMACNA Standard 006-2006 *HVAC Duct Construction Standards – Metal and Flexible*, as published by the Sheet Metal and Air Conditioning Contractors' National Association. 3<sup>rd</sup> ed. Chantilly, VA: SMACNA, 2005. All references to this document throughout this Section refer to this specific edition.
- C. ANSI/SMACNA Standard 016-2012 *HVAC Air Duct Leakage Test Manual*, as published by the Sheet Metal and Air Conditioning Contractors' National Association. 2<sup>nd</sup> ed. Chantilly, VA: SMACNA, 2012. All references to this document throughout this Section refer to this specific edition.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver sealant and firestopping materials to site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.
- B. Store and handle sealant and firestopping materials according to manufacturer's written recommendations.
- C. Shipping ductwork.
  - 1. All ductwork and accessories shipped from a fabrication shop shall be shipped in an enclosed trailer or enclosed truck to protect from damage, dirt, and moisture during transit.
- D. Handling ductwork.
  - 1. Ductwork shall not be placed on the ground when moving or unloading.

2. Ductwork shall be placed directly in storage vans or within the building as it is unloaded, no exceptions.
  3. Ductwork shall be moved on carts or dollies.
  4. Ductwork that is wrapped shall not be dragged across the floor as it can damage the seals.
- E. Storing ductwork.
1. Ductwork delivered to the site should be installed as soon as possible.
  2. Care shall be taken to schedule only enough material on site for the immediate workload.
  3. Ductwork stored on site must be enclosed in vans or inside the building at least 4" above the floor to avoid damage from weather or spills.
  4. Openings shall be covered at all times.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Fibrous-Glass Duct Liner:
    - a. CertainTeed Corporation "ToughGard."
    - b. Ductmate Industries, Inc. "PolyArmor" (polyester duct liner alternative)
    - c. Knauf Fiber Glass GmbH "Duct Liner E-M."
    - d. Johns Manville Corporation "Permacote Linacoustic."
    - e. Owens-Corning Fiberglas Corporation "Aeroflex Plus."
  2. Factory Pre-Insulated Duct Systems:
    - a. Kingspan Insulation Ltd. (indoor ducts only)
    - b. Thermaduct, LLC (outdoor ducts).
    - c. or approved equal.
  3. Field-Applied Duct Sealant Materials:
    - a. Ductmate, Inc.
    - b. H.B. Fuller Construction Products Inc. (Childers and/or Foster brands)
    - c. Hardcast, Inc.
    - d. McGill Air Seal Corporation.
  4. Optional Manufactured Duct Slide-on Flange System:
    - a. Ductmate, Inc.
    - b. Nexus Inc.
    - c. Ward Industries, Inc.
  5. Optional Round Duct Coupling System:
    - a. Lindab, Inc. "Spirosafe"
    - b. Sheet Metal Connectors, Inc.

- c. Spiramir Corp.
- d. Stamped Fittings Inc. "The Edge"

## 2.2 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with *SMACNA 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. Sheet Gage: SMACNA standards notwithstanding, no material thinner than 26-gage is permitted for spiral-seam round duct, and no material thinner than 24-gage is permitted for all other ducts.
- C. Galvanized Sheet Steel: Comply with ASTM A653 / A653M.
  - 1. Galvanized Coating Designation: G60 (Z180) or G90 (Z275).
  - 2. Finishes for Surfaces Exposed to View: Mill-phosphatized.
- D. Reinforcement Shapes and Plates: ASTM A36 / A36M, steel plates, shapes, and bars; black and galvanized. 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: Comply with Articles 2.5 through 2.9, including all accompanying Tables and Figures, of the *SMANCA HVAC Duct Construction Standards*.

## 2.3 DUCT LINER (RETURN AIR TRANSFER GRILLES AND TRANSFER DUCT ONLY)

- A. Fibrous-Glass Liner: ASTM C1071 flexible bonded mat of glass fiber; surfaces exposed to airstream shall be coated to prevent erosion of glass fibers. Comply with NFPA 90A and with NAIMA AH124.
  - 1. Polyester Duct Liner: Hypoallergenic polyester material webbed into a thermal blanket, then bonded with an aluminum-foil, fiberglass-reinforced scrim (FSK) with kraft-paper backing facing the airstream.
- B. Thickness: 1-inch (25 mm).
- C. Density: 1½-pound
- D. Thermal Conductivity (k-Value): Not more than 0.26 at 75°F (0.037 at 24°C) mean temperature per ASTM C518.
- E. Moisture Resistance: Not more than 3% by weight at 120°F, 95% relative humidity. Insulation shall not support or promote mold or fungus growth per UL 181, ASTM C665, and ASTM G21 tests.
- F. Performance: Rated for 4000 fpm, 150°F air temperature. Sound absorption coefficients per ASTM C423 Type "A" mounting shall be as follows:
  - 1. 125 Hz Octave Band: 0.10
  - 2. 250 Hz Octave Band: 0.25



3. 500 Hz Octave Band: 0.50
  4. 1000 Hz Octave Band: 0.70
  5. 2000 Hz Octave Band: 0.82
  6. 4000 Hz Octave Band: 0.83
  7. NRC: 0.60
- G. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E84.
- H. Liner Adhesive: Water based duct liner adhesive equal to Foster 85-60 and/or Childers CP-127. Comply with NFPA 90A and with ASTM C916.
- I. Mechanical Fasteners: Galvanized steel suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in duct.
1. Tensile Strength: Indefinitely sustain a 50-lb- (23-kg-) tensile, dead-load test perpendicular to duct wall.
  2. Fastener Pin Length: As required for thickness of insulation and without projecting more than 1/8-inch (3 mm) into airstream.
  3. Adhesive for Attaching Mechanical Fasteners: Comply with fire-hazard classification of duct liner system.

#### 2.4 SEALANT MATERIALS

- A. Two-Part Sealing System: Woven-fiber tape impregnated with gypsum mineral compound and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal; Hardcast® Two-Part Sealing System, Uni-Cast® by McGill AirSeal Corporation, or equal.
- B. One-Part Sealing System: Flexible, adhesive sealant, fiber-reinforced, resistant to UV light when cured, UL 723 listed, and complying with NFPA requirements for Class 1 ducts. Examples of acceptable products include Uni-Mastic 181 by McGill, Foster 32-19, and Childers CP-146.
- C. Water-Based Seam Sealant: Flexible, adhesive sealant, resistant to UV light when cured, UL 723 listed, and complying with NFPA requirements for Class 1 ducts.
- D. Formed-on Duct Connectors: Flange shop roll-formed onto edge of ductwork, with corner closures, cleats and gaskets for seal; TDC or TDF constructed per SMACNA T-25a or T-25b.
1. Flanged Joint Mastic: One-part, acid-curing, silicone, elastomeric joint sealant complying with ASTM C920, Type S, Grade NS, Class 25, Use O.
  2. Flange Gaskets: Butyl rubber or EPDM polymer with polyisobutylene plasticizer.
  3. Contractor's Option: Proprietary manufactured slide-on duct connectors by Ductmate, Ward, or Nexus meeting the above requirements will be accepted wherever formed-on duct connectors are required by these specifications.

#### 2.5 RECTANGULAR DUCT FABRICATION

- A. General: Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA *HVAC Duct Construction Standards – Metal and*

*Flexible.* Comply with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, deflection limits, and joint types and intervals, except where more stringent requirements are specified herein.

- B. All sheet metal shall be a minimum of 24-gage thickness in any case. Use 24-gage sheet metal where SMACNA allows thinner material.
- C. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure classification.
- D. Materials: Free from visual imperfections such as pitting, seam marks, roller marks, stains, and discolorations.
- E. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches (480 mm) and larger and 0.0359-inch (0.9 mm) thick or less, with more than 10 sq. ft. (0.93 sq. m) of unbraced panel area, unless ducts are lined.
- F. Pressure Classification: See Schedule in Part 3 of this Section.
- G. Seal Classification: See Schedule in Part 3 of this Section.
- H. Longitudinal Seams: Contractor's choice of Pittsburgh lock (SMACNA Figure 2-2 Type L-1) or Button Punch Snap Lock (SMACNA Figure 2-2 Type L-2) shall be used on all longitudinal seams. See "Seam and Joint Sealing" in Part 3 of this Section for further requirements.
- I. Contractor is free to alter the indicated sizes of rectangular duct to suit field conditions, provided that revised size is selected for friction loss no greater than that of indicated size. No prior approval by the Engineer is required for equal-friction duct size changes unless proposed size has an aspect ratio greater than 4 to 1.
- J. All changes of direction shall be fabricated as elbows in accordance with SMACNA Figure 4-2 except that RE-4, RE-9 and RE-10 are prohibited. RE-6 is limited to a change-of-direction angle of 45 degrees or less.
- K. Divided flow branches shall be Type 1 or Type 2 per SMACNA Figure 4-5. Type 3 divided flow branches are permitted only where expressly shown. Seek Engineer's approval of Type 3 where space and/or layout clearances prohibit Type 1 or Type 2.
- L. Branch connections shall be per SMACNA Figure 4-6, except that straight taps are not permitted on any ducts 2-inch pressure class or above. Straight-tap "spin-in" fittings are permitted on ½-inch and 1-inch pressure class ductwork only.
- M. Offsets and transitions shall be per SMACNA Figure 4-7, except that offset Type 2 (mitered) is limited to an angle of 45° or less.
- N. Fittings at obstructions shall be per SMACNA Figure 4-8, except that Figure D is not permitted. Use Figure 4-8.B in lieu of Figure 4-8.D. Seek Engineer's approval of Figure 4-8.D where space and/or layout clearances prohibit use of Figure 4-8.B.

## 2.6 ROUND DUCT AND FITTING FABRICATION

- A. Contractor's Option: The contractor is permitted to furnish spiral lock-seam round ductwork anywhere rectangular duct is indicated, provided the Contractor's coordination drawings demonstrate that adequate ceiling clearances and space required by other trades will permit round ductwork. If this option is chosen, round duct sizes shall be selected by the Contractor according to "equal friction" with respect to the rectangular sizes shown.
- B. Round, Spiral Lock-Seam Ducts: Fabricate supply ducts of galvanized steel according to SMACNA *HVAC Duct Construction Standards – Metal and Flexible* except that 26-gage is the thinnest material acceptable.
- C. Longitudinal-seam round ducts ("stovepipe") of a minimum 24-gage thickness, will be permitted on ½-inch and 1-inch pressure classifications only; and only if the Seal Class specified in Part 3 of this Section can be achieved.
- D. 90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA *HVAC Duct Construction Standards – Metal and Flexible*, with metal thicknesses specified for longitudinal-seam straight ducts.
- E. Diverging-Flow Fittings: Fabricate with reduced entrance to branch taps and with no excess material projecting from fitting onto branch tap entrance.
- F. Fabricate elbows using die-formed, gored, pleated, or mitered construction. Bend radius of die-formed, gored, and pleated elbows shall be 1½ times duct diameter. Adjustable-angle elbow fittings are not permitted. Unless elbow construction type is indicated, fabricate elbows as follows:
  - 1. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA *HVAC Duct Construction Standards – Metal and Flexible* unless otherwise indicated.
  - 2. 90-Degree, 2-Piece, Mitered Elbows: Use only if approved by the Engineer where space restrictions do not permit using radius elbows. Fabricate with turning vanes.
  - 3. Round Elbows 8 Inches (200 mm) and Less in Diameter: Fabricate die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30, 45, 60, and 90 degrees only. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
  - 4. Round Elbows 9 through 14 Inches (225 through 355 mm) in Diameter: Fabricate gored or pleated elbows for 30, 45, 60, and 90 degrees unless space restrictions require mitered elbows. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
  - 5. Round Elbows Larger Than 14 Inches (355 mm) in Diameter and All Flat-Oval Elbows: Fabricate gored elbows unless space restrictions require mitered elbows.

## 2.7 FACTORY PRE-INSULATED DUCT AND FITTINGS

- A. Contractor's Option: For any ductwork specified to be field-insulated as identified in Division 23 Section "Mechanical Insulation," the contractor shall be granted the option to install factory pre-insulated ductwork in lieu thereof, as specified in this sub-section.
- B. To be considered acceptable, the factory pre-insulated duct system shall meet the same performance requirements specified for each application of traditional ductwork

and duct insulation specified herein and in Division 23 Section "Mechanical Insulation," including but not limited to the following characteristics:

1. R-value and thermal conductivity.
  2. UL-723 25/50 Flame/Smoke rating.
  3. UL-181 Class I air duct compliance.
  4. Frictional losses, pressure classes, temperature, and velocity limits.
  5. Air leakage class and seal class ratings.
  6. CFC/HCFC-free and zero Ozone Depletion Potential requirements.
- C. The factory pre-insulated duct system shall include rigid phenolic insulation panels of minimum 29 psi (200 kPa) compressive strength. The rigid phenolic insulation panels shall comprise a closed-cell insulation core, auto-adhesively bonded on both sides to a 1 mil (25 micron) aluminum foil facing, reinforced with a 0.2-inch (5 mm) glass scrim, providing a 0.02-perm water vapor transmission rating.
- D. All other components required for the fabrication of the factory pre-insulated duct system including, but not limited to, the silicone sealant, contact adhesive, aluminum tape, self-adhesive gasket, ductwork reinforcements, closures, connectors and flanges shall be as approved and/or supplied by the manufacturer.
- E. The fabrication and installation of the factory pre-insulated duct system shall be carried out by a fabricator and installer that has successfully completed a specialist training course provided by the manufacturer.

## 2.8 HANGERS AND SUPPORTS

- A. General: Support all ductwork in accordance with Chapter 5 of *SMACNA HVAC Duct Construction Standards – Metal and Flexible* except where more stringent requirements are specified herein.
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
1. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches (100 mm) thick.
  2. Exception: Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.
- C. Hanger Materials: Galvanized sheet steel or threaded steel rod. Primary duct hanger systems consisting of cable or wire are not acceptable; use steel angles, straps, and/or threaded rods.
1. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
  2. Strap and Rod Sizes: Comply with *SMACNA HVAC Duct Construction Standards – Metal and Flexible* for steel sheet width and thickness and for steel rod diameters.
- D. All supporting material surfaces in direct contact with supported ductwork or duct insulation, as applicable) shall be designed to maintain a minimum of one-inch (25 mm) contact width along full length of contact.

- E. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- F. Trapeze and Riser Supports: Steel shapes complying with ASTM A36.
  - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

## 2.9 SEISMIC-RESTRAINT DEVICES

- A. General Requirements for Restraint Components: As defined in Division 20 Section "Seismic Protection."
- B. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
- C. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.
- D. Restraint Cables: ASTM A603, galvanized-steel cables with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips. Use ASTM A492, stainless-steel cables where attached to aluminum or stainless steel ducts.
- E. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod. Reinforcing steel angle clamped to hanger rod is also acceptable.
- F. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E488.

## PART 3 - EXECUTION

### 3.1 DUCT PRESSURE CLASS SCHEDULE

- A. Static-Pressure Classes: Unless otherwise indicated, construct ducts according to the following:
  - 1. Variable volume Supply Ducts upstream of VAV boxes: 3-inch wg (750 Pa).
  - 2. Variable volume Supply Ducts downstream of VAV boxes: 1-inch wg (250 Pa).
  - 3. Return Ducts: 2-inch wg (500 Pa), positive or negative pressure as applicable.
  - 4. Transfer Ducts: 1/2-inch wg (125 Pa).
  - 5. Exhaust Ducts: 2-inch wg (500 Pa), positive or negative pressure as applicable.

### 3.2 DUCT MATERIAL SCHEDULE

- A. All ducts shall be galvanized steel.

### 3.3 DUCT INSTALLATION

- A. Construct and install ducts according to *SMACNA HVAC Duct Construction Standards – Metal and Flexible* unless otherwise indicated.
- B. Install round ducts in lengths not less than 12 feet (3.7 m) unless interrupted by fittings.
- C. Install ducts with fewest possible joints. Install fabricated fittings for changes in directions, size, and shape and for connections.
- D. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12-inches (300 mm), with a minimum of 3 screws in each coupling.
- E. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- F. Install ducts with a clearance of 1-inch (25 mm), plus allowance for insulation thickness.
- G. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.
- H. Install duct accessories as required by Division 23 Section “Duct Accessories.”
- I. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.
- J. Drawings are diagrammatic in nature. Not necessarily all fittings and offsets are shown. Provide all required fittings and offsets as required by field conditions and coordination with the work of other trades, whether specifically shown or not, for a complete and functional installation.
- K. Seal all joints and seams. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws.
- L. Electrical Equipment Spaces: Route ducts to avoid passing through transformer vaults and electrical equipment spaces and enclosures.
- M. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls and are exposed to view, conceal spaces between construction openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap openings on 4 sides by at least 1½ inches (38 mm).
- N. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire dampers, sleeves, and firestopping sealant. Fire and smoke dampers are specified in Division 23 Section “Duct Accessories.” Firestopping materials and installation methods are specified in Division 07 Section “Penetration Firestopping.”

- O. Install ducts with hangers and braces designed to withstand, without damage to equipment, seismic forces as further described in Division 20 Section "Seismic Protection."
- P. Protect duct interiors from the elements and foreign materials throughout construction. Follow SMACNA's "Duct Cleanliness for New Construction." Deliver ducts with shop-applied impervious protective covering over all open ends. Maintain protective end coverings through shipping, storage, and handling to prevent entrance of dirt, debris, and moisture. As ductwork is installed, remove protective end covering as each successive segment is connected, but with protective end covering maintained over open ends remaining exposed. Contractor to ensure that protective end covers are installed on ductwork at the end of each workday or when work is suspended for any length of time, i.e. breaks, lunch, etc.

#### 3.4 SEAM AND JOINT SEALING SCHEDULE

- A. General: Ducts noted as welded in the Duct Material Schedule above shall be made liquid-tight with all joints and seams full-penetration welded continuously along the entire length of the seam or joint. Otherwise, seal duct seams and joints according to the duct pressure class indicated and as described in *SMACNA HVAC Duct Construction Standards – Metal and Flexible* except where more stringent requirements are specified herein.
- B. Seal externally insulated ducts before insulation installation.
- C. Seal Class Schedule: Seal Class A and Leakage Class 6 is required for all ducts except as noted below.
  - 1. Spiral lock-seams need not be sealed.
  - 2. Transfer air ducts and transfer air boots need not be sealed.
- D. Rectangular Duct: Sealant materials and methods shall be at contractor's option, chosen from among the products specified in Part 2 of this Section; provided that the above seal class and leakage class schedule is met.
- E. Round Duct: Transverse joints shall be made with a SMACNA RT-1 interior slip coupling beaded at center, fastened to duct with screws; in addition, apply Two-Part Sealing System continuously around exterior side of joint.
  - 1. Contractor's Option: Furnish prefabricated round duct connection system consisting of self-sealing gasketed fittings. Round duct joints made with this type of fitting do not require the additional sealant specified above, provided that specified seal class is achieved.

#### 3.5 HANGING AND SUPPORTING

- A. Install rigid round and rectangular metal duct with support systems indicated in *SMACNA HVAC Duct Construction Standards – Metal and Flexible*.
- B. Support horizontal ducts within 24-inches (600 mm) of each elbow and within 48-inches (1200 mm) of each branch intersection.

- C. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.
- D. Install powder-actuated concrete fasteners after concrete is placed and completely cured. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4-inches (100 mm) thick.
- E. Repair any building insulation or building fireproofing materials, whether new or existing, that are removed or scraped away in order to attach hangers and supports, so as to maintain an equivalent insulation or fire rating as existed without said hanger or support attachment.
- F. Provide seismic bracing and restraints as further described in Division 20 Section "Seismic Protection."

### 3.6 CONNECTIONS

- A. Make connections to equipment with flexible connectors according to Division 23 Section "Duct Accessories."
- B. Comply with *SMACNA HVAC Duct Construction Standards – Metal and Flexible* for branch, outlet and inlet, and terminal unit connections.

### 3.7 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections according to *SMACNA's HVAC Air Duct Leakage Test Manual* and prepare test reports:
  1. 25% of all indoor ducts if design pressure rating is 3-inch w.g. or greater.
- B. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
- C. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If pressure classes are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing.
- D. Maximum Allowable Leakage: Comply with requirements for Leakage Class 6.
- E. Remake leaking joints and retest until leakage is equal to or less than maximum allowable.

### 3.8 CLEANING NEW SYSTEMS

- A. Ductwork systems shall be installed at the site to maintain "shop" or "mill" (free of mill oil) conditions. The ductwork shall be cleaned as necessary to maintain these conditions.
- B. Clean all interior surfaces of ductwork upon installation by removing surface contaminants and deposits with 20% Isopropyl alcohol.



- C. Interior surfaces must be dust free and exterior surfaces must be free of foreign substances.
- D. Cleanliness Verification:
  - 1. Visually inspect metal ducts for contaminants.
  - 2. Where contaminants are discovered, re-clean and reinspect ducts.

END OF SECTION 23 3113

## SECTION 23 3300 – DUCT ACCESSORIES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Manual volume dampers.
  - 2. Automatic control dampers.
  - 3. Combination fire/smoke dampers.
  - 4. Turning vanes.
  - 5. Duct-mounted access doors.
  - 6. Flexible connectors.
  - 7. Duct accessory hardware.

#### 1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 20 0800 "Seismic Protection," Section 23 0100 "Basic Mechanical Requirements," and Section 23 0500 "Basic Mechanical Materials and Methods" all apply to the work of this Section as if fully repeated herein.
- C. The following Sections contain requirements that relate to this Section:
  - 1. Division 23 Section "Control Systems" for actuators associated with automatic control dampers.
  - 2. Division 26 Section "Fire Alarm Systems" for duct-mounted fire detectors.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

#### 1.4 QUALITY ASSURANCE

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
- B. Comply with AMCA 500-D testing for damper rating. All manufactured dampers of every type shall bear the AMCA Certified Ratings Program seal for Air Performance, Air Leakage, and Efficiency.

#### 1.5 REFERENCED STANDARDS

- A. Sheet Metal and Air Conditioning Contractors' National Association. *HVAC Duct Construction Standards – Metal and Flexible*. 3rd ed. Chantilly, VA: SMACNA, 2005.

## 1.6 EXTRA MATERIALS

- A. Furnish extra fusible links that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Furnish quantity equal to 10 percent of amount installed, but not less than two (2).

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. HVAC Dampers (all types):
    - a. Air Balance Inc.; a division of Mestek, Inc.
    - b. Greenheck Inc.
    - c. Nailor Industries Inc.
    - d. Pottorff; a division of PCI Industries, Inc.
    - e. Ruskin Company.
    - f. Vibro-Acoustics.
  - 2. Turning Vanes:
    - a. Ductmate Industries, Inc.
    - b. DuroDyne Inc.
    - c. Metalaire, Inc.
    - d. Semco Incorporated.
    - e. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
  - 3. Duct-Mounted Access Doors:
    - a. American Warming and Ventilating; a division of Mestek, Inc.
    - b. Cesco Products; a division of Mestek, Inc.
    - c. Ductmate Industries, Inc.
    - d. Flexmaster U.S.A., Inc.
    - e. Greenheck Fan Corporation.
    - f. McGill AirFlow LLC.
    - g. Nailor Industries Inc.
    - h. Pottorff; a division of PCI Industries, Inc.
    - i. Ventfabrics, Inc.
    - j. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
    - k. Ruskin Company.
  - 4. Flexible Connectors:
    - a. Ductmate Industries, Inc.
    - b. Duro Dyne Inc.
    - c. JP Lamborn Co.
    - d. Ventfabrics, Inc.
    - e. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

## 2.2 MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A653/A653M and having G60 (Z180) or G90 (Z275) coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.
- C. Minimum Thickness: All sheet steel used on this project shall be a minimum of 24-gage thickness, and all aluminum sheets shall be a minimum of 0.04-inch thickness, regardless of whether or not SMACNA standards permit thinner gage material.
- 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: Comply with Articles 2.5 through 2.9, including all accompanying Tables and Figures, of the SMANCA HVAC Duct Construction Standards.

## 2.3 MANUAL VOLUME DAMPERS

- A. Manual volume dampers shall be standard leakage rating, with linkage outside airstream, suitable for horizontal or vertical applications. Volume dampers may be factory-manufactured or contractor-fabricated per SMACNA Fig. 7-4/7-5.
- B. Material: Match material options throughout this subsection to the material of adjacent ductwork. For duct material, refer to Division 23 Section "Metal Ducts."
- C. Frames: Hat-shaped channels with mitered and welded corners, flanges for attaching to walls, and flangeless frames for installing in ducts.
  - 1. Galvanized-steel, 16-gage or 0.064-inch (1.62-mm) minimum thickness, for use in galvanized steel ducts.
  - 2. The above requirements may be reduced to 20-gage for round dampers installed in round ducts.
- D. Blades: Multiple-blade; single-blade if duct dimension is 12-inch or less in the direction perpendicular to damper axis. Parallel or opposed-blade design (contractor's choice, unless a specific type is indicated). Stiffen damper blades for stability.
  - 1. Galvanized-steel, 16-gage or 0.064-inch (1.62 mm) thick, for use in galvanized steel ducts.
  - 2. The above requirements may be reduced to 20-gage for round dampers installed in round ducts.
- E. Blade Axles: Galvanized steel, aluminum, or stainless steel, as required to match blade material. Dampers shall have axles full length of damper blades, and bearings at both ends of operating shaft.

- F. Bearings: Oil-impregnated bronze, molded synthetic, and stainless-steel sleeve-type are acceptable.
- G. Tie Bars and Brackets: Galvanized steel or aluminum.
- H. Jackshaft:
  1. Size: 1-inch (25-mm) 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.
- I. Damper Hardware:
  1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- (2.4-mm-) thick zinc-plated steel, and a 3/4-inch (19-mm) hexagon locking nut.
  2. Include center hole to suit damper operating-rod size.
  3. Include elevated platform for insulated duct mounting.

## 2.4 AUTOMATIC CONTROL DAMPERS

- A. Refer to specification section 230900 "Control Systems".

## 2.5 COMBINATION FIRE AND SMOKE DAMPERS

- A. General Requirements: Dynamic; rated and labeled according to UL 555 and UL 555S by an NRTL. Low-leakage rating, with linkage outside airstream. Subject to compliance with requirements, an example of an acceptable product is Ruskin Model FSD-36.
- B. Leakage Rating: Class II.
- C. Closing rating in ducts up to 4-inch wg (1-kPa) static pressure class and minimum 2000-fpm (10-m/s) velocity.
- D. Fire Rating: 1½ hours.
- E. Heat-Responsive Device: Replaceable, 165°F (74°C) rating, fusible link or similar UL-approved bimetal resettable heat-responsive device.
- F. Frames: Galvanized sheet steel frame formed into a structural hat channel reinforced at the corners; with mitered and welded corners.
- G. Blades: Multiple-blade type; horizontal airfoil-shaped or triple-v-groove blades with maximum blade width of 6-inches (150 mm).
- H. Blade Axles: ½-inch- (13-mm-) diameter; galvanized steel; square or hex-shape mechanically locked to blade; and blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.
- I. Bearings: High impact molded synthetic, or stainless-steel sleeve type, with thrust bearings at each end of every blade. Dampers shall have axles full length of damper blades and bearings at both ends of operating shaft.

- J. Jamb Seals: Stainless steel flexible compression type.
- K. Damper Motors: Furnished and installed as the work of Division 23 Section "HVAC Instrumentation and Controls."
- L. Smoke Detector: Furnished and installed as the work of Division 26.
- M. Mounting Sleeve: Factory-installed, galvanized sheet steel; length to suit wall or floor application.
- N. Damper Motors: Two-position action.
- O. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Motors."
  - 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. Temperature Class: -40 to +200°F.
  - 3. Action: Parallel or opposed action as scheduled; opposed if not scheduled.
  - 4. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.
  - 5. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
  - 6. Equip with an integral spiral-spring mechanism for fail-safe position as indicated or scheduled. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 150 in. x lbf (17 N x m).
  - 7. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40°F (minus 40°C).
  - 8. Electrical Connection: 120-Volt AC.
  - 9. Test and reset switches, damper-mounted.
- P. Accessories: Auxiliary switches for fan control or position indication.

## 2.6 TURNING VANES

- A. All turning vanes, where required, shall be single-thickness type, 2-inch (50-mm) radius, 1½-inch (38-mm) spacing, at least 24-gauge thickness, and curved through an arc matching the change of direction (i.e., a vane curved through 90-degrees for a 90-degree elbow). Construct of material matching that of the adjacent duct (i.e., galvanized steel turning vanes in a galvanized steel duct, stainless steel turning vanes in a stainless steel duct, etc.).
- B. Where two or more changes of direction occur with less than four duct widths (measured in the plane of the change of direction) between each elbow, each turning vane shall also include a straight trailing edge extension of 1-inch (25 mm). At contractor's option, all turning vanes may include this straight trailing edge extension even if not required.
- C. Include vane rails or runners for attachment of vane blades to duct.

- D. Either contractor-fabricated or factory-manufactured turning vanes meeting these specifications will be acceptable.

## 2.7 DUCT-MOUNTED ACCESS DOORS

- A. Duct-Mounted Access Doors: Factory-manufactured doors, airtight and suitable for duct pressure class.
- B. Door: Double wall, rectangular, galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
- C. Insulation: 1-inch (25-mm-) thick, fibrous-glass or polystyrene-foam board.
- D. Hinges and Latches: 1-by-1-inch (25-by-25-mm) butt or piano hinge and cam latches.
- E. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets. Seal around frame attachment to duct and door to frame with neoprene or foam rubber.
- F. Number of Hinges and Locks: Two hinges, or continuous piano hinge, and two sash locks.
- G. Size: 18 by 10-inches (460 by 250 mm) unless noted otherwise

## 2.8 FLEXIBLE CONNECTORS

- A. Materials: Flame-retardant or noncombustible fabrics.
- B. Coatings and Adhesives: Comply with UL 181, Class 1.
- C. Metal-Edged Connectors: Factory fabricated with a fabric strip 5<sup>3</sup>/<sub>4</sub>-inches (146 mm) wide attached to 2 strips of 2<sup>3</sup>/<sub>4</sub>-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized sheet steel or 0.032-inch- (0.8-mm-) thick aluminum sheets. Provide metal compatible with connected ducts.
- D. Fabric: Glass fabric double-coated with neoprene or polychloroprene. Fabric layers shall be shielded with metal on both sides at the seam, attached with a mechanical metal-to-fabric bond.
  1. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
  2. Tensile Strength: 480 lbf/inch (84 N/mm) in the warp and 360 lbf/inch (63 N/mm) in the filling.
  3. Service Temperature: Minus 40 to plus 200°F (Minus 40 to plus 93°C).
  4. Insulated Service: Flexible ductwork connections shall be constructed of two layers of fabric as specified above, encapsulating 1-inch nominal thickness of R-4.2 fiberglass insulation. Required if the adjacent ductwork is specified to be insulated or internally lined.

## 2.9 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.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards – Metal and Flexible."
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel ducts.
- C. Install volume dampers at points on supply and exhaust systems where branches extend from larger ducts.
  - 1. Locate dampers at least two duct diameters from fittings and as far away as possible from outlets.
  - 2. Install steel volume dampers in steel ducts.
- D. Set dampers to fully open position before testing, adjusting, and balancing.
- E. Install test holes at fan inlets and outlets and elsewhere as indicated.
- F. Install combination fire/smoke dampers according to UL listing.
- G. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
  - 1. Adjacent to and close enough to fire dampers, to reset or reinstall fusible links.
  - 2. Elsewhere as indicated.
- H. Install access doors with swing against duct static pressure.
- I. Label access doors according to Division 23 Section "Basic Mechanical Materials and Methods" to indicate the purpose of access door.
- J. Install flexible connectors to connect ducts to equipment using metal-edged connections or flanges.
- K. For fans developing static pressures of 5-inch wg (1250 Pa) and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- L. Install duct test holes where required for testing and balancing purposes.

#### 3.2 FIELD QUALITY CONTROL

- A. Operate dampers to verify full range of movement.
- B. Inspect locations of access doors and verify that purpose of access door can be performed.



- C. Operate fire dampers to verify full range of movement and verify that proper heat-response device is installed.
- D. Inspect turning vanes for proper and secure installation.

END OF SECTION 23 3300

## SECTION 23 3600 – AIR TERMINAL UNITS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Shutoff single-duct air terminal units.

#### 1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 20 0800 "Seismic Protection," Section 23 0100 "Basic Mechanical Requirements," and Section 23 0500 "Basic Mechanical Materials and Methods" all apply to the work of this Section as if fully repeated herein.
- A. Related sections include Division 23 Section "Control Systems" for control devices and installation associated with air terminals.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated, include rated capacities; furnished specialties and accessories; shipping, installed, and operating weights; and sound-power ratings for each model indicated. Detail equipment assemblies and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection. Include a schedule showing unique model designation, room location, model number, size, and accessories furnished.
- B. Shop Drawings: For air terminal units. Include plans, elevations, sections, details, and attachments to other work. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.
- C. Verify compliance with each third-party test or rating Standard referenced in the "Quality Assurance" subsection below.
- D. Coordination Drawings: Refer to Division 23 Section "Basic Mechanical Requirements."
- E. Field quality-control reports.
- F. Operation and Maintenance Data: For air terminal units to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01, include instructions for resetting minimum and maximum air volumes and for adjusting software set points.

#### 1.4 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of air terminal units and are based on the specific system indicated. Refer to Division 23 Section "Basic Mechanical Requirements."
- B. NFPA Compliance: Install air terminal units according to NFPA 90A-2015 *Standard for the Installation of Air Conditioning and Ventilating Systems*.
- C. AHRI Certification: Only air terminals that are certified under the AHRI Standard 880-2017 Certification Program and carry the AHRI Seal will be accepted.
- D. Controls: Test and rate air terminal unit controls in accordance with ANSI/ASHRAE 195-2013 *Method of Test for Rating Air Terminal Unit Controls*. This standard specifies instrumentation, facilities, test installation methods, and procedures for determining the accuracy and stability of airflow control systems for pressure independent terminal units at various airflow setpoints for variable-air-volume and constant-volume air-moving systems.
- E. Control sequences shall be in complete and strict accordance with ASHRAE Guideline 36-2018 *High Performance Sequences of Operation for HVAC Systems*.

#### 1.5 COORDINATION

- A. Coordinate layout and installation of air terminal units and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide Air Terminal Units by one of the following:
  - 1. Air System Components Inc. (Titus, Krueger, and Tuttle & Bailey brands).
  - 2. Price Industries Inc.
  - 3. Trane Technologies plc.

#### 2.2 AIR TERMINAL UNITS, general

- A. Configuration: Pressure independent terminal unit as scheduled; including volume-damper assembly inside unit casing with control components located inside a protective metal shroud. Unit sizes, capacities, maximum and minimum airflows, maximum noise ratings, and maximum air pressure drops shall be as scheduled on the Drawings.
- B. Casing: Minimum 22-gage galvanized steel or 0.032-inch (0.8-mm) aluminum.
  - 1. Air Inlets: Beaded round stub connection of length at least 2-inches beyond airflow sensor taps for inlet duct attachment.
  - 2. Air Outlets: Rectangular S-slip and drive connections.

3. Access: Removable panels or access door for access to damper, heating coil, and other parts requiring service, adjustment, or maintenance; with airtight gasket.
- C. Volume Damper: Minimum 22-gage galvanized steel with peripheral edge gasket and self-lubricating bearings. Include a mechanical hard stop to prevent over-stroking. Include permanent markings on damper shaft to indicate damper position by simple visual inspection.
- D. Maximum allowable damper leakage is given below, when tested according to AHRI 880-2017, based on 4-inch wg (1000-Pa) differential static pressure (inlet to outlet) and 2500 fpm (12.7 m/s) air velocity at nominal box inlet diameter.
1. 3% for nominal size 4-inch (100 mm).
  2. 2% for nominal sizes 5-inch (125 mm) through 7-inch (175 mm).
  3. 1% for nominal sizes 8-inch (200 mm) and larger.
- E. Maximum allowable casing leakage is given below, when tested according to AHRI 880-2017, based on 3-inch wg (750-Pa) differential static pressure (inlet to outlet) and 2500 fpm (12.7 m/s) air velocity at nominal box inlet diameter.
1. 3% for nominal size 4-inch (100 mm).
  2. 2% for nominal sizes 5-inch (125 mm) through 9-inch (225 mm).
  3. 1% for nominal sizes 10-inch (250 mm) and larger.
- F. Airflow Sensor: Multipoint, multi-axis inlet velocity sensor with center-averaging feature, factory installed and connected to the controller with UL-listed fire-retardant pneumatic tubing. Single axis sensor is not acceptable for inlet diameters 6-inch and larger. The sensor shall output an amplified differential pressure signal that is at least 2.3 times the equivalent velocity pressure signal obtained from a conventional pitot tube. Balancing taps and airflow calibration charts shall be provided for field airflow measurements.

## 2.3 UNIT INSULATION

- A. Fibrous-Glass Liner: All Air Terminal Units of all types shall include factory-installed internal liner. Comply with NFPA 90A and UL 181.
1. Materials: Rigid, rectangular, fibrous-glass duct board; factory molded and faced on airstream side with fire-resistive, reinforced, foil-scrim-kraft barrier. 4-pound density, 475 flexural rigidity, standard duty. All cut edges or exposed fibers not encapsulated by the foil scrim surface shall be sealed from the airstream by mechanically bonded metal edge strips or nosings.
  2. Alternative Materials: Subject to compliance with other requirements specified herein, including but not limited to acoustic requirements, manufacturer's standard internal fiberglass liner will be accepted if entirely isolated from the airstream by an inner solid liner constructed of 26-gage galvanized sheet metal or 0.032-inch aluminum sheet.
  3. Thickness: ½-inch (13 mm) minimum; thicker if required to meet specified or scheduled values for thermal and/or acoustic performance.
  4. Thermal Conductivity (k-Value): 0.26 at 75°F (0.037 at 24°C) mean temperature per ASTM C518.
  5. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E84.

6. Liner Adhesive: Comply with NFPA 90A and with ASTM C916.

#### 2.4 INTEGRAL HYDRONIC HEATING COILS

- A. Casing: Minimum 20-gauge galvanized steel, factory-installed, with flanged connection for outlet ductwork. See "Air Terminal Units, General" subsection above for sizing criteria.
- B. Pressure Rating: Leak test to 300 psi air under water; minimum burst pressure of 2000 psi.
- C. Performance Ratings: As scheduled on Drawings. Coils shall be designed, tested and rated according to AHRI Standard 410-2001 *Forced-Circulation Air-Cooling and Air-Heating Coils*.
- D. Tube Construction: Copper, ½-inch O.D. with 0.016-inch minimum wall.
- E. Fin Construction: Aluminum, 0.006-inch minimum thickness, not more than 12 per inch, mechanically-bonded to tubes.
- F. Piping Connections: Male solder header. Coil connections shall be on the side of the unit indicated on the Drawings.

#### 2.5 AIR TERMINAL UNIT CONTROLS

- A. Direct Digital Controls: Bidirectional damper operator and microprocessor-based controller. Control devices shall be compatible with temperature controls specified in Division 23 Section "HVAC Instrumentation and Controls" and shall have the following features.
- B. Damper Actuator: 24-Volt, powered closed, powered open, fail in last position unless noted otherwise. Suitable for operation with duct pressures between 0.25- and 3.0-inch wg (60- and 750-Pa) inlet static pressure.
- C. Terminal Unit Controller: Air terminal units shall be supplied without manufacturer's controller. Refer to specification section 230900 "Control Systems" and Temperature Control Drawings for Owner and Contractor responsibilities.
- D. Supply air temperature sensor: As specified in Division 23 Section "Control Systems" and required for all Air Terminal Units.
- E. Control Logic: Dual maximum as further specified in ASHRAE Guideline 36-2018 *High Performance Sequences of Operation for HVAC Systems*.
- F. Test and rate air terminal unit controls in accordance with ANSI/ASHRAE 195-2013 *Method of Test for Rating Air Terminal Unit Controls*.

#### 2.6 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Steel Cables: Galvanized steel complying with ASTM A603.

- C. 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.
- D. Air Terminal Unit Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- E. Trapeze and Riser Supports: Steel shapes and plates for units with steel casings; aluminum for units with aluminum casings.
- F. Requirements for Seismic Restraint: As described in Division 20 Section "Seismic Protection."

## 2.7 SOURCE QUALITY CONTROL

- A. Identification: Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory-set airflows, coil type, and AHRI certification seal.
- B. Verification of Performance: Test and rate air terminal units according to AHRI 880-2017 *Standard for Performance Rating of Air Terminals*.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install air terminal units level and plumb, according to manufacturer's written instructions, rough-in drawings, original design, and referenced standards. Maintain sufficient clearance for normal service and maintenance.
- B. Protect all openings of air terminal units with filters or temporary covers throughout project storage, handling, and placement, to keep clean the interiors of air terminal units.
- C. Terminal units shall be continuously insulated with thermal insulation and vapor barrier, in unbroken path from inlet duct through to outlet duct, so that no bare metal surfaces are left uninsulated. Field-insulate any portions of terminal unit if not factory-insulated, including but not limited to heating coil casing and duct inlet collar. Field insulation and vapor barrier are specified in Division 23 Section "Mechanical Insulation."
- D. After completing system installation, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes.

### 3.2 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible," Chapter 4, "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. Use powder-actuated concrete fasteners for standard-weight aggregate concretes and for slabs more than 4 inches (100 mm) thick.

2. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes and for slabs less than 4 inches (100 mm) thick.
  3. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hangers Exposed to View: Threaded rod and angle or channel supports.
- D. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- 3.3 SEISMIC-RESTRAINT-DEVICE INSTALLATION
- A. Install hangers and braces designed to support the air terminal units and to restrain against seismic forces required by applicable building codes, as further described in Division 20 Section "Seismic Protection."
  - B. Install seismic-restraint devices for air terminal units using ANSI/SMACNA Standard 001-2008 *Seismic Restraint Manual; Guidelines for Mechanical Systems*, as issued by the Sheet Metal and Air Conditioning Contractors National Association, Inc., 2008; Chantilly, Virginia; Third Edition.
- 3.4 MECHANICAL CONNECTIONS
- A. Ductwork: Connect ductwork to air terminals according to Division 23 ductwork Sections and Details on Drawings.
  - B. Hot Water Piping: Connect heating coils in accordance with Details on Drawings. Install piping adjacent to air terminal units to allow service and maintenance. Piping installation requirements are specified Division 23 Section "Hydronic Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- 3.5 ELECTRICAL CONNECTIONS
- A. Power, signal, and control wiring for cooling-only Air Terminal Units and/or Air Terminal Units with hydronic heating coils is the work of Division 23 Section "Control Systems."
- 3.6 IDENTIFICATION
- A. Label each air terminal unit with plan number, nominal airflow, and maximum and minimum factory-set airflows. Comply with requirements in Division 23 Section "Basic Mechanical Materials and Methods" for equipment labels.
- 3.7 FIELD QUALITY CONTROL
- A. Complete installation and startup checks according to manufacturer's written instructions, and perform the following field tests and inspections:
    1. Verify that inlet duct connections are as recommended by air terminal unit manufacturer to achieve proper performance.
    2. Verify that controls and control enclosure are accessible.
    3. Verify that control connections are complete.
    4. Verify that nameplate and identification tag are visible.
    5. Verify that controls respond to inputs as specified.

6. After installing air terminal units, and after electrical circuitry (where applicable) has been energized, test for compliance with requirements.
  7. Leak Test: After installation, fill water coils and test for leaks. Repair leaks and retest until no leaks exist.
  8. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Remove and replace malfunctioning units and retest as specified above.
- C. Engage a factory-authorized service representative to train Owner's maintenance personnel in proper adjustment, operation, troubleshooting, and maintenance of air terminal units. Refer to Division 01 for requirements.

END OF SECTION 23 3600



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## SECTION 23 3713 – DIFFUSERS, REGISTERS, AND GRILLES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes ceiling- and wall-mounted diffusers, registers, and grilles.

#### 1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 20 0800 "Seismic Protection," Section 23 0100 "Basic Mechanical Requirements," and Section 23 0500 "Basic Mechanical Materials and Methods" all apply to the work of this Section as if fully repeated herein.
- C. The following Sections contain requirements that relate to this Section:
  - 1. Division 23 Section "Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.
  - 2. Division 23 Section "Testing, Adjusting, and Balancing" for balancing diffusers, registers and grilles.

#### 1.3 DEFINITIONS

- A. Diffuser: Circular, square, or rectangular air distribution outlet, generally located in the ceiling and comprised of deflecting members discharging supply air in various directions and planes and arranged to promote mixing of primary air with secondary room air.
- B. Grille: A louvered or perforated covering for an opening in an air passage, which can be located in a sidewall, ceiling, or floor.
- C. Register: A combination grille and damper assembly over an air opening.

#### 1.4 SUBMITTALS

- A. Product Data: For each 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.

#### 1.5 QUALITY ASSURANCE

- A. Testing: Test and publish performance according to ANSI/ASHRAE Standard 70-2006 *Method of Testing the Performance of Air Outlets and Air Inlets*.
- B. NFPA Compliance: Install diffusers, registers, and grilles according to NFPA 90A-2015 *Standard for the Installation of Air-Conditioning and Ventilating Systems*. Where located

less than 84 inches above finish floor, diffusers, registers and grilles shall be designed to prohibit passage of a ½-inch sphere.

- C. Single-Source: Unless noted otherwise, a single manufacturer shall furnish all diffusers, registers, and grilles.

## PART 2 - PRODUCTS

### 2.1 COMMON REQUIREMENTS, ALL UNITS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Air System Components Inc. (Titus, Krueger, and Tuttle & Bailey brands).
  - 2. Carnes Co.
  - 3. Hart & Cooley, Inc.
  - 4. Metalaire, Inc.; Metal Industries Inc.
  - 5. Nailor Industries, Inc.
  - 6. Price Industries.
- B. Diffusers, registers, and grilles are scheduled on Drawings. All model numbers, finish designations, border types, and accessory designations are based one manufacturer identified therein. Products by other manufacturers listed above may be furnished, but must be equal in all respects to the device identified, including but not limited to NC, pressure, and cfm ratings.
- C. Diffusers, Registers, and Grilles Finish: Acrylic baked enamel paint, pencil hardness HB to H, color as scheduled. The finish shall pass a 250-hour ASTM 870 Water Immersion Test, a 100-hour ASTM D117 Corrosive Environments Salt Spray Test, and a 50 inch-pound ASTM D2794 Reverse Impact Cracking Test.
- D. Diffusers, Registers, and Grilles Mounting: Provide border frame mounting type as scheduled. If not scheduled, provide border frame mounting type compatible with ceiling or wall type indicated on Architectural Drawings. Distinguish between flush flat-tee lay-in ceilings, drop-face lay-in ceilings, and the narrow-tee or screw-slot lay-in ceilings by providing a border type specifically designed for each as applicable; a generic standard lay-in border frame will not be acceptable for multiple lay-in ceiling types.
- E. Seismic Restraint: Earthquake ceiling tabs are required on all diffusers, registers, and grilles installed in a lay-in ceiling, to provide positive connection of air device to ceiling runners. Refer to Division 20 Section "Seismic Protection" for additional seismic requirements.

### 2.2 PRODUCT SPECIFICATIONS

- A. Perforated-Face Ceiling Diffuser: 24 gage steel face with 3/16-inch holes on staggered ¼-inch centers for at least 50% free area. The back pan shall be one-piece die-stamped and include an integrally drawn inlet (welded-in inlets and corner joints are not acceptable). Include a diffuser neck of minimum 1¼-inch depth for connection and attachment of round or rectangular (as scheduled) duct.

- B. Square Plaque Ceiling Diffuser: 22-gage steel (use 0.040-inch aluminum where scheduled) face panel that captures a secondary panel of equal material and thickness. The face panel shall be removable via four hanger brackets. The exposed surface of the face panel shall be smooth, flat, and free of visible fasteners. The face panel shall project not more than ¼-inch below the outer border of the diffuser back pan. The back of the face panel shall have a rolled edge, shaped for horizontal discharge. Face panel shall be no smaller than 18-inch by 18-inch for diffusers nominally 24-inch by 24-inch. Face panel shall be no smaller than 9-inch by 9-inch for diffusers nominally 12-inch by 12-inch. The back pan shall be one-piece die-stamped and include an integrally drawn inlet (welded-in inlets and corner joints are not acceptable). Include a diffuser neck of minimum 1¼-inch depth for connection and attachment of round or rectangular (as scheduled) duct.
  - 1. Include directional blow clips to restrict the discharge air in certain directions.
  - 2. Include molded insulation blanket of R-6, foil-backed. Provide an additional 1-inch gap around the neck to install insulated flex duct.
- C. Other grilles, registers and diffusers not specified above may be specified on the Drawings or by virtue of make and model number on the Schedule.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- 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. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Install diffusers, registers, and grilles level and plumb.
- C. 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 practicable. 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.
- D. Install diffusers, registers, and grilles with airtight connections to ducts.
- E. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.
- F. 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 23 3713

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## SECTION 26 0500 - **COMMON WORK RESULTS FOR ELECTRICAL**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. This Section specifies the basic requirements for electrical installations and includes requirements common to all sections of Division 26. It expands and supplements the requirements specified in sections of Division 00. [This section is also applicable to Division 27 "Communications"] [and Division 28 "Electronic Safety and Security"].
- B. Drawings and general provisions of the Contract, including general and supplementary conditions and specification sections Divisions 00 through 01, apply to this Section.
- C. Codes and Standards: All equipment, material and installations shall comply with applicable codes, standards, and installation practices. Comply with the requirements of the applicable local building codes, the applicable NEC, all local rules and regulations including those of the fire authorities. Comply with all applicable NFPA standards. All material and equipment shall be listed by the Underwriters Laboratories (UL) standard that is applicable for the specific purpose of the material and equipment. The National Electrical Code, National Electrical Manufacturer's Association (NEMA) Standards, and applicable ANSI and IEEE standards shall apply to the pertinent materials, equipment, and installation practices. Testing shall be in accordance with the applicable International Electrical Testing Association (NETA) standards.
  - 1. These specifications include references to the [2008] [2011] [2014] edition of the NFPA 70 "National Electrical Code." Where a different edition of the NEC has been adopted by the local Authority Having Jurisdiction, the references associated with that edition of the Code shall be applicable.

#### 1.2 SUMMARY OF WORK

- A. The word "furnish" means supply for use, the word "install" means install in its proper location and connect up complete and ready for operation, and the word "provide" means to furnish and install.
- B. Provide all new materials as indicated on the drawings and specifications and all items required to make the electrical system complete and in working order.
- C. System descriptions included in scope of work are as follows:
  - 1. Electrical power systems, including luminaires, motors, wiring devices, etc.
  - 2. Grounding system.
  - 3. Fire alarm system.
  - 4. Power and communications for temperature control system.
  - 5. Wiring of equipment furnished by the Owner or other Divisions.
  - 6. Selective demolition work and modification of existing systems and equipment.
  - 7. Low voltage systems as described in Divisions 27 and 28.
- D. Work not included:

1. Temperature control wiring for plumbing and HVAC equipment (unless otherwise indicated) shall be by other Divisions.

### 1.3 WORK SEQUENCE

- A. All work that produces excessive noise or interference with normal building operations shall be coordinated and scheduled with the Owner. Such work may require scheduling of work after occupied hours or weekends. The Owner reserves the right to determine when such work is conducted.

### 1.4 QUALITY ASSURANCE

- A. Responsibility Prior to Submitting Pricing or Bid Data:

1. Thoroughly review the contract documents and specifications and visit the site prior to issuing bid. Resolve all reported deficiencies with the Engineer prior to awarding any subcontracts, ordering material, or starting any work.

- B. Qualifications:

1. Only products of specified manufacturers, or approved equals as determined by the Engineer, are acceptable.
2. Employ only workmen who are skilled in their trades.

- C. Compliance with Codes, Laws, and Ordinances:

1. Conform to all requirements of the state, city and local codes, laws and ordinances and other regulations having jurisdiction over this installation.
2. If there are any discrepancies between the codes and regulations and these specifications, the Engineer shall determine the method or equipment to be used.
3. Inform the Engineer in writing, requesting a clarification at the time of the bidding, if any parts of the drawings or specifications are found not to comply with the codes or regulations. Submit a separate price to make the system comply if there is insufficient time for this procedure.
4. Inform the Engineer in writing requesting a clarification if there is any discrepancy between a manufacturer's recommendation and these specifications.
5. Follow the current issue of NFPA 70 "National Electrical Code" if there are no local codes having jurisdiction.

- D. Examination of Drawings:

1. The drawings for the indicated work are diagrammatic, intended to convey the scope of the electrical work and to indicate the general arrangements and locations of equipment, wiring devices, etc., and the approximate sizes of equipment. Field verification of dimensions on plans is required. The actual conditions, including heights, lengths and orientation shall be the basis of the work.
2. The architectural, structural, mechanical, and electrical drawings and specifications shall be considered as mutually explanatory and complementary. Any electrical work called for by one and not by the other shall be performed as though required by all. All sections and subsections of the Electrical work shall be governed by and subject to the general and supplementary conditions. Report any discrepancies in or between the drawings and specifications, or between the

drawings and actual field conditions to the Engineer in sufficient time to issue an addendum for clarification.

3. Determine the exact locations for equipment and rough-ins, and the exact routing of raceways.
4. Do not scale drawings to determine equipment and system locations.
5. Not all required components are shown on the documents, including junction boxes, pull boxes, conduit fittings, etc. Provide all components required for proper installation of the work.
6. Any item either shown on the drawings or called for in the specifications shall be included in this contract.
7. Determine quantities and quality of material and equipment required from the documents. Provide the more expensive or higher quality amount where discrepancies arise among drawings, schedules, or specifications.

E. Electronic Media and Files:

1. Electronic media files of the contract drawings in AutoCAD or PDF format and copies of the specifications in PDF format may be requested.
2. Complete and return a signed "Electronic File Transmittal" form provided by Ross & Baruzzini upon request for electronic media.
3. Obtain approval from the appropriate Design Professional for use of their part of the documents if the information requested includes information prepared by other than Ross & Baruzzini.
4. The electronic contract documents may be used for preparation of shop drawings and record drawings only. The information may not be used in whole or in part for any other project.
5. The drawings prepared by Ross & Baruzzini for bidding purposes may not be used directly for raceway layout drawings or coordination drawings.
6. The use of these documents does not allow relief from the responsibility for coordination of work with other trades and verification of space available for the installation.
7. The information is provided to expedite the project with no guarantee by Ross & Baruzzini as to the accuracy or correctness of the information provided. Ross & Baruzzini accepts no responsibility or liability for the use of the provided information.

1.5 SEISMIC REQUIREMENTS

- A. Conform to requirements in Section 20 0800 "Seismic Protection" including required submittals described under Section 20 0800.

1.6 ROUGH-IN

- A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
- B. Coordinate equipment rough-in requirements with Divisions 02 through 28.

1.7 SUBMITTAL REVIEW RESPONSIBILITIES

- A. General: Submittals are not requested for all products covered in the specifications. Submit only the data requested under the submittals portion of each specification section or where indicated in a Submittal Log, if included within Division 01. Un-



requested submittals will not be processed or reviewed and will be returned to the submitter. Refer to "Submittal Register" for all required submissions of each specification section. All required submissions of that specification section are to be submitted for review in one all-inclusive submission. Any deviation from specified items is considered a substitution.

1. Non-requirement of submittals, when so noted, is not to be construed as an allowance for substitutions and does not provide relief from full compliance with the contract documents.
2. Any deviation from specified items is considered a substitution. A formal request for substitution must be submitted prior to bid date (no exceptions), in accordance with the procedures and time limitations set forth in Division 02, if the use of other than specified items is being proposed. Where not defined in Division 01, requests for substitutions shall be submitted no less than ten (10) working days prior to bid date. The submitter must pay the engineer for review of substitution requests. Charges for this substitution review will be calculated based on the Engineer's standard hourly rates, as defined in their contract with the Owner.

B. Definitions:

1. Product Data: Pre-printed manufacturer's data.
2. Shop Drawings: Drawings made specifically for the manufacture of a particular piece of equipment to be used on this project.
3. Operation and Maintenance Data: Information containing instructions on the proper operation, maintenance, and repair of the equipment, complete with written text, diagrams, photos, exploded views and parts lists.
4. Record Documents: Information indicating the actual installed conditions of the project on Mylar, electronic media, photographs, or typed paper. Photographs are not allowed as a substitute for correcting the construction documents; the photographs are for the Owner's future reference. Submit type, quantities and on media specified where indicated to be submitted.

C. Where more than one model is shown on a manufacturer's sheet, clearly indicate exactly which item and which data is relevant to the work.

D. Where the manufacturer lists multiple part numbers or options on a single data sheet, the part number and options to be used shall be clearly set apart from other part numbers shown on that sheet.

E. Ensure that all submittals have been reviewed for total completeness and accuracy as to the requirements of the specifications and drawings before being submitted to the Engineer for review. The Contractor's approval stamp is required on all submittals before submittal to the Engineer. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Clearly mark all deviations from the contract documents on all submittals. The item shall be required to meet all drawing and specification requirements if deviations are not clearly marked.

1. One comprehensive submittal shall be provided for each individual specification section. All required submittal information called for in each individual specification section shall be included in the submittal. Partial or incomplete submissions will be rejected.

2. The Engineer shall not be responsible for informing the submitter on items that have not been included and are necessary for a complete review of the required submittal information for a specification section.
  3. The Engineer shall have the option of returning any submittal, unmarked, if all required documentation called for in the specifications has not been provided in the submittal.
  4. The Engineer shall review each submittal no more than two times and return to the submitter with the appropriate disposition.
  5. If the Engineer is required to review a submittal a second time, it will be limited to review of the changed information, which must clearly be highlighted by the submitter. The submittal will be returned to the submitter with the appropriate disposition.
  6. If the submittal is required to be reviewed a third time, it shall be done at the expense of the submitter. Charges for this additional submittal review will be calculated based on the Engineer's standard hourly rates, as defined in their contract with the Owner.
- F. Operation and Maintenance Manuals: All items required for insertion into each Operation and Maintenance (O&M) Manual are called out in the submittals portion of each specification section or in a Submittal Log, if included within Division 01. Ensure that the O&M submittal has been reviewed and includes all the requirements of the specifications. Submit only the data requested under the submittals portion of each specification section. FAX or photo copies are not allowed as submittals for operating and maintenance manuals. The Engineer will review the submittal for the Operation and Maintenance Manual one time and return to the submitter with the appropriate disposition.
1. If the submittal is required to be reviewed a second time, it shall be done at the expense of the submitter. Charges for this additional submittal review will be calculated based on the Engineer's standard hourly rates, as defined in their contract with the Owner.
  2. Submittals for the Operation and Maintenance Manual must be original documentation.
  3. Photo copies of marked up Operations and Maintenance submittals are not acceptable.
- G. Coordination Drawings: Prepare and submit Coordination Drawings as further described herein and as indicated in the Special Conditions. Provide the Engineer with one copy of all coordination drawings supplied to the Owner when required in this specification. Coordinate the work as outlined herein. Receipt by the Engineer of a copy of the coordination drawings is to verify conformance to the submittal requirements set forth in this specification section. It is not an admission by the Engineer as to the accuracy or completeness of the coordination proposed.
- H. Refer to Division 01 and each individual Division 26 [,27] [,28] Section for additional submittal requirements.
- 1.8 PRODUCT OPTIONS AND MATERIAL SUBSTITUTIONS
- A. Where two or more materials are listed in the "Part 2 – Products" subsection of any Division 26, 27 or 28 section, do not assume that the selection of materials is an option. Refer to "Part 3 – Execution" subsection of that same specification section for an

explanation of which specific material(s) shall be used for which specific application(s). For example, Part 2 may list several types and grades of conductors, and Part 3 will describe which type and grade of conductors to use for a given application.

- B. When two or more items of same material or equipment are required, they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, wire, conduit, fittings, sheet metal, steel bar stock, welding rods, solder, fasteners, motors for dissimilar equipment units, and similar items used in Work except as otherwise indicated.
  - C. Provide products which are compatible within systems and other connected items.
  - D. Substitutions: Products other than those specified must be submitted, approved and secured in writing from the Engineer via Addendum. If requested, a sample of the proposed substitution must be submitted to the Engineer for evaluation. This sample shall be supplied at no cost to the Engineer, and will be returned to the submitter, at the submitter's expense at the end of the evaluation period.
  - E. Where several manufacturers' names are given, the manufacturer for which a catalog number is given is the basis of design and establishes the quality required.
  - F. Any material, article or equipment of other unnamed manufactures which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Engineer via Addendum. Assume all costs incurred as a result of using the offered material, article or equipment, including the part of other Divisions whose work is affected.
  - G. Voluntary add or deduct prices for alternate materials may be listed on the bid form. These items will not be used in determining the low bidder. Assume all costs incurred as a result of using the offered material or equipment on his part or on the part of other Divisions whose work is affected.
  - H. All material substitutions requested after the final Addendum must be listed as voluntary changes on the bid form.
- 1.9 PRODUCT, DELIVERY, STORAGE, HANDLING AND MAINTENANCE
- A. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage and handling. Protect stored equipment and materials from damage.
  - B. Coordinate deliveries of electrical materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations. Review the site prior to bid for path locations and any required building modifications to allow movement of equipment.
  - C. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage.
  - D. Keep all materials clean, dry and free from damaging environments.

## 1.10 MISCELLANEOUS MATERIALS

### A. Miscellaneous Materials Include:

1. Miscellaneous metals for support of electrical materials and equipment.
2. Wood grounds, nailers, blocking, fasteners and anchorage for support of electrical materials and equipment.
3. Concrete bases for equipment.
4. Sealers for sealing around electrical materials and equipment; and for sealing penetrations in floors and walls.
5. Access panels and doors in walls, ceilings, and floors for access to electrical materials and equipment.

## 1.11 WARRANTIES

- A. Refer to the Division 01 "Closeout Procedures" for procedures and submittal requirements for warranties. Refer to individual equipment specifications for warranty requirements.
- B. Compile and assemble the warranties specified in Divisions 26, 27 and 28 into a separated set of vinyl covered, three-ring binders, tabulated and indexed for easy reference.
- C. Provide complete warranty information for each item to include product or equipment, date of beginning of warranty or bond; duration of warranty or bond; and names, addresses, telephone numbers and procedures for filing a claim and obtaining warranty services.
- D. Warranty requires correction of all work found to be defective or nonconforming to the Contract Documents, without cost to the Owner. Bear all costs associated with corrective measures and damage due to defects or nonconformance with the Contract Documents, excluding repairs required as a result of improper maintenance or operation, or normal wear and tear as determined by the Engineer.

## PART 2 - PRODUCTS

### 2.1 MISCELLANEOUS LUMBER

- A. All lumber shall be fire-treated.
- B. Framing Materials: Standard Grade, light-framing-size lumber of any species. Number 3 Common or Standard Grade boards complying with WCLIB or AWPB rules, or Number 3 boards complying with SPIB rules. Lumber shall be preservative-treated in accordance with AWPB LP-2, and kiln-dried to a moisture content of not more than 19 percent.

### 2.2 ACCESS DOORS

- A. Steel Access Doors and Frames: Factory-fabricated and assembled units, complete with attachment devices and fasteners ready for installation. Joints and seams shall be continuously welded steel, with welds ground smooth and flush with adjacent surfaces.

- B. Frames: 16-gage steel, with a 1-inch-wide exposed perimeter flange for units installed in unit masonry, pre-cast, or cast-in-place concrete, ceramic tile or wood paneling.
- C. For Installation in Masonry, Concrete, Ceramic Tile, or Wood Paneling: 1 inch-wide-exposed perimeter flange and adjustable metal masonry anchors.
- D. For Gypsum Wallboard or Plaster: Perforated flanges with wallboard bead.
- E. For Full-Bed Plaster Applications: Galvanized expanded metal lath and exposed casing bead, welded to perimeter of frame.
- F. Flush Panel Doors: 14-gage sheet steel, with concealed spring hinges or concealed continuous piano hinge set to open 175 degrees; factory-applied prime paint.
- G. Fire-Rated Units: Insulated flush panel doors with continuous piano hinge and self-closing mechanism.
- H. Locking Devices: Flush, screwdriver-operated cam locks.
- I. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Bar-Co., Inc.
  - 2. J.L. Industries.
  - 3. Karp Associates, Inc.
  - 4. Milcor Div. Inryco, Inc.
  - 5. Nystrom, Inc.

### 2.3 SLEEVES FOR RACEWAYS AND CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Sleeves for Rectangular Openings: Galvanized sheet steel.
  - 1. Minimum Metal Thickness:
    - a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
    - b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).
  - 2. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

### 2.4 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Manufacturers: Subject to compliance with requirements. Provide products by one of the following
  - a. Advance Products & Systems, Inc.
  - b. Calpico, Inc.
  - c. GPT Link-Seal
  - d. Metraflex Co.
  - e. Pipeline Seal and Insulator, Inc.
2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
3. Pressure Plates: Plastic. Include two for each sealing element.
4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.
5. Place head end of bolts on accessible side of wall to allow for future adjustments.

## 2.5 GROUT

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

## PART 3 - EXECUTION

### 3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounted items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right-of-Way: Give to piping systems installed at a required slope.
- F. Jobsite Safety: The Contractor is the sole entity responsible for jobsite safety.

### 3.2 EXAMINATION

- A. Examine substrates, areas, and conditions, with installer present, for compliance with requirements for installation tolerances and other conditions affecting installation and

application of sealants and access panels. Do not proceed with installation until unsatisfactory conditions have been corrected.

- B. Install equipment and materials in accordance with manufacturer instructions and the requirements in Section 20 0800 "Seismic Protection."

### 3.3 ROUGH-IN

- A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
- B. Coordinate equipment rough-in requirements with Divisions 01 through 28.

### 3.4 ELECTRICAL INSTALLATIONS

- A. Coordinate electrical equipment and materials installation with other building components.
- B. Verify all dimensions by field measurements.
- C. Arrange for chases, slots, and openings in other building components to allow for electrical installations.
- D. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components as they are constructed.
- E. Sequence, coordinate and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing-in the building.
- F. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
- G. Install systems, materials, and equipment to conform to project requirements and approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Engineer.
- H. Systems, materials, and equipment which will be exposed in finished areas shall be installed level and plumb, parallel and perpendicular to other building systems and components.
- I. Install electrical services and overhead equipment to provide the maximum headroom possible where mounting heights are not detailed or dimensioned.
- J. Install electrical equipment to facilitate maintenance and repair or replacement of equipment components. Maintain code clearances in front of and about all electrical equipment. As much as practical, connect equipment for ease of disconnecting with minimum of interference with other installations.

- K. Coordinate the installation of electrical materials and equipment above ceilings with suspension system, mechanical equipment and systems and structural components.
- L. Include in the Work all labor, materials, equipment, services, apparatus, and drawings (in addition to the Contract Documents) as required to complete the intended Work.
- M. Control and interlock wiring shall be installed in a separate raceway and shall not be installed in the same raceway as power conductors.
- N. Only new, clean and perfect equipment, apparatus, materials and supplies of latest design and manufacture shall be incorporated in the Work in order to assure an electrical system of high quality.
- O. The Work required in order to obtain utility services such as telephone and electric, is delineated in these specifications and on the drawings. Unless otherwise noted, construction or connection charges (except for temporary power) by those companies shall be paid by the Owner.
- P. Determine electrical utility elevations prior to installation and coordinate with other trades. Installation priorities at a minimum shall be as follows:
  - 1. Luminaires.
  - 2. Gravity flow piping, including steam and condensate.
  - 3. Electrical bus duct.
  - 4. Sheet metal.
  - 5. Cable trays, including access space.
  - 6. Other piping.
  - 7. Conduits and wireway.

### 3.5 CONNECTIONS TO EQUIPMENT AND APPLIANCES

- A. In many instances the drawings show an outlet box and power supply for specific equipment, be it Owner- or Contractor-furnished. It is to be understood, unless otherwise noted, that the Work includes a connection from the box to the equipment or appliance. Verify circuit conductor quantities and sizes and overcurrent device number of poles and rating as well as any special grounding requirements, for all Owner-furnished equipment and adjust the required work accordingly.
- B. Owner Furnished Equipment:
  - 1. Install and connect Owner-supplied items electrical items indicated on Architectural Equipment Plans and Schedules even if not shown on the electrical plans. Connect all Owner-supplied items requiring electrical connections, whether or not shown on the electrical plans. Make all electrical system connections required for fully functional units.
  - 2. The Owner will supply manufacturer's installation data for new equipment purchased by owner for this project.
  - 3. Repair all damage to Owner-furnished equipment caused during installation, to the satisfaction of the Owner.



### 3.6 CUTTING AND PATCHING

- A. General: Perform cutting and patching in accordance with Division 01 Section "Execution." In addition to the requirements specified in Division 01, the following requirements apply:
  - 1. Perform cutting, fitting and patching of electrical equipment and materials required to:
    - a. Uncover Work to provide for installation of ill-timed Work.
    - b. Remove and replace defective Work.
    - c. Remove and replace Work not conforming to requirements of the Contract Documents.
    - d. Remove samples of installed Work as specified for testing.
    - e. Install equipment and materials in existing structures.
    - f. Cut, remove, and legally dispose of selected electrical equipment, components, and materials as indicated, including but not limited to, removal of electrical items indicated to be removed and items made obsolete by the new Work.
  - 2. Coordinate the cutting and patching of building components to accommodate the installation of electrical equipment and materials.
    - a. Protect the structure, furnishings, finishes and adjacent materials not indicated or scheduled to be removed.
    - b. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

### 3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGE

- A. Cut, fit, and place miscellaneous metal fabrications accurately in location, alignment and elevation to support and anchor electrical materials and equipment.
- B. Field Welding: Comply with AWS "Structural Welding Code."

### 3.8 ERECTION OF WOOD SUPPORTS AND ANCHORAGE

- A. Cut, fit and place wood grounds, nailers, blocking and anchorage accurately in location, alignment and elevation to support and anchor electrical materials and equipment.
- B. Select fastener sizes that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

### 3.9 APPLICATION OF SEALERS

- A. General: Comply with sealer manufacturers' printed application instructions applicable to products and applications indicated, except where more stringent requirements apply.

1. Comply with recommendations of ASTM C 962 for use of elastomeric sealants.
  - B. Tooling: Immediately after sealant application and prior to time shinning or curing begins, tool sealants to form smooth, uniform beads; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.
- 3.10 INSTALLATION OF ACCESS DOORS
- A. Set frames accurately in position and securely attached to supports with face panels plumb and level in relation to adjacent finish surfaces.
  - B. Adjust hardware and panels after installation for proper operation.
- 3.11 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS
- A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
  - B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
  - C. Contract shall X-ray concrete slabs and walls prior to core drilling to avoid damage to utilities or reinforced steel.
  - D. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
  - E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
  - F. Cut sleeves to length for mounting flush with both surfaces of walls.
  - G. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.
  - H. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable, unless indicated otherwise.
  - I. Seal space outside of sleeves with grout for penetrations of concrete and masonry
    1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
  - J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."
  - K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal

raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

- L. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- N. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

### 3.12 SLEEVE-SEAL INSTALLATION

- A. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve.
- B. Install to seal exterior wall penetrations.
- C. Install in concrete slabs and walls and all other fire-rated floors and walls for raceways and cable installations. Provide insulated bushings at each end of sleeve. For sleeves through fire rated-wall or floor construction, apply UL-listed firestopping sealant in gaps between sleeves and enclosed conduits and cables.
  - 1. Conduit Seals: Install seals for conduit penetrations of slabs on grade and exterior walls below grade and where indicated. Tighten sleeve seal screws until sealing grommets have expanded to form watertight seal.

### 3.13 FIRESTOPPING

- A. Apply rated firestopping sealants at all penetrations of fire and smoke walls; at all penetrations of floors and at other locations as noted on the drawings or where required by Code. Consider walls that are common to different abutting buildings, to different additions to buildings, and to fire and smoke separations within buildings as requiring firestopping sealant. Refer to architectural drawings. For existing buildings where fire separations are not noted on any drawings, use reasonable logic as to which separations are fire-rated. When in doubt, consult with Engineer or Architect.
- B. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

### 3.14 ADJUST AND CLEAN

- A. Thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project.
- B. Clean all foreign paint, grease, oil, dirt, labels, stickers, etc., from all equipment.
- C. Remove all rubbish, debris, etc., accumulated during construction from the premises.

- D. Refer to the Division 01 Section "Closeout Procedures" for general requirements for final cleaning.

### 3.15 SPECIAL REQUIREMENTS

- A. Coordinate the installation of all equipment, controls, devices, etc., with other trades to maintain clear access area for servicing.
- B. Install all equipment to maximize access to parts needing service or maintenance. Review the final location, placement, and orientation of equipment with the Owner's representative prior to setting equipment.
- C. Include removal and reinstallation of equipment and devices if they were installed without regard to coordination of access requirements and without previous confirmation with the Owner's representative.

### 3.16 SYSTEM COMMISSIONING

- A. The electrical systems shall be complete and operating. Include system start-up, testing, balancing and satisfactory system performance. This includes all calibration and adjustment of electrical controls, balancing of loads, troubleshooting and verification of software, and final adjustments that may be needed.
- B. All operating conditions and control sequences shall be tested during the start-up period. Testing all interlocks, safety shut-downs, controls, and alarms.
  - 1. Utilize only skilled technicians to ensure that all systems perform properly. Reimburse the Owner on a time and materials basis for services rendered at the Engineer's standard hourly rates in effect when the services are requested if the Engineer is requested to visit the job site for troubleshooting, assisting in start-up, obtaining satisfactory equipment operation, resolving installation, workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period, through no fault of the design. Pay the Owner for services required that are project-, installation- or workmanship-related. Payment is due within 30 days after services are rendered.

### 3.17 FIELD QUALITY CONTROL

- A. General:
  - 1. All required equipment and systems tests shall be made during and post-Construction as required.
  - 2. All required testing instruments, meters, etc., shall be provided.
  - 3. Technicians operating testing equipment shall be trained in testing procedures.
  - 4. Testing shall confirm that equipment and systems provided by the Contractor have been installed properly.
  - 5. Unsatisfactory test results shall result in revisions or replacement of equipment or settings as required to provide a system capable of meeting test requirements. Tests shall be repeated, or additional tests made as necessary to confirm system capability as required by the Owner, Engineer or Authority Having Jurisdiction.

### 3.18 OPERATION AND MAINTENANCE DATA

- A. Refer to the Division 01 Section: "Closeout Procedures" for procedures and requirements for preparation and submittal of maintenance manuals.
- B. In addition to the information required by Division 01 for Maintenance Data, include the following information:
  - 1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts.
  - 2. Manufacturer's printed operating procedures to include start-up, break-in, routine and normal operating instructions, regulation, control, stopping, shut-down, and emergency instructions; and summer and winter operating instructions.
  - 3. Maintenance procedures for routine preventive maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
  - 4. Servicing instructions and lubrication charts and schedules.
- C. Submit three (3) properly indexed and bound copies in "D" ring style notebooks, of the Operations and Maintenance Instructions to the Architect or Engineer. Make all corrections or additions required.
- D. Operation and Maintenance Instructions shall include:
  - 1. Notebooks shall be heavy duty locking three-ring binders, black in color, and incorporate clear vinyl sheet sleeves on the front cover and spine for slip-in labeling. "Peel and stick" labels are not acceptable. Sheet lifters shall be supplied at the front of each notebook. Size notebooks a minimum of 1/2 inch thicker than the material for future inserts. Label the spine and front cover of each notebook. If more than one notebook is required, label in consecutive order. For example; 1 of 2, 2 of 2. No other forms of binding will be acceptable.
  - 2. Prepare binder covers (front and spine) with printed title "Operation and Maintenance Instructions," title of project, and subject matter of binder when multiple binders are required.
  - 3. Title page with project title, Architect, Engineer, Contractor, and Subcontractor with addresses, telephone numbers, and contacts.
  - 4. Table of Contents describing all index tabs.
  - 5. Listing of all Subcontractors and major equipment suppliers with addresses, telephone numbers and contacts.
  - 6. Index tabs dividing information by specification section, major equipment, or systems. All tab titles shall be clearly printed under reinforced plastic tabs. Label all equipment to match the identification in the construction documents.
  - 7. Copies of warranties.
  - 8. Copies of all final approved shop drawings and submittals. Copy of power system study and overcurrent protective device settings.
  - 9. Copies of all factory inspections and or equipment start-up reports.
  - 10. Schematic wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
  - 11. Dimensional drawings of equipment.
  - 12. Detailed parts lists, each with a list of suppliers.
  - 13. Operating procedures for each system.

14. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
  15. Repair procedures for major components.
  16. Replacement parts and service material requirements for each system and the frequency of service required.
  17. Instruction books, cards, and manuals furnished with the equipment.
- E. Operation and maintenance data shall consist of written instructions for the care, maintenance, and operation of the equipment and systems. Instruction books, cards, manuals furnished with the equipment shall be included.
- F. In addition to the information required by Division 01 for Maintenance Data, include the following information:
1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts.
  2. Manufacturer's printed operating procedures to include start-up, break-in, routine and normal operating instructions, regulation, control, stopping, shut-down, and emergency instructions; and summer and winter operating instructions.
  3. Maintenance procedures for routine preventive maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
  4. Servicing instructions and lubrication charts and schedules.
- G. Adequately instruct the Owner's designated representative in the maintenance, care, and operation of the complete systems installed under this contract.
- H. Provide verbal and written instructions to the Owner's representatives by factory personnel in the care, maintenance and operation of the equipment and systems.
- I. Make DVD format compact disc of the instructions to the Owner while explaining the system so additional personnel may view the instructions at a later date. The video shall become the property of the Owner.
- J. The instructions shall include:
1. Maintenance of equipment.
  2. Start-up procedures for all major equipment.
  3. Description of emergency system operation.
- K. Notify the Engineer of the time and place for the verbal instructions to the Owner's representative so his representative can be present if desired.
- L. Minimum hours of instruction time for each item and/or system shall be as indicted in each individual specification section.
- M. Operating Instructions:
1. Include instructions to the Owner's representatives for the electrical and specialized systems, using factory-authorized technical representatives.

### 3.19 RECORD DOCUMENTS

- A. Prepare record documents in accordance with the requirements in Division 01 Section "Closeout Procedures." In addition to the requirements specified in Division 01, indicate installed conditions for:
1. Raceways of 2-inches and larger, indicating size and location, for both exterior and interior; locations of control devices; distribution and branch electrical circuitry; and fuse and circuit breaker size and arrangements.
  2. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
  3. Location of every home run point, such as receptacle, lighting fixture, or switch.
  4. Approved substitutions, Contract modifications, and actual equipment and materials installed.
  5. Mark Drawings to indicate revisions to conduit size and location both exterior and interior; actual equipment locations, dimensioned from column lines; concealed equipment, dimensioned to column lines; distribution and branch electrical circuitry; fuse and circuit breaker size and arrangements; support and hanger details; change orders; concealed control system devices.
  6. Mark Specifications to indicate approved substitutions, change orders, actual equipment and materials used.
- B. Maintain at the job site a separate and complete set of electrical drawings and specifications with all changes made to the systems clearly and permanently marked in complete detail.
- C. Mark Drawings to indicate revisions to conduit size and location both exterior and interior; actual equipment locations, dimensioned from column lines; concealed equipment, dimensioned to column lines; distribution and branch electrical circuitry; fuse and circuit breaker size and arrangements; support and hanger details; Change Orders; concealed control system devices.
- D. Mark drawings and specifications to indicate approved substitutions; Change Orders, and actual equipment and materials used. Mark all Change Orders, RFI responses, clarifications, and other supplemental instructions on the documents. Record documents that merely reference the existence of the above items are not acceptable. Reimburse the Engineer for all costs for the Engineer to develop record documents which comply with this requirement if unable to comply with said above requirements. Reimbursement shall be made at the Architect or Engineer's hourly rates in effect at the time of the work.
- E. Record changes daily and keep the marked drawings available for the Architect or Engineer's examination at any normal work time.
- F. Upon completing the job, and before final payment is made, give the marked-up drawings to the Engineer.

### 3.20 PROJECT CLOSEOUT

- A. The following paragraphs supplement the requirements of Division 01:
- B. Final Jobsite Observation:

1. Certify that the project jobsite is ready for the final jobsite observation.
  2. Reimburse the Engineer, based on the Engineer's standard hourly rates as defined in their contract with the Owner, for additional time and expenses when additional trips are required because the project jobsite was not ready for final observation and additional trips are required by the Engineer for review of final conditions.
  3. Notify the Engineer a minimum of two working days prior to installation of ceiling tiles or lay-in ceilings to allow the Engineer to visit the project site.
- C. Submit the following documents to the Architect or Engineer prior to requesting final payment:
1. Operation and maintenance manuals with copies of approved shop drawings.
  2. Record documents including electronic AutoCAD or REVIT drawings and specifications.
  3. Documentation of completion of all required training of Owner's personnel.
  4. Provide spare parts, maintenance and extra materials in quantities specified in individual specification sections.
  5. Inspection and testing reports.
  6. Start-up reports on all equipment requiring a factory installation or start-up.
  7. [Submittals required by commissioning of the electrical systems.]

END OF SECTION 26 0500



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## SECTION 26 0519 - **CONDUCTORS AND CABLES**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Conductors and Cables.
  - 2. Health Care Facilities (HCF) type Metal Clad cable (MC).
  - 3. Remote Control and Signal Cable.

#### 1.3 SUBMITTALS

- A. Submittals for approval by the Engineer are not required for this section. Unrequested submittals will not be processed or reviewed. Non-requirement of submittals is not to be construed as an allowance for substitutions and does not allow relief from full compliance with the contract documents.
- B. Product Data: For each type of product indicated.
  - 1. Health Care Facilities (HCF) type Metal Clad Cable.

#### 1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70 "National Electrical Code."
  - 1. Conform to applicable codes and regulations regarding toxicity of combustion products of insulating materials.
- C. UL Compliance: Provide components which are listed and labeled by Underwriters Laboratories under the following standards.
  - 1. UL Std. 83 Thermoplastic-Insulated Wires and Cables.
  - 2. UL Std. 486A Wire Connectors and Soldering Lugs for Use with Copper Conductors.
  - 3. UL Std. 1569 Metal Clad Cables.
- D. NEMA and ICEA Compliance: Provide components which comply with the following standards:
  - 1. WC-70: Power Cables Rated 2,000V or Less for the Distribution of Electrical Energy.
- E. IEEE Compliance: Provide components which comply with the following standard.

1. Std. 82: Test procedures for Impulse Voltage Tests on Insulated Conductors.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. American Insulated Wire Corp.; a Leviton Company.
  2. General Cable Corporation.
  3. Senator Wire & Cable Company.
  4. Southwire Company.
  5. Cerro Wire.
  6. Superior Essex.
  7. Encore Wire Corporation.
- B. Copper Conductors: Comply with NEMA WC 70.
- C. Conductor Insulation: Comply with NEMA WC 70 for Types THW, THHN-THWN, XHHW and SO.
- D. Multiconductor Cable: Comply with NEMA WC 70 for metal-clad cable, Type MC mineral-insulated, metal-sheathed cable, Type MI and Type SO with ground wire.

### 2.2 CONDUCTORS AND CABLES

- A. General: Provide wire and cable suitable for the temperature, conditions and location where installed.
- B. Feeders: Copper [Copper for feeders smaller than No. 4 AWG; copper or aluminum for feeders No. 4 AWG and larger], 600 volt insulation. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- C. Branch Circuits: Copper, 600 volt insulation. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- D. Control Circuits: Copper, stranded conductor, 600 volt insulation.
- E. Wire for the following specialized systems shall be as shown on drawings or as dictated within these specifications. Where not designated, the systems manufacturer's recommendations shall be adhered to for the following systems:
  1. Fire Alarm.
  2. Low Voltage Switching.
  3. Electronic Control.
  4. Data.
  5. Security.
  6. Nurse Call.
- F. Single Conductors for Feeders and Branch Circuits:

1. Stranding: Provide solid conductors for branch circuits and non-vibrating power utilization equipment utilizing Number 10 AWG and smaller. Provide stranded conductors for Number 8 AWG and larger. Provide stranded conductors, regardless of size, for connections to vibrating equipment such as motors and transformers.

## 2.3 HEALTH CARE FACILITIES (HCF) TYPE METAL CLAD CABLE

- A. General: Healthcare-grade metal clad cables may be utilized for branch circuit wiring as defined in NFPA 70, Article 330 and Article 517 subject to acceptance by State and Local Codes.
- B. Construction: Health Care Facilities Metal Clad cable to be a factory assembly of one or more individually insulated conductors enclosed in a metal sheath qualified as a grounding conductor with a redundant grounding/bonding conductor. MC cable shall be listed and labeled under UL 1569.
- C. Sheathing: Green steel or aluminum interlocking tape, smooth tube or corrugated tube. Convolutions of interlocking tape shall not separate when cable is bent at a radius as tight as seven times the external diameter of the cable sheath.
- D. Conductor Material: Copper, minimum 12 AWG.
- E. Grounding Conductor Material: Copper, minimum 12 AWG.
- F. Conductor Insulation: Minimum temperature rating of 90 degrees Celsius and of a type listed in NEC Table 310-13.
- G. Dedicated Neutral: Each 120 Volt and 277 Volt circuit shall have a dedicated neutral conductor. Neutral conductors shall be considered current-carrying conductors for cable derating.
- H. Redundant Grounding: Factory provided assembly shall include redundant grounding provided by an armor assembly comprised of interlocked armor with a full-sized bare aluminum grounding/bonding conductor and a separate green insulated copper grounding conductor. The bare aluminum grounding/bonding conductor shall be located outside the binding tape covering for the phase, neutral and equipment grounding conductor.
- I. Health care facilities (HCF) type metal clad cable shall not be used for circuits connected to the essential electrical system.
- J. Approved use of metal clad cable is limited. Refer to Part 3 of this specification for permitted uses.

## 2.4 REMOTE CONTROL AND SIGNAL CABLE

- A. Control Cable for Class 1 Remote Control and Signal Circuits: Copper conductor, 600 volt insulation, rated 60 degrees C, individual conductors twisted together, shielded, and covered with a PVC jacket.

- B. Control Cable for Class 2 or Class 3 Remote Control and Signal Circuits: Copper conductor, 300 volt insulation, rated 60 degrees C, individual conductors twisted together, shielded, and covered with a PVC jacket; UL listed.
- C. Plenum Cable for Class 2 or Class 3 Remote Control and Signal Circuits: Copper conductor, 300 volt insulation, rated 60 degrees C, individual conductors twisted together, shielded and covered with a nonmetallic jacket; UL listed for use in air handling ducts, hollow spaces used as ducts, and plenums.

## 2.5 CONNECTORS AND SPLICES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. AFC Cable Systems, Inc.
  - 2. Hubbell Power Systems, Inc.
  - 3. O-Z/Gedney; EGS Electrical Group LLC.
  - 4. 3M; Electrical Products Division.
  - 5. Tyco Electronics Corp.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type and class for application and service required.

## PART 3 - EXECUTION

### 3.1 CONDUCTOR INSULATION, APPLICATIONS AND WIRING METHODS

- A. Concealed in Ceilings, Walls, Partitions, Raised Flooring and Crawlspace: Type THHN-THWN, single conductors in raceway.
- B. Concealed in Ceilings, Walls, Partitions, Raised Flooring and Crawlspace: Type THHN-THWN, single conductors in raceway. Metal Clad cable is not permitted. Hospital Grade Metal Clad cable is permitted only as follows:
  - 1. Where used to connect to an under-cabinet luminaire, health care facilities metal clad cable may be used only for the vertical drop concealed within a wall to the final termination at the under-cabinet luminaire. A junction box should be provided above the ceiling at the wall where the cabinet is mounted to transition to HCF cable.
    - a. HCF metal clad cable shall not be used for circuits serving the Essential Electrical System.
- C. Within prefabricated, listed medical headwall units: Type THHN-THWN, single conductors in raceway or type HCF MC cable. Refer to construction drawings for additional information.
- D. Exposed, Including in Crawlspace: Type THHN-THWN, single conductors in raceway.
- E. Class 1 Control Circuits: Install per NEC Article 725.

- F. Class 2 Control Circuits: Install per NEC Article 725.

### 3.2 DEVIATION FROM CONTRACT DRAWINGS

- A. Basis of Design is copper conductors installed in raceway, based on 30 degrees C ambient temperature (NEC Table 310.15(B)(16)). If materials or methods selected for installation differ from the basis of design, size conductors and conduits to meet or exceed the ampacity of circuits selected for the basis of design.
- B. Routing multiple conductors within a single conduit requires the conductor ampacity to be derated per National Electrical Code Article 310. Do not provide more than 4 conductors within a single conduit to serve loads such as panelboards, motor control centers, motors over 1/4 horsepower, etc.

### 3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Install products in accordance with manufacturer's instructions.
- B. Conceal cables in finished walls, ceilings and floors unless otherwise indicated.
- C. Completely and thoroughly swab raceway before installing wire.
- D. 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.
- E. Use pulling means including fish tape, cable, rope, and basket weave wire and cable grips which will not damage cables or raceways. Do not use rope hitches for pulling attachment to wire or cable. Do not exceed maximum tensile strength of conductor or grip. Do not exceed maximum sidewall pressure limitations of cables.
- F. Pull conductors simultaneously where more than one is being installed in the same raceway.
- G. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.
- H. Feeder conductors shall be continuous and shall not contain splices.
- I. Provide adequate length of conductors within electrical enclosures and train the conductors to terminal points with no excess. Bundle multiple conductors, with conductors larger than Number 10 AWG cabled in individual circuits. Make terminations so there is no more than 1/8 inch of exposed bare conductor at the terminal. Observe NEC 310.15 (B)(2)(a) adjustment factors.
- J. Verify that interior of building has been protected from weather and mechanical work likely to damage wire and cable has been completed prior to installing wire and cable.
- K. Use conductor not smaller than Number 12 AWG for power and lighting circuits.
- L. Single conductors used for control circuits shall not be smaller than Number 14 AWG.

- M. Use Number 10 AWG conductors (phase, neutral and ground) for 20 ampere, 120 volt branch circuits longer than 75 feet, unless drawings requirements are more stringent.
- N. Use Number 10 AWG conductors (phase, neutral and ground) for 20 ampere, 277 volt branch circuits longer than 200 feet, unless drawings requirements are more stringent.
- O. Use Number 8 AWG conductors (phase, neutral and ground) or larger for outdoor lighting circuits.
- P. Place an equal number of conductors for each phase, neutral and ground of a circuit within the same raceway or cable when routing parallel conductors. Conductor lengths must be equal.
- Q. Support cables according to Division 26 Section "Hangers and Supports."
- R. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

### 3.4 CABLE INSTALLATION, APPLICATIONS AND WIRING METHODS

- A. Open cabling shall be routed in a symmetrical manner, tight and parallel to walls.
- B. Support open cable by appropriate size bridle rings or j-hooks at five foot intervals. Open cable may not rest on suspended ceilings. Wire and cable from different systems shall not be installed within the same bridle rings or j-hooks. Neatly bundle grouped cables every two-and-a-half feet with a nylon tie wrap.
- C. Open cable may only be installed where specifically dictated on drawings or permitted elsewhere within these specifications.

### 3.5 HEALTH CARE FACILITIES (HCF) TYPE METAL-CLAD CABLE INSTALLATION

- A. Hospital grade metal clad cables may be utilized for 20A and 15A branch circuit wiring as defined in NFPA 70, Article 330 and Article 517 subject to acceptance by State and Local Codes. Feeder wiring must consist of individual insulated conductors in conduit.
- B. Metal clad cable installations shall comply with the requirements stipulated within Article 330 of the National Electrical Code.
- C. Provide individual insulated conductors in conduit from branch panelboard to junction box(es) located above the ceiling in the same room as the final device(s) or luminaire(s) being served.
  - 1. HCF metal clad cable is permitted to be extended from this junction box to electrical devices and luminaires in the same room.
  - 2. In rooms or spaces with inaccessible ceilings, the aforementioned junction box may be located in the nearest accessible ceiling, corridor preferred.
- D. HCF metal clad cable is allowed for flexible connection to luminaires in lengths not to exceed 6'-0".
- E. HCF metal clad cable shall only be run concealed.

- F. HCF metal clad cable shall not be daisy chained from [receptacle-to-receptacle or from] luminaire to luminaire. Metal clad cable runs shall be from a junction box to the final device or luminaire.
- G. HCF metal clad cable shall not be used for circuits serving the Essential Electrical System.

### 3.6 CONNECTIONS AND TERMINATIONS

- A. Tighten electrical connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A.
- B. Clean conductor surfaces before installing lugs and connectors.
- C. Utilize solderless compression terminals applied with circumferential compression for conductor sizes 8 AWG and larger and crimp in accordance with manufacturer instructions. Indenter compression method may be used for conductor sizes 10 AWG and smaller.
- D. Phase Sequence: Connections to phase conductors at electrical equipment shall be made such that the A-B-C conductors, when facing the equipment, are oriented top to bottom, or left to right.
- E. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

### 3.7 SPLICES AND TAPS

- A. Conductor splices shall be kept to a minimum.
- B. Only splice within accessible junction boxes or enclosures.
- C. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors. Splices and taps shall be capable of carrying the full ampacity of the conductors without perceptible temperature rise.
- D. Above Grade:
  - 1. Use copper compression connectors applied with circumferential compression for conductor sizes 6 AWG and larger.
  - 2. Use pre-molded insulated tap connectors for copper conductor splices and taps, Number 8 AWG and smaller. Insulate with UL listed insulating cover supplied by same manufacturer as connector.
  - 3. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, Number 10 AWG and smaller.
  - 4. Tape uninsulated conductors and connectors with electrical tape to 150 percent of insulation rating of conductor, or three layers of tape, whichever is greater.

### 3.8 FIELD QUALITY CONTROL

- A. Inspect wire for physical damage and proper connection.



- B. Measure tightness of bolted connections with properly scaled and calibrated torque tool and compare torque measurements with manufacturer's recommended values.
- C. Before energizing, test wires and cables for electrical continuity and for short circuits.
- D. Remove and replace malfunctioning conductors and retest as specified above.

END OF SECTION 26 0519

## SECTION 26 0526 - **GROUNDING AND BONDING**

### 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 solid grounding of electrical systems and equipment. It includes basic requirements for grounding for protection of life, equipment, circuits and systems. Grounding requirements specified in this Section may be supplemented in other sections of these Specifications.

#### 1.3 SUBMITTALS

- A. Submittals for approval by the Engineer of products to be used are not required for this section. Unrequested submittals will not be processed or reviewed. Non-requirement of submittals is not to be construed as an allowance for substitutions and does not allow relief from full compliance with the contract documents.
- B. Field Test Reports: Submit written test reports to include the following:
  - 1. Test procedures used.
  - 2. Weather and soil conditions observed on test date.
  - 3. Test results that comply with requirements.
  - 4. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

#### 1.4 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.
- C. Listing and Labeling: Provide products specified in this Section that are listed and labeled for the specific purposes by Underwriters Laboratories.
- D. Testing Agency Qualifications: Member Company of NETA or an NRTL.
  - 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

## PART 2 - PRODUCTS

### 2.1 GROUNDING AND BONDING PRODUCTS

- A. Products: Of types indicated and of sizes and ratings to comply with NEC. Where types, sizes, ratings and quantities indicated are in excess of NEC requirements, the more stringent requirements and the greater size, rating, and quantity indications govern.

### 2.2 CONDUCTORS

- A. General: Comply with Division 26 Section "Conductors and Cables" for insulated grounding conductors. Conform to NEC Table 8, except as otherwise indicated, for conductor properties, including stranding.
- B. Equipment Grounding Conductor: Green insulated; conductor metal shall match branch circuit conductor metal.
- C. Grounding Electrode Conductor: Stranded cable.
- D. Copper Conductors: Conform to the following:
  - 1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
  - 2. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
  - 3. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
  - 4. Bonding Strap Conductor/Connectors: Soft copper, 0.05 inch thick and 2 inches wide, except as indicated.

### 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. Bus-bar Connectors: Mechanical type, cast silicon bronze, solderless compression type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
- C. Bolted Clamps: Heavy-duty units listed for the application.
- D. Exothermic Welded Connections: Provided in kit form and selected for the specific types, sizes, and combinations of conductors and other items to be connected.
- E. Compression Connectors: Irreversible compression connectors must be factory filled with oxide inhibitor and fully crimped with a 14-ton or larger hydraulic tool so that index number is embossed on the connector. May be used above or below grade.

## PART 3 - EXECUTION

### 3.1 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.

### 3.2 EQUIPMENT GROUNDING

- A. Equipment Grounding Conductor Application: Comply with NEC Article 250 for sizes and quantities of equipment grounding conductors, except where larger sizes or more conductors are indicated.
- B. Install separate insulated equipment grounding conductors with all feeders and branch circuit conductors. Terminate each end on a grounding lug or bus.

### 3.3 BONDING

- A. Air Duct Equipment Circuits: Install an insulated equipment grounding conductor to duct-mounted electrical devices operating at 120-V and above including air cleaners and heaters. Bond the conductor to each such unit and to the air duct.
- B. Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, pumps, blowers, electric heaters and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.
- C. Building Expansion Joints: Provide flexible bonding jumper between columns and beams on both sides of each expansion joint.
- D. Separately Derived Systems: Where the NEC requires separately derived systems to be grounded, provide grounding in accordance with the NEC.
- E. Connection to Other Systems: Bond electrical system grounding, lightning protection, telephone, CATV, other communications systems, metal water piping, metal gas piping and other piping systems together.
- F. Signal and Communication Equipment: In addition to grounding and bonding required by NFPA 70, provide a separate grounding system complying with requirements in TIA/ATIS J-STD-607-A.
  - 1. For telephone, alarm, voice and data and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet and central equipment location.
  - 2. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-inch by-4-inch by-12-inch (6.3-by-100-by-300-mm) grounding bus.
  - 3. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
- G. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

### 3.4 CONNECTIONS

- A. General: Select connectors, hardware and conductors and make connections in such a manner as to minimize possibility of galvanic action or electrolysis.
  1. Make connections with clean bare metal at points of contact.
  2. Coat and seal connections involving dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
  3. Exothermic Welded Connections or Compression-type Connections: Use for connections to structural steel and for underground connections except those at test wells. Install at connections to ground rods and plate electrodes. Comply with manufacturer's written recommendations. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable. Compression connections should be inspected for visible die index number matching the die and connector used. Connections that do not show this are not acceptable.
- B. Conductor Terminations and Connections:
  1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
  2. Connections to Structural Steel: Exothermic-welded or compression-type ground stud connector.
- C. Equipment Grounding Conductors: Terminate insulated equipment grounding conductors for feeders and branch circuits with pressure-type grounding lugs.
- D. Metallic Raceway Continuity: Where metallic raceways terminate at metallic housings without mechanical and electrical connection to the housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to the ground bus in the housing. Bond electrically non-continuous conduits at both entrances and exits with grounding bushings and bare grounding conductors.
- E. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values for connectors and bolts. Where manufacturer's torquing requirements are not indicated, tighten connections to comply with torque tightening values specified in UL 486A.
- F. Compression-Type Connections: Use hydraulic compression tools of at least 14-ton size to provide the correct circumferential pressure for compression connectors. Use tools and dies recommended by the manufacturer of the connectors. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on the ground conductor.

### 3.5 EQUIPOTENTIAL GROUNDING SYSTEM

- A. Provide equipotential grounding in the following locations:

1. Patient Care Areas:
  - a. In addition to the above requirements, connect an insulated continuous copper conductor not smaller than No. 8 AWG between the equipment grounding terminal buses of the normal and essential branch-circuit panelboards serving the same patient care vicinity.

### 3.6 FIELD QUALITY CONTROL

- A. Tests and Inspections: After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements:
  1. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
  2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal 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.
  3. Maximum Ground Resistance Values:
    - a. Equipment rated 500 kVA and Less: 10 Ohms.
  4. Where resistance to ground exceeds specified values, notify Engineer and include recommendations to reduce ground resistance.

END OF SECTION 26 0526

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## SECTION 26 0529 - **HANGERS AND SUPPORTS**

### 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. Secure support from the building structure for electrical items by means of hangers, supports, anchors, sleeves, inserts, seals and associated fastenings.
  - 2. Construction requirements for concrete bases.

#### 1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. RMC: Rigid metal conduit.
- C. Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of four times the applied force.

#### 1.4 SUBMITTALS

- A. Submittals for approval by the Engineer are not required for this section. Unrequested submittals will not be processed or reviewed. Non-requirement of submittals is not to be construed as an allowance for substitutions and does not allow relief from full compliance with the contract documents.

#### 1.5 QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. Electrical components shall be listed and labeled for the specific intended purpose by Underwriters Laboratories, Inc.
- C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

#### 1.6 COORDINATION

- A. Coordinate size, shape and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.



## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. Slotted Metal Angle and U-Channel Systems:
    - a. Allied Tube & Conduit.
    - b. American Electric.
    - c. B-Line Systems, Inc.
    - d. GS Metals Corp.
    - e. Unistrut Diversified Products.
  2. Conduit Sealing Bushings:
    - a. Bridgeport Fittings, Inc.
    - b. Killark Electric Mfg. Co.
    - c. O-Z/Gedney.
    - d. Raco, Inc.
    - e. Red Seal Electric Corp.

### 2.2 COATINGS

- A. Coating: Supports, support hardware, and fasteners shall be protected with zinc coating or with treatment of equivalent corrosion resistance using approved alternative treatment, finish or inherent material characteristic.

### 2.3 MANUFACTURED SUPPORTING DEVICES

- A. Raceway Supports: Clevis hangers, riser clamps, conduit straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets and spring steel clamps.
- B. Fasteners: Types, materials and construction features as follows:
1. Expansion Anchors: Carbon steel wedge or sleeve type.
  2. Toggle Bolts: All steel springhead type.
  3. Through Bolts: Structural type, hex head, high strength. Comply with ASTM A 325.
- C. Conduit Sealing Bushings: Factory-fabricated watertight conduit sealing bushing assemblies suitable for sealing around conduit or tubing passing through concrete floors and walls. Construct seals with steel sleeve, malleable iron body, neoprene sealing grommets or rings, metal pressure rings, pressure clamps and cap screws.
- D. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for non-armored electrical cables in riser conduits. Provide plugs with number and size of conductor gripping holes as required to suit individual risers. Construct body of malleable-iron casting with hot-dip galvanized finish.
- E. U-Channel Systems: 16-gauge steel channels, with 9/16-inch-diameter holes, between one and one half and two and one half inches on center, in top surface. Provide fittings

and accessories that mate and match with U-channel and are of the same manufacture.

## 2.4 FABRICATED SUPPORTING DEVICES

- A. General: Shop- or field-fabricated supports or manufactured supports assembled from U-channel components.
- B. Steel Brackets: Fabricated of angles, channels, and other standard structural shapes. Connect with welds and machine bolts to form rigid supports.
- C. Pipe Sleeves:
  - 1. Provide pipe sleeves of one of the following:
    - a. Interior Dry Locations: Fabricate from Schedule 40 galvanized steel pipe or Schedule 40 PVC plastic pipe.
    - b. Exterior or Interior Wet or Damp Locations: Fabricate from Schedule 40 PVC plastic pipe.
  - 2. Sleeves shall not penetrate structural members without approval from the Structural Engineer.
  - 3. Openings through unexcavated floors and/or foundation walls below the floor shall have a smooth finish with sufficient annular space around material passing through opening so slight settling will not place stress on the material or building structure.
  - 4. Install all sleeves concentric with conduits. Secure sleeves in concrete to wood forms. This Contractor is responsible for sleeves dislodged or moved when pouring concrete.
  - 5. Where conduits rise through concrete floors that are on earthen grade, provide 3/4-inch resilient expansion joint material (asphalt and cork) wrapped around the pipe, the full depth of concrete at the point of penetration. Secure to prevent shifting during concrete placement and finishing.
  - 6. Size sleeves large enough to allow expansion and contraction movement.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install supporting devices to fasten electrical components securely and permanently in accordance with NEC requirements.
- B. Coordinate with the building structural system and with other disciplines' installations.
- C. Raceway Supports: Comply with the NEC and the following requirements:
  - 1. Conform to manufacturer's recommendations for selection and installation of supports.
  - 2. Strength of each support shall be adequate to carry present and future load multiplied by a safety factor of at least four. Where this determination results in a safety allowance of less than 200 lbs, provide additional strength until there is a minimum of 200 pounds safety allowance in the strength of each support.

3. Install individual and multiple (trapeze) raceway hangers and riser clamps as necessary to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assembly and for securing hanger rods and conduits.
  4. Support parallel runs of horizontal raceways together on trapeze-type hangers.
  5. Support individual horizontal raceways by separate pipe hangers. Spring steel fasteners may be used in lieu of hangers only for 1-inch and smaller raceways serving branch circuits, telephone and data above suspended ceilings only. For hanger rods with spring steel fasteners, use 1/4-inch-diameter or larger threaded steel. Use spring steel fasteners that are specifically designed for supporting single conduits or tubing.
  6. Space supports for raceways in accordance with Table I of this section. Space supports for raceway types not covered by the above in accordance with NEC.
  7. Support exposed and concealed raceway within 3 feet of boxes, access fittings, device boxes or cabinets.
  8. In vertical runs, arrange support so the load produced by the weight of the raceway and the enclosed conductors is carried entirely by the conduit supports with no weight load on raceway or conductor terminals.
  9. Vertical Conductor Supports: Install simultaneously with installation of conductors.
  10. Miscellaneous Supports: Support miscellaneous electrical components as required to produce the same structural safety factors as specified for raceway supports. Install metal channel racks for mounting cabinets, panelboards, disconnects, control enclosures, pull boxes, junction boxes, transformers and other devices.
- D. Fastening: Unless otherwise indicated, fasten electrical items and their supporting hardware securely to the building structure, including but not limited to conduits, raceways, cables, cable trays, busways, cabinets, panelboards, transformers, boxes, motor control centers, disconnect switches and control components in accordance with the following:
1. Fasten by means of wood screws or screw-type nails on wood, toggle bolts on hollow masonry units, concrete inserts, or expansion bolts on concrete or solid masonry, and machine screws, welded threaded studs, or spring-tension clamps on steel. Do not weld conduit, pipe straps, or items other than threaded studs to steel structures. In partitions of light steel construction, use sheet metal screws.
  2. Holes cut to depth of more than 1-1/2 inches in reinforced concrete beams or to depth of more than 3/4-inch in concrete shall not cut the main reinforcing bars. Fill holes that are not used.
  3. Do not fasten supports to ceiling systems, piping, ductwork, mechanical equipment, or conduit unless otherwise noted.
  4. Do not use powder-actuated anchors without specific permission.
  5. Do not drill structural steel members.
  6. Install surface-mounted cabinets and panelboards with minimum of four anchors.
  7. Bridge studs top and bottom with channels to support flush-mounted cabinets and panelboards in stud walls.
- E. In wet locations and on all building floors below exterior earth grade install freestanding electrical equipment on concrete pads.
- F. Ensure that the load applied to any fastener does not exceed 25 percent of the proof test load. Use vibration- and shock-resistant fasteners for attachments to concrete slabs.

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.

### 3.2 PAINTING

- A. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

TABLE I: SPACING FOR RACEWAY SUPPORTS

Raceway Size (Inches)	No. of Conduits in Run	Location	Maximum Spacing of Supports (Feet)		
			RMC & IMC*	EMT	RNC
HORIZONTAL RUNS					
1/2, 3/4	1 or 2	Flat ceiling or wall.	5	5	3
1/2, 3/4	1 or 2	Where it is difficult to provide supports except at intervals fixed by the building construction.	7	7	--
1/2, 3/4, 1	3 or more	Any location.	7	7	--
1 & larger	1 or 2	Flat ceiling or wall.	6	6	--
1 & larger	1 or 2	Where it is difficult to provide supports except at intervals fixed by the building construction.	10	10	--
1 & larger	3 or more	Any location.	10	10	--
Any	--	Concealed.	10	10	--
VERTICAL RUNS					
1/2, 3/4	--	Exposed.	7	7	--
1, 1-1/4	--	Exposed.	8	8	--
1-1/2 and larger	--	Exposed.	10	10	--
Up to 2	--	Shaftway.	14	10	--
2-1/2	--	Shaftway.	16	10	--
3 & larger	--	Shaftway.	20	10	--
Any	--	Concealed.	10	10	--

\*Maximum spacings for IMC above apply to straight runs only. Otherwise the maximums for EMT apply.

END OF SECTION 26 0529

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## SECTION 26 0533 - **RACEWAYS**

### 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 raceways electrical wiring:
  1. Metallic Conduit and Tubing.
  2. Metal Wireways.
  3. Low Voltage Cabling Support.
  4. Communications Raceway Accessories.

#### 1.3 SUBMITTALS

- A. Submittals for approval by the Engineer are not required for this section. Unrequested submittals will not be processed or reviewed. Non-requirement of submittals is not to be construed as an allowance for substitutions and does not allow relief from full compliance with the contract documents.

#### 1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70 "National Electrical Code" for components and installation.
- C. Comply with NECA "Standard of Installation."
- D. Listing and Labeling: Provide products specified in this Section that are listed and labeled by Underwriters Laboratories for the specific purpose and comply with the following standards:
  1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
  2. ANSI C80.3 - Electrical Metallic Tubing, Zinc Coated.
  3. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
  4. ANSI/NFPA 70 - National Electrical Code.
  5. ANSI/NEMA FB 1 – Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable.
  6. NECA "Standard of Installation."
  7. TIA/EIA-569-A – Commercial Building Standard for Telecommunications pathways and spaces.
  8. TIA/EIA-606-A – The Administrative Standard for the Telecommunications Infrastructure of Commercial Buildings.

9. "Telecommunications Distribution Methods Manual" published by the Building Industry Consulting Services International (BICSI).

## PART 2 - PRODUCTS

### 2.1 GENERAL REQUIREMENTS

- A. Provide conduit, tubing and fittings of types, grades, sizes and weights (wall thicknesses) for each service indicated. Where types and grades are not indicated, provide proper selection determined by installer to fulfill wiring requirements, and comply with applicable portions of NFPA 70 for raceways.
- B. Bushings: Bushings for terminating conduits smaller than 1-1/4 inches are to have flared bottom and ribbed sides, with smooth upper edges to prevent injury to cable insulation. Install insulated type bushings for terminating conduits 1-1/4 inches and larger. Upper edge to have phenolic insulating ring molded into bushing. Bushings to have screw type grounding terminal.
- C. Raintight Sealing Hubs: Two piece type with outer internally-threaded hub to receive conduit, inner locking ring with bonding screw, insulated throat, and V-shaped ring or O-ring.

### 2.2 METAL CONDUIT AND TUBING

#### A. Rigid Steel (Metallic) Conduit:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Allied Tube & Conduit.
  - b. LTV Steel Tubular Products Company.
  - c. O-Z Gedney.
  - d. Wheatland Tube Company.
2. Description: Conduit to be seamless, hot dipped galvanized rigid steel. Threads to be cut and ends chamfered prior to galvanizing. Galvanizing to provide zinc coating fused to inside and outside walls of conduit. Provide an enamel lubricating coating on the inside of the conduit. Conduit to conform to ANSI C80.1 and listed and labeled under UL 6.
3. Fittings and Conduit Bodies: NEMA FB 1, single piece threaded, cadmium plated malleable iron.
  - a. [Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.]
4. Joint Compound: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

#### B. Electrical Metallic Tubing:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Allied Tube & Conduit.
  - b. Republic Conduit.
  - c. Wheatland Tube Company.
2. Description: Conduit to be seamless, hot dipped or electro-galvanized steel tubing. Galvanizing to provide zinc coating fused to outside walls of conduit. Provide an enamel lubricating coating on the inside of the conduit. Conduit to conform to ANSI C80.3 - 1983 and listed and labeled under UL 797.
  3. Fittings and Conduit Bodies: Compression.
  4. Expansion fittings for use with EMT shall allow for a minimum of four inches of movement and shall be similar to O-Z Gedney TX series, complete with bonding jumpers and hardware.
- C. Flexible Metal Conduit: Zinc-coated steel [Aluminum] [Zinc-coated steel or aluminum].
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. AFC Cable Systems.
    - b. Alflex Inc.
    - c. Electri-Flex Co.
  2. Description: Interlocked steel or aluminum construction, consisting of spirally wrapped, convoluted hot dip galvanized steel strip. Zinc coating to cover both sides and all edges of steel strip. Convolutions to be interlocked to prevent separation when conduit is bent at radius equal to 4-1/2 times conduit O.D. Conduit to be listed and labeled under UL 1.
  3. Fittings: ANSI/NEMA FB 1 -1988. Threadless hinged clamp type, galvanized zinc coated cadmium plated malleable cast iron.
- D. Liquidtight Flexible Metal Conduit:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. AFC Cable Systems.
    - b. Alflex Inc.
    - c. Electri-Flex Co.
  2. Description: Flexible steel conduit with PVC jacket, listed and labeled under UL 360.
  3. Fittings: and Conduit Bodies: Watertight, compression type, galvanized zinc coated cadmium plated malleable cast iron. Conduit to be listed and labeled under UL 360.

## 2.3 METAL WIREWAYS

- A. Available Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cooper B-Line, Inc.
  2. Hoffman.
  3. Square D; Schneider Electric.



- B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, 12, or 3R as environmental conditions dictate, unless otherwise indicated.
- C. Material: Primed and painted sheet steel for indoor locations, galvanized sheet steel for outdoor locations sized as indicated or required, whichever is greater.
  - 1. Wireway up to 6 inch by 6 inch cross section shall be minimum 16 gage.
  - 2. Wireway larger than 6 inch by 6 inch cross section shall be minimum 14 gage.
- D. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- E. Wireway Covers: [Hinged] [Screw-cover type]. Utilize flanged-and-gasketed type for outdoor locations.
- F. Finish: Manufacturer's standard gray enamel finish.

#### 2.4 LOW VOLTAGE CABLING SUPPORT

- A. General: The following supporting products are for use in systems below 50V.
- B. Open top cable supports (J-Hooks):
  - 1. Galvanized steel construction with smooth rounded edges.
  - 2. Complies with UL, cUL, NEC, and ANSI/TIA/EIA requirements for structured cabling systems.
  - 3. Manufacturers:
    - a. Erico.
    - b. B-Line.
    - c. Panduit.

#### 2.5 COMMUNICATIONS RACEWAY ACCESSORIES

- A. Pull cords:
  - 1. Pull wires shall be nylon type.
  - 2. Provide in all empty conduits, sleeves, raceways and all cabling pathways for future use.
  - 3. Pull cords shall have a tensile rating of 200 pounds minimum.

### PART 3 - EXECUTION

#### 3.1 METALLIC AND NON-METALLIC CONDUIT APPLICATION

- A. The following schedule shall be followed for all installations, unless it creates a violation of applicable codes or is otherwise specifically dictated otherwise within the drawings.
  - 1. Indoor Locations:

- a. Exposed, not subject to physical damage, or above 7 feet-0 inches of finished floor: RMC or EMT.
  - b. Exposed, subject to physical damage, or within 7 feet-0 inches of finished floor: RMC.
  - c. Finished spaces, concealed above suspended ceilings and interior walls and partitions: EMT.
  - d. Wet or Damp Locations: RMC.
- 2. Connections to vibrating equipment: FMC, except use LFMC in wet or damp locations.
  - 3. Communications Cable: EMT or Flexible type, listed for purpose.
- B. Conduit Size:
- 1. Conduits shall be sized as shown on drawings. Where conduit sizes are not indicated, conduits shall be sized in accordance with the latest version of the National Electrical Code (NFPA 70) and shall be limited to a 40 percent conductor fill percentage. Conductor ampacities must be maintained; therefore adjustment factors for temperature and quantity derating values must be observed.
    - a. Minimum Conduit Size: Unless otherwise noted, 3/4-inch (21-mm) trade size with the following exceptions:
      - 1) Switchlegs, Luminaire Whips and Control Wiring: 1/2-inch.
    - b. Conduit sizes may change only at the entrance or exit of a junction box.

### 3.2 METALLIC CONDUIT INSTALLATION

#### A. General Installation Requirements

- 1. Conduits shall be mechanically and electrically continuous from source of current to all outlets unless a properly sized grounding conductor is routed within the conduit. All metallic conduits shall be bonded per NFPA 70.
- 2. Do not reduce the indicated sizes of raceways. Conduit sizes may only change junction and pull boxes.
- 3. Complete raceway installation before starting conductor installation.
- 4. Use temporary closures to prevent foreign matter from entering raceway.
- 5. Avoid moisture traps; provide junction box with drain fitting at low points in raceway system.
- 6. 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. Empty raceways shall be labeled at each end indicating origin of the raceway. Labels shall be self-adhesive vinyl labels.
- 7. Raceways containing feeders and circuits associated with [branches of the essential power system], [the emergency power system], [the legally required power system], [the optional standby system] must be kept entirely independent from [each other and] other sources of power.

#### B. Conduit Routing:

1. Conduit shall be concealed in walls and above ceilings within finished spaces and may be exposed within unfinished spaces (such as mechanical and utility areas) where conditions dictate and as practical. Where routed exposed, headroom shall be maintained for pedestrian and vehicular traffic.
2. Raceway routing proposed on Drawings is diagrammatic in nature and shown in approximate locations unless dimensioned. Coordinate conduit routing with beams, joists, columns, windows, etc., as required to complete wiring system. Verify field measurements, routing and termination locations of raceway with obstructions and other trades prior to rough-in.
3. Conduit installation shall be coordinated with all other systems on the project. The Construction Team shall exchange details of their work in order to ensure adequate and coordinated fit of all systems within ceiling spaces and exposed unfinished areas.
4. Run concealed raceways with a minimum of bends in the shortest practical distance considering the type of building construction and obstructions, except as otherwise indicated.
5. Route exposed conduit and conduits above ceilings parallel and perpendicular to building structural lines, and as close to building structure as possible.
6. Raceways are not to cross pipe shafts or ventilating duct openings, nor are they to pass through HVAC ducts. Support riser raceway at each floor level with clamp hangers. Maintain adequate clearance between raceway and piping.
7. Coordinate layout and installation of conduit with other construction elements to ensure adequate headroom, working clearance and access.
8. Route conduit through roof openings provided for piping and ductwork or rooftop unit curbs where possible. Where unavoidable, route conduit through suitable roof jack with pitch pocket. Coordinate roof penetrations with other trades.
9. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Conduit Supports:

1. Install raceways level and square and at proper elevations. Provide adequate headroom. Group related conduits; support using conduit rack. Construct rack using steel channel. All conduit supports shall be secured to walls, structural members, [slabs] and bar joists. Do not support conduits from non-structural members, such as ductwork, water or fire suppression piping, or ceiling grid support system.
2. Run parallel or banked raceways together, on common support racks where practical and make bends from same center line to make bends parallel. Use factory elbows only where they can be installed parallel; otherwise, provide field bends for parallel raceways. Provide space within each rack for 20 percent additional conduits.
3. Support raceways as specified in Division 26 Section "Hangers and Supports."

D. Conduit Fittings and Terminations:

1. 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.

2. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
3. Install raceway sealing fittings according to the manufacturer's written instructions. Locate fittings at suitable, approved, accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank coverplate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings where conduits enter or leave hazardous locations, where conduits pass from warm locations to cold locations, such as the boundaries of refrigerated spaces, such as kitchen cold boxes, air-conditioned spaces and other places indicated on the drawings or required by NFPA 70.
4. Expansion/Deflection Joints: Provide suitable fittings to accommodate expansion and contraction where raceway crosses seismic and expansion joints. Install expansion fittings in the full open position if installed during a period of lowest expected temperature, and in the fully closed position if installed during a period of highest expected temperature. Install at proportionate intermediate position for intermediate temperatures.
  - a. In addition to the foregoing, provide expansion fittings according to the following table, for exposed linear runs or runs in hung ceilings where such runs do not contain junction boxes, pull boxes, nor bends totaling more than 30 degrees.
  - b. EMT and RMC expansion couplers shall be UL listed with an internal copper braided bonding jumper that meets the requirements of NEC 250.98. Fitting shall be listed as suitable for wet locations and rain water tight when installed in wet or outdoor locations.

Raceway Material	Indoor, conditioned areas	Outdoors and non-conditioned areas
Steel	One expansion fitting in runs longer than 80 feet, additional expansion fittings every 400 feet	One expansion fitting in runs longer than 40 feet, additional expansion fittings every 200 feet

5. Flexible Connections: Use maximum of 6 feet of flexible metal conduit for recessed and semi-recessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement and for all motors. Use Liquidtight flexible metal conduit in wet or damp locations. Install ground conductor across flexible connections.
6. PVC Externally Coated Rigid Steel Conduit: Use only fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduit. All installations shall be completed by a factory certified installer.
7. Avoid use of dissimilar metals throughout system to eliminate possibility of electrolysis. Where dissimilar metals are in contact, coat surfaces with corrosion inhibiting compound before assembling.

E. Conduit Bends:

1. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.
2. Make bends and offsets so the inside diameter is not reduced. Unless otherwise indicated, keep the legs of a bend in the same plane and the straight legs of offsets parallel.
3. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one-shot bender when field-fabricated elbows are required for bends in metal conduit larger than 2 inch size.
4. Stub-Up Connections: Use type of conduit described for stub-ups from slab. Extend conduit through concrete floor for connection to freestanding equipment to a distance 6-inches above the floor. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

### 3.3 WIREWAY INSTALLATION

- A. Wireway shall be securely fastened to walls using steel channels. Mount plumb and level.
- B. Raintight wireways may only be installed in horizontal orientations.

### 3.4 COMMUNICATIONS RACEWAY INSTALLATION REQUIREMENTS

#### A. General:

1. These guidelines are intended to supplement the requirements listed in other portions of this specifications section.
2. Minimum raceway size shall be as necessary to comply with fill ratio of referenced standards, but in no case less than [1 inch] [1-1/4 inch].
3. Provide specified pull wires in all cabling pathways.
4. Conduit terminations for all low voltage wiring shall have nylon bushings installed on each end.
5. Ground and bond all systems in accordance with the NEC and ANSI/TIA/EIA 607.
6. All installation material and practices shall fully comply with NFPA 70 "National Electrical Code" and ANSI/TIA/EIA 569A Commercial Building Standard for Telecommunications Pathways and Spaces (BICSI).
7. Coordinate work with the building structural systems and electrical installation.
8. All work shall fully comply with these Specifications and related Drawings and all manufacturers' recommended installation practices.
9. Do not install conduit in concrete slab.
10. There shall not be more than the equivalent of 180 degrees of bends in any single run of conduit between adequately sized pull.
11. Conduits entering a Telecommunications room below the finished ceiling shall be extended a minimum of 4-inches below the ceiling and shall be routed as tight to the adjacent wall as possible.
12. Conduits entering a Telecommunications room through a wall shall extend 15 inches into the room and kept a minimum of 8 feet above finished floor.
13. Conduit bends:
  - a. Bends shall be made so that the conduit will not be flattened or kinked and the internal diameter of the conduit will not be reduced.
  - b. The radius of the curve of the inner edge of any bend shall not be less than as indicated by the National Electrical Code and ANSI/TIA/EIA 569A

Commercial Building Standard for Telecommunications Pathways and Spaces.

- c. In no case shall any conduit be bent or any fabricated elbow be applied to less than the allowable bending radius as specified by the cable manufacturer of the installed conductor.
  - d. When necessary to make field bends, use tools designed for conduit bending. Heating of metallic conduit to facilitate bending is not permitted.
14. A conduit run shall not be longer than 100 feet between pull boxes for conduit runs inside a building.
  15. Do not cut, burn or drill any structural member to mount electrical equipment or to facilitate tray or conduit installations without having previously received approval, in writing, from the Architect/Engineer/Consultant.
  16. Mount all conduit a minimum of [3 inches] [X inches] above any accessible type ceiling.
  17. Maintain conduit runs at least 6 inches from insulate pipes, steam lines or any other hot pipes they pass. Where the lines are not insulated, the clearances shall be increased until the temperature of the conduit, with no live conductors enclosed, does not rise above the ambient temperature of the installation area.
- B. Communications Pathway Separation Requirements:
1. Provide separation of communications pathways to minimize the effects of electromagnetic interference (EMI) by installing pathways in the following manner:
    - a. Provide a minimum of 37 inches separation from electrical motors and transformers and communications pathways.
    - b. When power lines or cables of different signal conditions must intersect, crossing shall be made at 90 degree angle, with proper separation as outlined above.
- C. Open Top Cable Supports (J-Hooks):
1. Install J-hook pathway, supporting at least every [5 feet], as straight as possible parallel and/or perpendicular to building structure.
  2. Shall be mounted to building structure or suspended by threaded rod from the deck above approximately [6 inches] [12 inches] [as noted on drawings] above suspended ceiling.
  3. Attachment of J-hooks must be to building structure directly or utilize a minimum of 1/4 inch all-thread rod anchored into deck above.
  4. Bundle cables with Velcro cable straps per TIA 596C and at each directional change.
  5. Under no condition shall there be more than 12 inches of vertical cable sag between supports.
  6. Cinch-tight cable ties are prohibited for all low voltage cabling support.
  7. Cable routes of less than ten 4 pair UTP (or equivalent weight) may be supported with bridal rings at maximum 5 feet-0 inch intervals.
  8. During installation of cables thru open top cable supports, pulling tension of cables shall not exceed 25 lbs.

### 3.5 SEISMIC REQUIREMENTS

- A. Whenever Specification Section 20 0800 "Seismic Protection" is included in these specifications, the following is also required for those life safety, emergency, fire alarms, etc., conduits that are defined therein. Details on the drawings, when shown, are intended to clarify or supplement these requirements:
  - 1. All expansion joints shall be considered seismic joints that can cause movement in any direction during a seismic event. Conventional expansion fittings are not adequate for this condition.
  - 2. For exposed conduit runs or runs in hung ceilings, provide a length of flexible metal conduit across the joint that will allow 2 inches of conduit movement in any direction. Length of the flexible section shall not exceed 6 feet.

### 3.6 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

### 3.7 PROTECTION

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
  - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
  - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

### 3.8 CLEANING

- A. Upon completion of installation of system, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches and abrasions.

### 3.9 MARKING AND IDENTIFICATION

- A. Mark and identify conduits in accordance with Section 26 0553 "Identification for Electrical Systems."
- B. Mark and identify communications conduits in accordance with Section 27 0553 "Identification for Communications Systems."

### 3.10 RECORD DOCUMENTS

- A. Accurately record actual routing of all feeder and sub-feeder conduits regardless of size and branch circuits conduits larger than 2-inches.

END OF SECTION 26 0533

## SECTION 26 0534 – **BOXES, CABINETS AND ENCLOSURES**

### 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 boxes, cabinets, and enclosures for electrical wiring.

#### 1.3 SUBMITTALS

- A. Submittals for approval by the Engineer are not required for this section. Unrequested submittals will not be processed or reviewed. Non-requirement of submittals is not to be construed as an allowance for substitutions and does not allow relief from full compliance with the contract documents.

#### 1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction and marked for intended use.
- B. Comply with the following standards:
  - 1. NECA "Standard of Installation."
  - 2. NEMA OS 1: Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports.
  - 3. NEMA OS 2: Non-Metallic Outlet Boxes, Device Boxes, Covers and Box Supports.
  - 4. NEMA FB 1: Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable.
  - 5. NEMA 250: Enclosures for Electrical Equipment (1000 Volts Maximum).

### PART 2 - PRODUCTS

#### 2.1 OUTLET BOXES

- A. General: Outlet boxes shall be constructed in accordance with National Electrical Code Article 314. Outlet boxes shall be sized for the volume required by the National Electrical Code, but in no case shall they be less than 1-1/2 inches deep.
- B. Sheet Metal Boxes: Comply with NEMA OS 1, galvanized steel.
- C. Nonmetallic Outlet Boxes: Comply with NEMA OS 2.
- D. Cast Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy or aluminum, type FD with gasketed cover and threaded hubs.



- E. Boxes for receptacle, telephone and data outlets shall be 4-11/16 inches square by 2-1/8 inches deep and shall be provided with extension rings. Furnish outlet boxes with fixture studs where required.
- F. Boxes for switches or local light control shall be 4 inches square by 1-1/2 inches deep and shall be provided with raised cover to fit flush with finished wall line. Provide single box for multiple-ganged devices with single coverplate, sized for the quantity of devices to be installed.
- G. Provide 4-inch octagonal and square outlet boxes for all exposed conduit work with fixture extension pan or deep fixture canopy to enclose the outlet box.
- H. Boxes for recessed light fixtures shall be 4-inch octagonal or square according to fixture hardware requirements, minimum 1-1/2 inches deep complete with blank cover.
- I. Provide corrosion-resistant steel knockout closures for unused openings.

## 2.2 JUNCTION AND PULL BOXES

- A. Small Sheet Metal Pull and Junction Boxes: Comply with NEMA OS 1, galvanized steel. Flush-mounted boxes shall have an overlapping cover.
- B. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1, [galvanized,] [cast iron] [or aluminum] with gasketed cover.
- C. Covers: Covers shall be the same material as the box. Covers shall be on the largest access side of the box, unless otherwise indicated.
  - 1. Less than 12 inches in any dimension: Screw-on cover.
  - 2. Greater than 12 inches in any dimension: Hinged cover.
- D. Hinged-Cover Enclosures: Comply with NEMA 250, [Type 1] [Type 12] with continuous-hinge cover with flush latch, unless otherwise indicated.
  - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

## 2.3 CABINETS AND ENCLOSURES

- A. Comply with NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
- B. Provide metal barriers to separate wiring of different systems and voltage.
- C. Hinged Cover: Hinged door in front cover with flush latch and concealed hinge.
- D. Where lockable cabinets are provided, key latch to match panelboards.
- E. Provide accessory feet where required for freestanding equipment.

## PART 3 - EXECUTION

### 3.1 BOX AND CABINET INSTALLATION

#### A. General Installation Requirements:

1. Electrical boxes are shown on drawings in approximate locations unless dimensioned. The Engineer or Architect shall be allowed to adjust the location of boxes up to 10 feet in any direction without additional cost to the project. This is intended for boxes for receptacles and switches and other wiring devices.
2. Provide boxes as shown and for splices, taps, wire pulling, equipment and fixture connections and where required by applicable codes and installation practices.
3. Locate boxes to maintain headroom and present a neat appearance. Locate to allow proper access. Provide access doors for boxes located above inaccessible ceilings.
4. Provide knockout closures to cap unused knockout holes where blanks have been removed.
5. Support all boxes, cabinets and enclosures rigidly and independently of conduit except where specifically allowed by the National Electrical Code. Use supports suitable for the purpose.
6. Boxes located outdoors above ground shall be raintight and gasketed cast aluminum.
7. Provide covers for all boxes.
8. Do not install boxes back-to-back in same wall. Provide at least 6 inch separation or greater where required by the building code. In hollow fire walls, maintain minimum 24 inch horizontal separation between outlets on opposite sides. As an alternate to the 24 inch separation, the use of listed putty pads or other listed materials and methods approved by the Authority Having Jurisdiction are acceptable.

#### B. Outlet Box Installation:

1. All devices (receptacles, switches, occupancy sensors, fire alarm devices, low voltage devices, telephone jacks, TV jacks, data jacks, microphones jacks, etc., and any other device) furnished under this project shall be mounted on or in an outlet box regardless of whether or not the associated system wiring is in conduit, unless otherwise noted.
2. Flush-mount outlet boxes in finished areas. Outlets in mechanical rooms, electrical rooms, and the above removable ceilings may be surface-mounted.
3. Use multiple gang boxes where more than one device is mounted together. Provide barriers to separate different voltage systems.
4. For outlets mounted above counters, benches, or backsplashes, coordinate location and mounting heights with architectural details. Install with bottom of box minimum 6 inch above backsplash.
5. Align wall-mounted outlet boxes for switches, thermostats, and similar devices.
6. Adjust outlet mounting height and horizontal location to agree with required location for equipment served as may be shown on installation instructions or shop drawing for the equipment.
7. Position outlets to locate luminaires as shown on reflected ceiling drawings. For recessed boxes in finished areas, secure to interior wall and partition studs; allow for surface finish thickness.

8. Ensure that thermal insulation will be in place behind outlet boxes before installing them in insulated walls. Do not damage insulation.
9. Special care shall be taken to set all flush boxes square and true with the building finish. The edge of the cover shall meet the building finish or be no greater than 1/8 inch back from the finish surface. All wall outlets shall be rigidly secured to the stud system, using adjustable supports where necessary, to prevent all box movement.
10. Do not set boxes back further than required by Code. Coordinate with building finishes. Do not install any box so that the device pushes back into the wall when pushed. All boxes are to be set so that the device yoke will securely bear upon the box or wall finish. Where the sheetrock contractor cuts an opening too big for this to be achieved, install a fitting such as Caddy # RLC.
11. Installation within Masonry walls:
  - a. Adjust position of outlets in finished masonry walls to suit masonry course lines where possible. Do not, however, violate maximum heights defined by accessibility codes such as ADA.
    - 1) Coordinate cutting in of walls to achieve neat openings for boxes. Locate boxes in walls so that only the corner need be cut from masonry units where possible.
    - 2) 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.
12. Outlet Box Application: Unless otherwise noted, outlet boxes shall be installed as follows:
  - a. Galvanized Steel Box Installation Locations:
    - 1) Concealed interior locations.
    - 2) Exposed interior locations above 7 feet-0 inches of finished floor.
    - 3) Kitchen and laundry rooms, when recessed.
  - b. Cast Box Installation Locations:
    - 1) Exterior locations.
    - 2) Hazardous locations.
    - 3) Exposed interior locations within 7 feet-0 inches of finished floor.
    - 4) Wet or damp locations.
    - 5) Direct contact with earth or concrete slabs on grade.
    - 6) Kitchen and laundry rooms, when exposed.

C. Pull and Junction Boxes:

1. Locate above accessible ceilings or in unfinished areas.
2. Locate pull or junction boxes to limit conduit runs to no more than 150 linear feet of four (4) 90 degree bends between pulling points. For telephone/ data limit bends to no more than three (3) 90 degree bends to pulling points.

D. Cabinets and Enclosures:

1. Install hinged cover enclosures and cabinets plumb. At a minimum, support at each corner.

2. Provide knockout closures to cap unused knockout holes where blanks have been removed.

### 3.2 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

### 3.3 PROTECTION

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

### 3.4 CLEANING

- A. Upon completion of installation of system, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

### 3.5 MARKING AND IDENTIFICATION

- A. Mark and identify boxes, cabinets, and enclosures in accordance with Section 26 0553 "Identification for Electrical Systems."

END OF SECTION 26 0534

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## SECTION 26 0553 - 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 for wires, cables and conductors.
  3. Warning labels and signs.
  4. Instruction signs.
  5. Equipment identification labels.
  6. Miscellaneous identification products.

#### 1.3 SUBMITTALS

- A. Submittals for approval by the Engineer are not required for this section. Unrequested submittals will not be processed or reviewed. Non-requirement of submittals is not to be construed as an allowance for substitutions and does not allow relief from full compliance with the contract documents.

#### 1.4 QUALITY ASSURANCE

- A. Comply with the following standards:
  1. ANSI A13.1 and IEEE C2.
  2. NFPA 70.
  3. 29 CFR 1910.144 and 29 CFR 1910.145.
  4. ANSI Z535.4 for safety signs and labels.
- B. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

#### 1.5 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - 1. Electromark - Wolcott, New York.
  - 2. Ideal Industries, Inc.
  - 3. 3M.
  - 4. Panduit Corp.
  - 5. Seton Name Plate Co.
  - 6. Thomas & Betts.
  - 7. W. H. Brady, Co. - Signmark Division - Milwaukee, Wisconsin.

### 2.2 ELECTRICAL IDENTIFICATION PRODUCTS

- A. Self-Adhesive Vinyl Labels (Raceways and Boxes): Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- B. Self-Adhesive Vinyl Tape for Banding (Raceway, Wire and Cable): Colored, heavy duty, waterproof, fade resistant; 2 inches wide.
- C. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch (50 by 50 by 1.3 mm), with stamped legend, punched for use with self-locking cable tie fastener.
- D. Conductor Identification Products:
  - 1. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.
  - 2. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

### 2.3 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door or other access to equipment unless otherwise indicated.
- C. Engraved, Plastic-Laminated Labels, Signs, and Instruction Plates: Engraving stock melamine plastic laminate, 1/16-inch minimum thick for signs up to 20 square inches, or 8 inches in length; 1/8-inch thick for larger sizes. Engraved legend in black letters on white face and punched for mechanical fasteners.

### 2.4 EQUIPMENT IDENTIFICATION LABELS

- A. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Overlay shall provide a weatherproof and UV-resistant seal for label. Labels shall be at least 2-1/4 inches high. Where space does not permit this label size, smaller stock and lettering is permitted.

- B. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with lettering and background colors as indicated. Labels shall be at least 2-1/4 inches high. Where space does not permit this label size, smaller stock and lettering is permitted.

## 2.5 CABLE TIES

- A. Cable Ties: Fungus-inert, self-extinguishing, nylon one-piece, self-locking cable ties, 0.18-inch minimum width, 50-lb minimum tensile strength, and suitable for a minimum temperature range from minus 50 degrees F to 350 degrees F. Provide ties in specified colors when used for color-coding.
- B. Identification Cable Ties: Same as "Cable Ties" above, except with integral tab of suitable size for marking requirements.

## 2.6 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in Division 09 painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior). Comply with maximum volatile organic compound levels imposed within Division 09.
- B. Fasteners for Labels and Signs: Self-tapping, stainless steel screws or stainless steel machine screws with nuts and flat and lock washers.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Increase size of labels and letters to those appropriate for viewing from the floor for elevated components.
- C. Lettering and Graphics: Coordinate names, abbreviations, colors and other designations used in electrical identification work with corresponding designations specified or indicated. Install numbers, lettering and colors [as approved in submittals and] as required by code.
- D. Install identification devices in accordance with manufacturer's written instructions and requirements of NEC.
- E. Clean and degrease surfaces prior to applying identification products. Apply identification to surfaces that require finish after finish work is completed. Utilize primer for metal surfaces, heavy-duty acrylic resin block filler for concrete masonry, and clear alkali-resistant alkyd binder-type sealer for concrete surfaces.
- F. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.



- G. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.
- H. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
  - 1. Outdoors: UV-stabilized nylon.
  - 2. In Spaces Handling Environmental Air: Plenum rated.
- I. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench [or concrete envelope] exceeds 16 inches (400 mm) overall.

### 3.2 LABEL COLOR CODE LEGEND

- A. Provide the following color coding scheme for each label based on the power system it is identifying:
  - 1. Normal Power: Black letters on white background.

### 3.3 RACEWAY IDENTIFICATION

- A. Identify Raceways of Certain Systems with Color Coding: Conduits shall be painted using a factory applied finish:
  - 1. Fire Alarm System: Red with Red junction boxes.
- B. Where conduits leave a switchboard, panelboard, motor control center, etc., identification shall be provided on each conduit indicating the load being served.
- C. Contractor shall be responsible for providing the Owner with laminated, colored, typewritten legends indicating the identification color scheme. At a minimum, these legends should be installed in the main electrical room and branch electrical closets. Provide two additional legends to the Owner to use at their discretion.
- D. Identification of Raceways with Labeling:
  - 1. Raceway Labeling: Provide labeling on conduits indicating electrical distribution system contained within (e.g. Normal, Life Safety, etc.) and operating voltage level. Label size shall be as follows:

Nominal EMT conduit size	Nominal RGS conduit size	Length of color background on label	Height of letters
up to 1 inch	up to 3/4 inch	8 inches	1/2 inch
1.25 to 1.5 inches	1 to 1.5 inches	8 inches	3/4 inch
2 to 5 inches	2 to 5 inches	12 inches	1.25 inches
6 inches	6 inches	24 inches	2.5 inches

### 3.4 BOX IDENTIFICATION

- A. Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage:
  - 1. Normal Power.
- B. At each junction, pull and connection box, identify the following: with self-adhesive vinyl labels [or permanent marker (color coded) neatly hand-printed]. Identification of these boxes shall be located on the inside of cover if located in finished spaces:
  - 1. Power and lighting circuits: Indicate system voltage and identify contained circuits and panelboard serving load (e.g., "120V, PP1-1, 3, 5").
  - 2. Other wiring: Indicate system type and wiring description (e.g., "FIRE ALARM NAC #2").
- C. Paint box covers to correspond with system types as follows:
  - 1. Fire Alarm: Red.
  - 2. Temperature Control/Building Automation System: Blue.

### 3.5 CIRCUIT IDENTIFICATION

- A. Label conductors as follows:
  - 1. Multiple Power or Lighting Circuits in the Same Enclosure: Where multiple branch circuits are terminated or spliced in a box or enclosure, label each conductor with source and circuit number.
  - 2. Multiple Control Wiring and Communication/Signal Circuits in Same Enclosure: For control and communications signal/wiring, use wire/cable marking tape at terminations in wiring boxes, troughs, and control cabinets. Use consistent letter/number conductor designations throughout on wire/cable marking tape.

### 3.6 CONDUCTOR COLOR CODING

- A. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, panelboards, manholes, handholes, switches, etc., use color-coding conductor tape to identify the phase.
  - 1. Color-Coding for Conductors rated 600 V or Less: Use colors listed below for all conductors.
    - a. Color shall be factory-applied, or field-applied for sizes larger than No. 6 AWG, if Authorities Having Jurisdiction permit
      - 1) 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.
    - b. Colors for 208/120V Circuits:

- 1) Phase A: Black.
- 2) Phase B: Red.
- 3) Phase C: Blue.
- 4) Neutral: White.
- 5) Ground Bond: Green.

c. Colors for 480/277V Circuits:

- 1) Phase A: Brown.
- 2) Phase B: Orange.
- 3) Phase C: Yellow.
- 4) Neutral: Gray.
- 5) Ground Bond: Green.

d. [277/120V 208/120-V Isolated (Ungrounded) Power System:

- 1) Phase A: Orange with distinctive colored stripe other than white, green, or gray.
- 2) Phase B: Brown with distinctive colored stripe other than white, green or gray.
- 3) Phase C: Yellow with distinctive colored stripe other than white, green or gray.
- 4) Ground Reference: Green.]

B. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

C. Open Cable Identification

1. Low Voltage Cable (Less than 120V): Provide self adhesive pre-printed vinyl tape markers at 20 foot intervals to identify all cables run exposed or located above the accessible ceilings. Indicate the associated system by using the following color coding schemes:
  - a. Fire Alarm: Red lettering on white background.
  - b. Temperature Controls: Blue lettering on white background.
  - c. Security System: Black lettering on white background.
  - d. Telephone System: White lettering on blue background.

### 3.7 RECEPTACLE IDENTIFICATION

- A. Identification Material: Pre-printed, self-laminating vinyl labels, 3/16-inch font height. Utilize black lettering on clear background for normal power circuits [and red lettering on a clear background for emergency power circuits].

- B. Coverplates: Provide identification on all receptacle coverplates indicating the source panelboard and circuit number serving the device (e.g., PP1#1).

### 3.8 SIGNAGE

- A. Install instructional sign in each electrical room including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.
- B. Apply warning, caution, and instruction signs and stencils as follows:
  - 1. Install warning, caution or operating instruction signs where required by NEC, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation. Install fiberglass signs or outdoor items.
  - 2. Emergency Operating Signs: Install engraved laminate signs with white legend on red background with minimum 3/8-inch high lettering for emergency instructions on power transfer, load shedding or other emergency operations where required by NEC or where required to assure safe operation and maintenance.
  - 3. Arc Flash Hazard Warning: Provide signage on all electrical equipment such as switchboards, panelboards, industrial control panels, meter socket enclosures and motor control centers indicating arc flash hazard warning and advising appropriate PPE.

### 3.9 ELECTRICAL EQUIPMENT IDENTIFICATION

- A. On each unit of equipment, install unique designation label that is consistent with wiring diagrams, one-line diagram, schedules and the Operation and Maintenance Manual. Each section of a multiple-section equipment lineup shall be provided with its own identification label. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring and alarm systems unless equipment is provided with its own identification.
- B. Labeling Instructions:
  - 1. Indoor Equipment: Provide self-adhesive, engraved, laminated acrylic or melamine label [adhesive film label with clear protective overlay].
  - 2. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
  - 3. Nameplate Data: Provide permanent operational data nameplate on each item of power operated equipment, indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances and similar essential data. Locate nameplates in an accessible location.
  - 4. Fusible Switches: Install fuse manufacturer-supplied labels inside the door of the fusible switch indicating the proper type and fuse required for replacement.
  - 5. Automatically Started Equipment: Provide adhesive label reading "DANGER - WARNING THIS MACHINE IS AUTOMATICALLY CONTROLLED. IT MAY START AT ANY TIME" on all motors, generators and other moving or hazardous equipment which is remotely or automatically operated. Sign to be similar to Brady Number 88191.

C. Specific Equipment Requirements:

1. Control Equipment: Including but not limited to disconnect switches, starters, variable-speed controllers, contactors, motor control centers, pushbutton stations, etc.

a. Identification label shall include the following:

- 1) Equipment type and tag designation shown on the contract documents of the actual equipment served in 1/2 inch high bold lettering.
- 2) Location of equipment being served in 1/4 inch high bold lettering. If the equipment being served by the control equipment is located in the same room, identify location as "THIS ROOM."
- 3) Voltage and phase rating of equipment in 1/4 inch high bold lettering.
- 4) The name of the upstream equipment and location/room number it is located in using 1/4 inch high bold lettering.

b. Example Identification Label:

AHU-6 Supply Fan 'AHU-6S'  
Located in Mechanical Room 001  
480V 3-Phase, 3 Wire  
Fed from Distribution Panel MHEQ; Room 200

END OF SECTION 26 0553

## SECTION 26 0600 - **ELECTRICAL DEMOLITION**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Electrical coordination, materials and methods for electrical demolition associated with remodeling of an existing area or facility for re-use.

#### 1.3 SELECTIVE DEMOLITION

- A. This Section includes limited scope general construction materials and methods for application with electrical installations as follows:
- B. Selective demolition including:
  - 1. Nondestructive removal of materials and equipment for reuse or salvage as indicated.
  - 2. Dismantling electrical materials and equipment made obsolete by these installations.
  - 3. Miscellaneous metals for support of electrical materials and equipment required to remain.
  - 4. Firestopping as required to maintain existing partition ratings.

#### 1.4 PROJECT CONDITIONS

- A. Conditions Affecting Selective Demolition: The following project conditions apply:
  - 1. Protect adjacent materials indicated to remain. Install and maintain dust and noise barriers to keep dirt, dust and noise from being transmitted to adjacent areas. Remove protection and barriers after demolition operations are complete.
  - 2. Locate, identify and protect electrical services passing through demolition area and serving other areas outside the demolition limits. Maintain services to areas outside demolition limits. When services must be interrupted, install temporary services for affected areas.
  - 3. Maintain and protect existing building services that transit the area affected by selective demolition.

#### 1.5 SEQUENCE AND SCHEDULING

- A. Coordinate the shut-off and disconnection of electrical, fire alarm and communication services with the Owner and the utility companies. Coordinate any electrical outages required for service switchovers or connections with the Owner a minimum of five working days prior to the interruption. Comply with Owner's specific requirements for partial or complete outage requests.

- B. All work that produces excessive noise and/or interference with normal building operations, as indicated on the drawings, shall be coordinated and scheduled with the Owner.
- C. Assume that all required re-connection of existing systems or equipment not indicated for demolition must remain operational unless otherwise noted. Provide temporary connections to maintain electrical services and systems serving adjacent areas during required outages.
- D. Maintain existing electrical service, electrical distribution, fire alarm and communication equipment in operation until the new electrical service or distribution equipment is energized, tested, and accepted.

#### 1.6 DRAWINGS AND SPECIFICATIONS

- A. The architectural, structural, mechanical and electrical drawings and specifications shall be considered as mutually explanatory and complementary. Any electrical demolition work called for by one and not by the other shall be performed as though required by all. All sections and subsections of the Electrical work shall be governed by and subject to the general and supplementary conditions. Any discrepancies in or between the drawings and specifications, or between the drawings and actual field conditions shall be reported to the Engineer/Architect in sufficient time to issue an addendum for clarification.
- B. The electrical drawings are diagrammatic, and the drawings indicate the general layout of the electrical systems. Field verification of scale dimensions on plans is directed since actual locations, distance and levels will be governed by actual field conditions.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS AND METHODS

- A. Materials and methods required for removing, patching, connections, etc., shall be as specified in the associated specification sections.

### PART 3 - EXECUTION

#### 3.1 COMMON REQUIREMENTS FOR ELECTRICAL DEMOLITION

- A. Comply with NECA 1.

#### 3.2 EXAMINATION AND COORDINATION

- A. Examine substrates, areas, and conditions with Installer present for compliance with requirements for conditions affecting demolition.
- B. Coordinate the demolition scope of work with the Owner and other Contractors to confirm that all required electrical demolition is addressed and scheduled to avoid disputes.

### 3.3 SELECTIVE DEMOLITION

- A. The Electrical Contractor shall remove, cap and/or relocate equipment, outlets, conduit, wire, etc., as shown and specified on drawings and as may become necessary because of existing field conditions. It shall be the responsibility of the Electrical Contractor to visibly examine all existing walls designated for removal to determine the conduit and the wiring that will require capping and/or removal, whether or not such conditions are indicated on the drawings. The contractor shall be held to having visited the site and taken all existing conditions into consideration.
- B. Where the architectural drawings indicate that partitions, walls, ceilings, etc., are to be removed the Electrical Contractor shall be responsible for removal of all electrical components within those structures including equipment, lighting fixtures, lighting controls, wiring devices, raceways, wiring, electrical systems, etc.
- C. In addition to the foregoing, comply with the following:
  - 1. Maintain circuit continuity to all existing fixtures, equipment, outlets, etc., to remain in use whether noted on the plans or not. Field-verify existing items to remain in use. Wiring for existing circuits which must be re-routed, or which are partially abandoned, shall be reconnected to service the remaining outlets on the circuit.
  - 2. In the demolition work, remove all unused wiring and cables and unused conduit that is exposed or within accessible ceilings which is affected by and is in the area of the work of this contract.
- D. The intention of the electrical demolition drawings is to disconnect and remove all electrical work made void by the scope of the construction and alteration. Field-verify exact material quantities required to be removed.
- E. Abandoned electrical power distribution equipment, including switchboards, motor controllers, panelboards, lighting fixtures and controls and wiring devices shall be disconnected and removed unless otherwise noted. [All supporting equipment for this equipment to be removed, including hangers, supporting rods, ballasts, etc., shall be removed.]
- F. All existing electrical work and associated raceway and wiring, which has been made obsolete by the work and/or is shown dashed on the electrical demolition drawings shall be disconnected and removed back to the source of power unless otherwise noted. Although an attempt has been made to indicate all of this work, total accuracy is not guaranteed. Contractor shall visibly examine all areas and walls and ceilings scheduled for removal to determine existing electrical items to remain.
- G. Where electrical equipment, conduit, boxes and supporting hardware are removed, patch and finish the surface as required to match the existing unless otherwise noted.
- H. Where buried conduits extending out of a concrete slab become abandoned, cut and grind the conduits off flush with top of slab and plug with non-shrink waterproof grout fill.
- I. All removed materials, other than removed materials to be relocated, or stored or turned over to the Owner shall become the property of the Contractor and shall be removed from the project site.



- J. Acceptance of contract means installer accepts existing conditions.
- K. Contractor shall coordinate all demolition work with all other trades.
- L. In walls or floors where a flush device is being removed, but the wall or floor remains or for any outlet which must remain, but has a device removed, provide a blank cover over the outlet. Match the color and material of existing remaining covers in the room or space.
- M. In areas where the partitions, ceilings, etc., are indicated to be temporarily removed, the Electrical Contractor shall be responsible for the disconnection, storage, re-installation and re-connection of equipment or devices within that partition, ceiling, etc., unless otherwise noted.
- N. Legally dispose of hazardous materials and ballasts or other equipment containing PCBs and lamps containing mercury or equipment containing oil. Comply with all Federal, state, and local laws. This includes HID and fluorescent lamps determined to be hazardous waste. These shall be disposed of at a permitted hazardous waste disposal facility or other appropriately permitted entity.
- O. Provide manifests and travel and disposal forms and documents to Owner when required by Owner or regulatory agencies.

#### 3.4 CLEANING

- A. Clean existing electrical distribution equipment affected by the project, including switchboards, motor controllers, panelboards, etc. Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide coverplates for openings. Modify existing panelboard directories (or replace) for panelboards which have had alterations to the circuits originating therein. Describe the load and location.
- B. Where luminaires are indicated to be retained and re-used, the Electrical Contractor shall clean all exterior and interior surfaces. Lamps and ballasts shall be replaced with new. Broken electrical parts, including guards and lens shall be replaced to match existing construction unless otherwise noted.

#### 3.5 FIRESTOPPING

- A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical demolition to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION 26 0600

## SECTION 26 0923 - 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. Occupancy sensors.
  - 2. Lighting contactors.
  - 3. Emergency shunt relays.
- B. Related Requirements:
  - 1. Section 26 2726 "Wiring Devices" for wall-box dimmers, and manual light switches.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product.
- B. For products used in lieu of basis of design, submit a lighting plan clearly marked by manufacturer showing proper product, location, and orientation of each sensor.
- C. Operation and Maintenance Data: For each type of lighting control device to include in emergency, operation, and maintenance manuals.

#### 1.4 QUALITY ASSURANCE

- A. Products supplied shall be from a single manufacturer that has been continuously involved in manufacturing of lighting controls for a minimum of five (5) years. Mixing of manufacturers shall not be allowed.
- B. All components shall be U.L. listed, offer a five (5) year warranty, and meet all state and local applicable code requirements.
- C. All occupancy sensors shall be tested to NEMA WD 7-2011 Occupancy Motion Sensors Standard.

#### 1.5 COORDINATION

- A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including luminaires, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.

## PART 2 - PRODUCTS

### 2.1 INDOOR OCCUPANCY SENSORS

- A. **Basis-of-Design Product:** Subject to compliance with requirements, provide as listed per each sensor type or comparable product by one of the following:
1. Cooper Industries, Inc.
  2. Hubbell Building Automation, Inc.
  3. Acuity Brands Lighting, Inc.
  4. Lutron Electronics Co., Inc.
- 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 30 minutes.
  3. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor is powered from the power pack.
  4. 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.
  5. Mounting:
    - a. Sensor: Suitable for mounting in any position on a standard outlet box.
    - b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
    - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
  6. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
  7. Bypass Switch: Override the "on" function in case of sensor failure.
  8. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; turn lights off when selected lighting level is present.
- C. **PIR Type:** Ceiling mounted; detect occupants in coverage area by their heat and movement. All sensors tested per NEMA WD7 standards. (WattStopper CI-300)
1. Detector Sensitivity: Detect occurrences of 6-inch-minimum movement of any portion of a human body that presents a target of not less than 36 square inch.
  2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. foot when mounted on a 96-inch-high ceiling.
  3. Detection Coverage (Corridor): Detect occupancy within 90 feet when mounted on a 10-foot-high ceiling.
  4. Normally open/normally closed contacts available for 3<sup>rd</sup> party integration.

## 2.2 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide as listed per sensor type or comparable product by one of the following:
1. Cooper Industries, Inc.
  2. Hubbell Building Automation, Inc.
  3. Acuity Brands Lighting, Inc.
  4. Lutron Electronics Co., Inc.
- 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 degrees F.
  3. Switch Rating: Not less than 800-VA fluorescent at 120 V, 1200-VA fluorescent at 277 V, and 800-W incandescent.
- C. Wall-Switch Sensor Tag SO (Wattstopper PW-301):
1. Standard Range: 180-degree field of view, with a minimum coverage area of 10'x15'.
  2. Sensing Technology: PIR.
  3. Switch Type: field selectable automatic "on," or 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. 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 between 1 and 30 minutes.

## 2.3 EMERGENCY SHUNT RELAY

- A. Basis-of-Design Product: Subject to compliance with requirements, provide WattStopper ELCU-200 or comparable product by one of the following:
1. Bodine
  2. Functional Devices.
- B. Description: Normally closed, electrically held relay, arranged for wiring in parallel with manual [or automatic] switching contacts; complying with UL 924.
1. Coil Rating: 120 / 277 V dual voltage.

## 2.4 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 0519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 26 0519 "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. Ultrasonic sensors to remain minimum of 6 feet from supply air.

### 3.2 WIRING INSTALLATION

- A. Wiring Method: Comply with Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch.
- B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- C. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

### 3.3 IDENTIFICATION

- A. Identify components and power and control wiring according to Section 26 0553 "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.

### 3.4 FIELD QUALITY CONTROL

- A. 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.
  - 3. Verify occupancy sensors operate per design intent.
- B. Lighting control devices will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

### 3.5 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.

### 3.6 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION 26 0923

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## SECTION 26 2726 - **WIRING DEVICES**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Receptacles, receptacles with integral GFCI and associated device plates.
  - 2. Hospital-grade receptacles.
  - 3. Snap switches and wall-box dimmers.

#### 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.
- E. TVSS: Transient voltage surge suppressor.
- F. UTP: Unshielded twisted pair.

#### 1.4 SUBMITTALS

- A. Submittals for approval by the Engineer are not required for this section. Unrequested submittals will not be processed or reviewed. Non-requirement of submittals is not to be construed as an allowance for substitutions and does not allow relief from full compliance with the contract documents.

#### 1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.
- B. Comply with NFPA 70.
- C. Comply with UL 498: "Attachment Plugs and Receptacles."
- D. Comply with UL 943: "Ground-Fault Circuit-Interrupters."



- E. Listing and Labeling: Provide products which are listed and labeled by Underwriters Laboratories for their applications and installation conditions and for the environments in which installed.

## PART 2 - PRODUCTS

### 2.1 WIRING DEVICES

- A. Comply with NEMA Standard WD 1, "General Purpose Wiring Devices" and NEMA Standard WD6 "Wiring Device Dimensional Requirements."
- B. Enclosures: NEMA 1 equivalent, except as otherwise indicated.
- C. Receptacles, Straight-Blade and Locking Type: Except as otherwise indicated, comply with UL Standard 498, "Electrical Attachment Plugs and Receptacles." Provide UL labeling of devices to verify these compliances. Provide straight blade receptacles per table on the following page.
- D. Any receptacles that are controlled by an automatic control device shall have the centralized receptacle marking furnished with the device or cover plate.
- E. Receptacles and switches shall include plug tail connectors consisting of a female at the device and a matching male on the pigtail are acceptable provided that that ratings and listings and other portions of this specification apply. The device shall have no exposed parts or wiring when the mating connector is installed.
- F. Receptacles located in areas accessible to Pediatric Patients must be hospital grade and tamper resistant type.

### 2.2 STRAIGHT BLADE RECEPTACLES

- A. Hospital-Grade, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498 Supplement SD.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Hubbell: HBL8300. Plug Tail-SNAP8300
    - b. Leviton: 8300. Plug Tail-M8300
- B. Tamper-Resistant Duplex Convenience Receptacles, 125V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R and UL 498.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Hubbell: BR20. Plug Tail-SNAP5362TR
    - b. Leviton: 5362. Plug Tail-M5362
- C. Hospital Grade, Tamper-Resistant, Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
  - 1. Products: Subject to compliance with requirements, provide one of the following:

- a. Hubbell: HBL8300SG. Plug Tail-SNAP8300TR
  - b. Leviton: 8300SG. Plug Tail-M8300SG
- D. Receptacles, Industrial Heavy-Duty: Conform to NEMA Standard PK 4 "Plugs, Receptacles, and Cable Connectors of the Pin and Sleeve Type for Industrial Use" and IEC 309.

### 2.3 GFCI RECEPTACLES

- A. General Description: Straight blade, [feed] [non-feed]-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.
- B. Hospital-Grade, Duplex GFCI Convenience Receptacles, 125 V, 20 A: Comply with UL 498 Supplement SD.
1. Products: Subject to compliance with requirements, provide one of the following:
- a. Hubbell: GFR8300HL. Plug Tail-GFR8300SNAP
  - b. Leviton: GFNT2-HF. Plug Tail-MGFN2-HG

### 2.4 SNAP SWITCHES

- A. Snap Switches: Quiet-type a.c. switches, Underwriters Laboratories listed and labeled as complying with UL Standard 20 "General Use Snap Switches." Switches shall be heavy duty industrial rated, 20A, 120/277V, ivory handle, back and side wired, number of poles as required, with ground screw.
- B. Comply with NEMA WD 1 and UL 20.
- C. Switches, 120/277 V, 20 A:
1. Products: Subject to compliance with requirements, provide one of the following:
- a. Leviton: 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).

### 2.5 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. LED Dimmer Switches: Modular, compatible with dimmer LED driver; trim potentiometer to adjust low-end dimming; dimmer-driver combination capable of consistent dimming with low end not greater than 10 percent of full brightness Lamp Dimmers: 120 V; control shall follow square-law dimming curve. On-off switch positions shall bypass dimmer module.
1. Products: Low voltage electronic driver, 16A minimum capacity, subject to compliance with requirements, provide one of the following:

- a. Lutron: DDTV Series.
- b. Lightolier: ZP Series
- c. Pass & Seymour: CD Series
- d. Wattstopper: ADF Series

## 2.6 WALL PLATES

- A. Single and combination types to match corresponding wiring devices.
  - 1. Plate-Securing Screws: Metal with head color to match plate finish.
  - 2. Tamper-Resistant Securing Screws: Metal, TORX configuration with head color to match plate finish.
  - 3. Material for Finished Spaces: Smooth, high-impact thermoplastic.
  - 4. Material for Unfinished Spaces: Galvanized steel.
  - 5. Material for Damp Locations: Thermoplastic with spring-loaded lift cover and listed and labeled for use in "wet locations."
- B. Device Enclosures for Outdoor and Other Wet and Damp Locations: Enclosure shall be suitable for wet locations while in use in accordance with Article 406.8 (B) and listed and labeled for the specific use by Underwriters Laboratories. Enclosure shall be clearly and visibly marked by the factory with the wording "Suitable For Wet Locations While In Use." Enclosure shall be non-metallic with hinged clear cover and integral key operated cover lock. Cover to have two exit holes for up to 3/8 inch diameter cords with holes located at bottom of cover. Provide cover with device opening matched to type of wiring device used, e.g., duplex receptacle, GFCI receptacle, and toggle switch.
- C. Color: Match wiring device except as otherwise indicated.

## 2.7 FINISHES

- A. Color: Wiring device catalog numbers in Section Text do not designate device color.
  - 1. Wiring Devices Connected to Normal Power System: As selected by the Architect, unless otherwise indicated or required by NFPA 70 or device listing.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Comply with NECA 1 including the mounting heights listed in that standard, unless otherwise noted.
- B. Coordination with Other Trades:
  - 1. Take steps to ensure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
  - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint and other material that may contaminate the raceway system, conductors and cables.
  - 3. Install device boxes in brick or block walls so that the coverplate 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. Protect devices and assemblies during painting if installed prior to wall painting.

C. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
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 all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.
10. Install devices and assemblies plumb and secure.
11. Install wall plates when painting is complete.
12. Utilize weather-resistant receptacles in wet or damp locations and outdoors.
13. For all devices mounted flush in walls where communications backboards are installed, provide extension ring with sufficient depth for the outlet and coverplate to mount flush to the face of the communications backboard. Devices and coverplates that mount recessed to the communications backboard are not acceptable.
14. Provide GFCI receptacles when installed within 6 ft. of the outside edge of a sink.
15. Provide hospital grade receptacles within all patient care spaces.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the left.
- F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- G. Dimmers:
1. Install dimmers within terms of their listing.
  2. Verify that dimmers used for fan speed control are listed for that application.
  3. Install unshared neutral conductors online and load side of dimmers according to manufacturers' device listing conditions in the written instructions.
- H. Arrangement of Devices: Unless otherwise indicated, mount flush with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multi-gang wall plates.
- I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.
- 3.2 IDENTIFICATION
- A. Comply with Division 26 Section "Identification for Electrical Systems."
- 3.3 FIELD QUALITY CONTROL
- A. Perform tests and inspections.
1. Test Instruments: Use instruments that comply with UL 1436.
  2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.
- B. Tests for Convenience Receptacles:
1. Line Voltage: Acceptable range is 105 to 132 V.
  2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
  3. Ground Impedance: Values of up to 2 ohms are acceptable.
  4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943 and per manufacturer's recommendations.
  5. Test wiring devices for proper polarity and ground continuity. Operate each operable device at least 6 times.
  6. Using the test plug, verify that the device and its outlet box are securely mounted.
  7. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones and retest as specified above.
  8. Replace damaged or defective components.
- C. Test straight blade hospital-grade convenience outlets for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz. (115 g).

3.4 CLEANING

- A. General: Internally clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

END OF SECTION 26 2726

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## SECTION 26 2816 - **ENCLOSED SWITCHES**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Fusible and non-fusible switches.
  - 2. Molded-case circuit breakers.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to Division 20 "Seismic Protection."
  - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified [and the unit will be fully operational after the seismic event]."

#### 1.4 SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, enclosure type, performance, electrical characteristics, ratings and accessories.
  - 1. Electrical characteristics shall include voltage, current and short-circuit ratings, factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
- B. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device. Submit on translucent log-log graph paper.
  - 1. Include selectable ranges for each type of overcurrent protective device where applicable.
  - 2. Include selective coordination study to prove all enclosed switches and circuit breakers associated with the essential electrical systems, emergency systems and legally required standby system selectively coordinate with the upstream overcurrent protective devices.

#### 1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories within same product category from single source and from single manufacturer.



- B. Electrical Component Standards: Provide components complying with NFPA 70 "National Electrical Code" and which are listed and labeled by UL. Comply with UL Standard 98 and NEMA Standard KS 1.

#### 1.6 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS - GENERAL

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. General Electric.
  - 2. Square D Company.

#### 2.2 FUSIBLE AND NONFUSIBLE SWITCHES

- A. General: Provide circuit and motor disconnect switches in types, sizes, duties, features, ratings, enclosures, and accessories as indicated within Disconnect Schedule, located on the drawings.
- B. Fusible and Non Fusible Switches: Type HD heavy-duty, quick-make, quick-break load interrupter enclosed knife switch, externally operable, lockable handle, interlocked with cover in closed position. Unless indicated otherwise, provide 3-blade with solid neutral when a neutral is provided. Compliant with NEMA KS 1.
- C. Provide positive pressure, reinforced Type Class R fuse clips for fusible switches 600 amps or less to prevent other than UL Class RK current limiting fuses. Provide for Class L fuses for switches over 600A.

#### 2.3 MOLDED-CASE CIRCUIT BREAKERS

- A. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3. Provide circuit breakers in sizes, ratings, enclosures and accessories as indicated within Equipment Data Schedule or Disconnect Schedule located on the drawings, with interrupting capacity to comply with available fault currents.
- B. Two and three pole circuit breakers shall have an internal common trip and all circuit breakers frame sizes rated 200 A and larger shall have interchangeable trips.
- C. All breakers shall be lockable for lockout procedures, either external device or integrated methods may be used. All electrically operated breakers shall have integrated method of locking.
- D. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

- E. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
- F. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing with the following field-adjustable settings:
  - 1. Instantaneous trip.
  - 2. Long- and short-time pickup levels.
  - 3. Long- and short-time time adjustments.
  - 4. Ground-fault pickup level, time delay, and I<sup>2</sup>t response.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install enclosed switches and circuit breakers in locations as indicated level and plumb, according to manufacturer's written instructions. Provide interconnection wiring for control and indication devices where applicable.
- B. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- C. Install fuses in fusible disconnect switches such that label and rating information is readable without removing the fuse. Provide permanent label affixed to the inside of the disconnect switch cover indicating the fuse class and size installed.

### 3.3 IDENTIFICATION

- A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

### 3.4 ADJUSTING

- A. Set field-adjustable circuit-breaker trip ranges [as specified in Division 26 Section "Overcurrent Protective Device Coordination Study]."

### 3.5 CLEANING

- A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish including chips, scratches, and abrasions.

END OF SECTION 26 2816

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## SECTION 26 5100 - LIGHTING

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Interior luminaires and accessories.
2. Emergency lighting units and exit signs.
3. Luminaire supports.

#### 1.2 SUBMITTALS

##### A. For each type of luminaire, arranged in order of luminaire designation. Include complete product model number and product data sheets on features, accessories, finishes, and the following:

1. Physical description of luminaire including dimensions, as well as effective projected area for exterior luminaires.
2. Details of attaching luminaires and accessories.
3. Emergency lighting units including battery and charger.
4. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.
5. LED photometric report per latest IESNA LM-79-08 testing guidelines, including luminaire model number, manufacturer of LED chip array/board and driver, input wattage, and independent testing laboratory name, report number, and date tested.
6. Dimmer device data for all LED luminaires specified as dimming. Must be from approved manufacturer per luminaire manufacturer requirements, furnished and installed by contractor. Contractor responsible for dimmer control and luminaire compatibility.

#### 1.3 QUALITY ASSURANCE

##### A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products, or by an independent agency complying with the IESNA Lighting Measurements Testing & Calculation Guides.

##### B. Comply with IEEE C2, "National Electrical Safety Code" and NFPA 70.

#### 1.4 COORDINATION

##### A. Coordinate layout and installation of luminaires and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver luminaire and components to site. Store such that luminaires, finishes, lenses, and trims are protected. Install with protective films on and remove only after construction clean-up is complete.
- B. Store poles on decay-resistant-treated skids at least 12 inches above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation. Prevent breakage and damage to finish.

## 1.6 WARRANTY

- A. Warranty Period for LED chips/arrays and drivers: 5 years from date of substantial completion.
- B. Warranty Period for Emergency Lighting Unit Batteries, and self-powered exit signs: 5 years from date of substation completion.
- C. Warranty Period for Luminaires: 5 years from date of substantial completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Products: Refer to Luminaire Schedule on the drawings.

### 2.2 GENERAL REQUIREMENTS FOR LUMINAIRES AND COMPONENTS

- A. All luminaires shall carry a UL listing, unless otherwise noted on the Luminaire Schedule. Exterior luminaires shall carry a UL wet location listing as well as designated IP rating, unless otherwise noted on the Luminaire Schedule.
- B. Recessed Luminaires: Housing shall be constructed of steel or aluminum, free of burrs and sharp corners and edges, free of light leakage and accessible without use of tools. Components shall be formed and supported to prevent warping and sagging. Lamp and ballast compartments shall be accessible from below the ceiling.
  - 1. Lensed troffers shall be provided with hinged door frames and positive spring-loaded latches, UV stabilized acrylic prismatic lenses with a minimum of 0.12 inch thickness, unless otherwise noted on the Luminaire Schedule.
  - 2. Parabolic louvers shall be interlocking low-iridescent, specular anodized aluminum in construction. Number of cells shall be specified on Luminaire Schedule.
  - 3. Direct/Indirect luminaire lamp chambers shall be made of one-piece perforated steel. Reflectors shall have a minimum reflectance of 90 percent.
  - 4. Volumetric luminaires shall have UV stabilized acrylic lens with optical pattern as designated on Luminaire Schedule. Reflectors shall have a minimum reflectance of 90 percent.
  - 5. Where fire-rated ceilings are specified, luminaires should be provided with listed enclosures meeting requirements to maintain fire-rated system rating.

- C. Suspended Luminaires: Canopies, power feeds, and mounting accessories shall be coordinated with architectural-designated ceiling type. Luminaires shall be installed plumb and level at luminaire height designated on Luminaire Schedule.

## 2.3 LIGHT EMITTING DIODE (LED) LUMINAIRE SYSTEMS

- A. Light emitting diodes shall have a minimum color rendering index (CRI) of 80 for interior applications and 70 for exterior applications. Refer to Luminaire Schedule for color temperature of the luminaires.
- B. Color changing LED chip arrays shall have chip colors as noted on the Luminaire Schedule.
- C. LED chips shall be wired so that operation of chip array is not prohibited by failure of one chip.
- D. LED Driver:
  - 1. Solid state driver with integral heat sink. Driver shall have overheat, short-circuit and overload protection, power factor 0.90 or above and maximum total harmonic distortion of 20 percent. Surge suppression device for all exterior luminaires.
  - 2. Drivers shall have dimming capabilities as outlined in the luminaire schedule for each luminaire type.
  - 3. Driver shall have a minimum of 50,000 hours rated life.

## 2.4 EXIT SIGNS

- A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:
  - 1. Provide Cooper Lighting Sure-Lites EUX Series.
  - 2. Edge-lit
  - 3. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
  - 4. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
    - a. Battery: Sealed, maintenance-free, nickel-cadmium type.
    - b. Charger: Fully automatic, solid-state type with sealed transfer relay.
    - c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
    - d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    - e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
    - f. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.

## 2.5 LUMINAIRE SUPPORT COMPONENTS

- A. Comply with Section 26 0529 "Hangers and Supports" for channel- and angle-iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.
- C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single luminaire. Finish same as luminaire.
- D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.
- E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage.
- F. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
- G. Hook Hangers: Integrated assembly matched to luminaire and line voltage and equipped with threaded attachment, cord, and locking-type plug.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Luminaires:
  - 1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
  - 2. Install lamps in each luminaire.
- B. Temporary Lighting: If it is necessary, and approved by Architect, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.
- C. Remote Mounting of Ballasts: Distance between the ballast and luminaire shall not exceed that recommended by ballast manufacturer. Verify, with ballast manufacturers, maximum distance between ballast and luminaire.
- D. Lay-in Ceiling Luminaire Supports: Use grid as a support element.
  - 1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each luminaire. Locate not more than 6 inches from luminaire corners.
  - 2. Support Clips: Fasten to luminaires and to ceiling grid members at or near each luminaire corner with clips that are UL listed for the application.
  - 3. Luminaires of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support luminaires independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
  - 4. Install at least one independent support rod or wire from structure to a tab on luminaire. Wire or rod shall have breaking strength of the weight of luminaire at a safety factor of 3.

- E. Suspended Luminaire Support:
  - 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
  - 2. Stem-Mounted, Single-Unit luminaires: Suspend with twin-stem hangers.
  - 3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of luminaire chassis, including one at each end.
  - 4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.
- F. When installing luminaires, the contractor shall use the luminaire manufacturer's mounting hardware and follow all manufacturer's installation direction.
- G. All recessed downlights must be installed so that the bottom of the throat is even with the finished ceiling plane. The overlapping flange must then fit flush to the ceiling plane/throat. No light leak must be visible. All miscellaneous hardware above the ceiling plane to accomplish the above shall be included in the base bid.
- H. All recessed downlights shall have self-flanged reflectors unless otherwise noted.
- I. When luminaires are installed in continuous rows of 2 or more, luminaires shall be approved for use as wireway.
- J. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.
- K. Embedded Poles: Set poles to depth below finished grade indicated on Drawings, but not less than one-sixth of pole height, installed plumb with double nuts for adjustment. Grout around pole anchor base.
- L. Raise and set poles using web fabric slings (not chain or cable), or non-chafing ropes.
- M. Ground metal and non-metallic poles and support structures according to Section 26 0526 "Grounding and Bonding."

### 3.2 IDENTIFICATION

- A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."

### 3.3 FIELD QUALITY CONTROL

- A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.
- B. Verify that self-luminous exit signs are installed according to their listing and the requirements in NFPA 101.
- C. Illumination Observations: Verify normal operation of luminaires after installing luminaires and energizing circuits with normal power source.



- D. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

#### 3.4 ADJUSTING AND CLEANING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting aimable luminaires to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Some of this work may be required after dark.
- B. Align luminaires and clean lenses and diffusers at completion of work. Clean paint splatters, dirt, and debris from installed luminaires. Touch up luminaire and pole finishes as necessary.
- C. Inspect each installed luminaire for damage. Replace damaged luminaires and components.

END OF SECTION 26 5100

## SECTION 27 1513 - **COMMUNICATIONS COPPER 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.
  - 1. Applicable requirements of Division 26 0500, "Common Work Results for Electrical."

#### 1.2 SUMMARY

- A. Work to be performed by the Contractor includes:
  - 1. Provide cable support pathways as defined on the drawings and in the specifications and as required by applicable EIA/TIA standards and University of Missouri Division of IT standards.
  - 2. Provide rough-in for telecommunications devices as defined on the drawings and in the specification and as required by applicable EIA/TIA standards and University of Missouri Division of IT standards.
  - 3. Provide firestopping components for telecommunication cables as specified herein.
  - 4. Installing UTP cabling as furnished by University of Missouri Division of IT staff to the Contractor. Contractor shall coil all cables at each end.

#### 1.3 DEFINITIONS

- A. BICSI: Building Industry Consulting Service International.
- B. EMI: Electromagnetic interference.
- C. IDC: Insulation displacement connector.
- D. LAN: Local area network.
- E. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.
- F. RCDD: Registered Communications Distribution Designer.
- G. UTP: Unshielded twisted pair

#### 1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate layout and installation of telecommunications cabling with University of Missouri Division of IT staff.
- B. Coordinate telecommunications rough-in locations with location of power receptacles at each work area.

1.5 UNIVERSITY OF MISSOURI DIVISION OF IT GROUP

- A. Work of this contract associated with the work of the voice, data and cable television systems shall be installed in strict accordance with the standards of University of Missouri Division of IT group.
  - 1. Prior to commencement of work, meet jointly with representatives of University of Missouri Division of IT staff to exchange information and agree on details of installation interfaces, points of service pick-up, etc. Prepare a Meeting Record to document topics discussed, agreements reached, etc. Furnish a copy of the Meeting Record to the Contractor, Owner and the Architect.

1.6 SUBMITTALS

- A. Product Data:
  - 1. Cable support components.
  - 2. Pre-manufactured fire rated pathways

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, qualified layout technician and installation supervisor.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
  - 1. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. University of Missouri Division of IT staff shall deliver cables to be installed by the Contractor to the Project site.
- B. Contractor shall be responsible for properly storing cables after taking delivery of the cables from University of Missouri Division of IT staff.

PART 2 - PRODUCTS

2.1 HORIZONTAL CABLING

- A. Rating: All vertical and horizontal in-building cable shall be plenum rated.
- B. Length Limitation: The maximum allowable horizontal cable length is 295 linear feet. This maximum allowable length does not include an allowance for the length of 16 feet to the device outlet or in the horizontal cross-connect.

2.2 CABLE SUPPORT COMPONENTS

- A. J-Hooks: Wide base design with smooth, beveled edges. Caddy "Catlink" models CAT16HP, CAT32HP, CAT48HP, or CAT64HP as required by installation, or approved

equal. Provide J-hook manufacturers standard system components and accessories as required for a complete and working installation

### 2.3 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Grounding: Comply with J-STD-607-A.

### 2.4 SOURCE QUALITY CONTROL

- A. Testing: The Owner shall test all cables installed by the Contractor.
- B. Cable shall be considered defective if it does not pass the Owner's test and inspections.

## PART 3 - EXECUTION

### 3.1 WIRING AND SUPPORT METHODS

- A. General: Conceal cables within accessible ceilings and walls utilizing approved raceways. Support hardware shall be free of sharp edges. Cables must be supported and may not lay directly on-top of other building elements (such as lighting, ductwork, piping, accessible ceiling grid, etc.).
- B. Route telecommunication cables within conduit, cable tray or j-hook pathway indicated on drawings.
- C. Capacity: Cable pathways shall be sized to provide 33% spare capacity for future cable installation.
- D. J-hooks: When installed above accessible ceilings, open cables routed outside of cable trays shall be installed within new J-hook supports. Supports shall be provided in intervals not to exceed 4 feet.
  - 1. Cable bundles supported by J-hooks shall not be larger than 50 cables, unless additional support is provided.
- E. Conduit: Cables routed within walls and above inaccessible ceilings shall be installed in EMT conduit per specification section 26 0533 "Raceways" and this specification.
- F. Cables shall be installed above the corridor ceilings as much as possible.
- G. The amount of cables routed above drywall ceilings shall be kept to a minimum.

### 3.2 INSTALLATION OF CONDUIT AND OUTLET BOXES

- A. At a minimum, conduit shall be extended from the outlet location box into the ceiling for entrance into the building cable distribution system. The conduit should turn 90° and provided with a bushing. Conduit must terminate before passing through a fire rated wall.

- B. The ends of metallic conduit shall be reamed, bushed and grounded according to the National Electrical Code and the National Electrical Safety Code.
- C. When conduit is used, sections of conduit shall not exceed 150 feet without the use of a pull box, and must not have more than, or the equivalent of 270° bends between pull points or pull boxes.
- D. Conduit inside bend radius must be:

Conduit size	Bend radius
2" or less	Six times the inside diameter
More than 2"	Ten times the inside diameter

- E. Pull boxes should be placed directly after a bend or sized accordingly if the pull box is located at the bend.
- F. Conduit Fill Limits:
  1. 1 inch - (3) CAT 6A cables maximum.
  2. 1 ¼ inches – (4) CAT 6A cables maximum.
  3. 1 ½ inches – (6) CAT 6A cables maximum.
  4. 2 inches – (12) CAT 6A cables maximum.
  5. 3 inches – (20) CAT 6A cables maximum.
- G. Outlet boxes for telecommunication devices shall be 4 inch square by 2-1/2 inch deep. Provide a single gang device ring on boxes to accommodate the installation of telecommunications devices.
  1. Joint power and telecommunication boxes are not allowed, even when provided with separation.
- H. Provide an empty conduit with pull wire (1 inch minimum) from the outlet box to above the nearest accessible ceiling. Provide a nylon grommet on the end of the conduit above the ceiling.

### 3.3 INSTALLATION OF CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
  1. Comply with TIA/EIA-568-B.1.
  2. Cables shall not be spliced. Secure and support cables at intervals not exceeding 48 inches.
  3. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
  4. Cold-Weather Installation: Bring cable to room temperature before de-reeling. Heat lamps shall not be used for heating.
  5. In the communications equipment room, install a 10-foot long service loop on each end of cable.

6. At the wall mounted and ceiling mounted devices, provide a 12 inch long service loop on the cable at the top of the vertical conduit stub. Do not coil cables in backbox.
7. At the video surveillance camera rough-in, provide a 10 foot service loop at the camera location and 20 foot service loop at the rack location within the telecommunications closet.
8. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions. Pull cable directionally from telecom room to outlets.
9. Maintain 20'-0" of cable slack at the telecom room, 18" of cable slack at the outlet, pulled to above ceiling space.

C. UTP Cable Installation:

1. Comply with TIA/EIA-568-B.2.

D. Open-Cable Installation:

1. Suspend UTP cable not in a raceway or pathway at the highest possible elevation above ceilings by cable supports not more than 48 inches apart. Maintain a minimum of 6 inches between the ceiling and cable pathway installation where ceiling space is at a minimum.
2. Cable shall not exhibit sag after installation to provide visual evidence that the cable tension is within 25 pounds as required by EIA-568-A.
3. Bundles of cable supported by J-hooks should not be larger than (50) cables.
4. Cables shall not be tightly cinched together. Ty wraps shall be hand tightened without the use of tools. Cables shall never be twisted.
5. Cables shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
6. Cables shall not lie on or be supported from suspended ceiling support wires or frames.

E. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA/EIA-569-A for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. All pathways shall provide clearances of at least 48 inches from motors or transformers; 12 inches of clearance from conduit and cables used for power distribution and 5 inches from fluorescent lighting.

### 3.4 FIRESTOPPING

- A. Comply with requirements in Division 07 Section "Penetration Firestopping."
- B. Comply with TIA/EIA-569-B, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.
- D. Provide fire rated pathways ("EZ Path" or approved equivalent) as specified herein where telecommunications cables extend through fire-rated wall assemblies.

3.5 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with ANSI-J-STD-607-A.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will perform tests and inspections.
- B. The Owner shall label and terminate all cables installed by the Contractor.
- C. Cables found to be defective as a result of the Owner's testing exercises shall be replaced with new cable. University of Missouri Division of IT shall provide the cable for re-installation.

END OF SECTION 27 1513

## SECTION 28 3111 - **DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Fire Alarm and Detection Systems.
- B. Related Sections include the following:
  - 1. Division 20 Section "Seismic Protection" for products and installation requirements necessary for compliance with seismic criteria.

#### 1.3 DEFINITIONS

- A. LED: Light-emitting diode.
- B. NICET: National Institute for Certification in Engineering Technologies.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. The fire alarm design documents and this specification section describe the minimum required features, material quality and operational requirements of the fire alarm system. These documents do not depict every connection to be made and wire to be installed. The Vendor and Contractor are solely responsible for determining all wiring, programming, interconnections, and additional equipment required to create a complete and fully functional fire alarm system, based on the equipment and performance characteristics described within these documents.
- B. Provide all components, devices, hardware, software, programming, peripheral devices, extension components, conduit, wiring, etc., required to extend the existing fire alarm system with the new fire alarm system. Required components include, but are not limited to, initiating devices and circuits, signaling devices and circuits, notification devices and circuits, monitoring devices and circuits, power supplies, batteries, auxiliary devices, and control circuits for other building systems such as dampers, magnetic door hold open devices, fan shut down, elevator recall, etc. Extend the existing fire alarm system in a manner that the existing fire alarm system's functionality and annunciation is equivalent to the existing conditions unless otherwise noted. Upon completion of construction, the complete fire alarm system shall function as a single system, able to be reset from any single reset location point, and annunciated at any annunciator location.
- C. Device layouts and limited equipment have been shown on the construction documents. Additional equipment, wiring, components, etc required to create a complete and fully functional system has not been shown, and is the responsibility of



the Contractor. Shop drawing submittals shall indicate all requirements to create said fire alarm system.

## 1.5 SUBMITTALS

### A. General Submittal Requirements:

1. Failure to comply with all of the requirements within specification 26 0500 and within this specification section will result in the submitted shop drawing being rejected without review. All listed requirements must be submitted within a single submittal package.
2. Shop Drawings shall be prepared by persons with the following qualifications:
  - a. Trained and certified by manufacturer in fire-alarm system design.
  - b. NICET-certified fire-alarm technician, Level IV minimum.
  - c. Licensed or certified by authorities having jurisdiction.

### B. Product Data: For each type of product indicated on drawings and required to complete installation if not indicated on drawings. Indicate part numbers being ordered for each equipment or component variation required. If device or equipment is shown on construction documents, indicate corresponding fire alarm symbol at the top of each product data sheet.

### C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Include CAD floor plans indicating the complete layout of the entire system, including auxiliary equipment, wiring and device addresses.
  - a. A legend shall be provided to indicate which fire alarm symbols correspond with construction document fire alarm symbols, if different.
2. Actual routing of notification appliance circuits required for circuit survivability as dictated in Part 3 of this specification.
3. Drawings shall include notification device mounting height, candela rating and sound level settings.
4. Include a complete fire alarm riser diagram indicating the wiring sequence of devices and their connections to the control equipment. Include a color code schedule for the wiring.
5. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
6. Include voltage drop calculations for notification appliance circuits.
7. Include battery-size calculations including total available capacity, used capacity and future capacity available.
8. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
9. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
10. Manufacturer wiring requirements, such as size, type, and manufacturer.

11. Photocopy of NICET certification of person overseeing the preparation of fire alarm drawings, shop drawings, installation, and testing.
  12. Stamp and signature of Professional Engineer overseeing fire alarm design shall be required on drawings as required to comply with local or state regulations.
- D. Installation and maintenance manuals per Section 26 0500.
- E. Field quality-control reports.
- F. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
  2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
  3. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:
    - a. Frequency of testing of installed components.
    - b. Frequency of inspection of installed components.
    - c. Requirements and recommendations related to results of maintenance.
    - d. Manufacturer's user training manuals.
  4. Provide shop drawings as reviewed by the Architect/Engineer and Authority Having Jurisdiction.
  5. Provide hardcopy and electronically reproducible CAD floor plans indicating location of fire alarm devices, wiring and associated addresses.
- G. Software and Firmware Operational Documentation:
1. Device address list.
- H. Project Record Documents:
1. Submit record documents per Section 26 0500.
  2. Provide a CAD drawing of each building area depicting each device location and address. Labeling of devices on drawings shall be consistent with labeling in the field. Scale CAD drawings no smaller than 1/16 inch = 1 foot-0 inch.
- 1.6 QUALITY ASSURANCE
- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- B. Installer Qualifications: A factory authorized, licensed electrical or security contractor with minimum 5 years experience in the design, installation, and maintenance of fire alarm systems by fire alarm system manufacturer specified and selected. Installation shall be by personnel certified by NICET as fire-alarm Level III technician.
- C. Source Limitations for Fire-Alarm System and Components: Obtain system from single source from single manufacturer. Components shall be compatible with and operate as an extension of existing system.

- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- E. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

#### 1.7 SYSTEM DESCRIPTION

- A. UL-certified automatic and manual addressable fire alarm system consisting of multiplexed signal transmission, dedicated to fire-alarm service only. Compliant with NFPA 72.
- B. Alarm Indication: By synchronized sounding of emergency voice alarm communication system and tone signals and synchronized flashing of strobes. Tone and visual signals shall be synchronized throughout the facility.
- C. Voice Communication: An emergency voice alarm communication system shall be utilized to notify occupants of fire alarm initiation, and provide instructions to evacuate the facility using digitized voice messages. Manual voice override functionality shall be provided.

#### 1.8 SEQUENCING AND SCHEDULING

- A. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:
  - 1. Notify Owner no fewer than two days in advance of proposed interruption of service.
  - 2. Do not proceed with interruption of service without Owner's written permission.
- B. Existing Fire-Alarm Equipment: Existing equipment shall be utilized to serve new devices installed as part of the contract.

#### 1.9 WARRANTY

- A. Provide one (1) year warranty for all labor and materials from date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Provide products compatible with existing devices installed within facility. Devices installed in finished areas should match existing devices.
  - 1. Siemens Building Technologies Inc.; Fire Safety Division.
- B. Proposed vendors must be able to show the ability to respond to requests for service within 24 hours and the ability to supply replacement parts for the system within 48 hours relative to the site where the system is to be installed.

## 2.2 FIRE ALARM CONTROL PANEL

- A. General: Existing FACP shall be utilized for this project.
- B. Signal Line Circuit Board (SLC):
  - 1. Pathway Class Designation: Class A: Circuits capable of transmitting an alarm signal during an open or a non-simultaneous single ground fault on a circuit conductor. Includes a redundant path.
- C. Notification Appliance Circuit Board (NAC):
  - 1. Pathway Class Designation: Class A: Circuits capable of transmitting an alarm signal during an open or a non-simultaneous single ground fault on a circuit conductor. Includes a redundant path.

## 2.3 SIGNALING LINE CIRCUIT DEVICES

- A. Manual Fire Alarm Boxes:
  - 1. Comply with UL 38.
  - 2. Boxes shall be directly connected to a SLC loop and finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
  - 3. Double-action mechanism requiring two actions to initiate an alarm pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
  - 4. Station Reset: Key- or wrench-operated switch.
- B. Smoke Detectors:
  - 1. Comply with UL 268.
  - 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
  - 3. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base in locations shown on drawings with all mounting hardware provided. Provide terminals in the fixed base for connection to building wiring.
  - 4. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
  - 5. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status.
  - 6. Photoelectric Smoke Detector: Detector shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.
  - 7. Detector shall be directly connected to a SLC loop. Each detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
  - 8. Dual status LEDs shall be provided on each smoke detector to indicate the detector is operational and in regular communication with the control panel, or in an alarm condition.
  - 9. Each detector shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel.

C. Duct Smoke Detectors:

1. Comply with UL 268A.
2. The smoke detector housing shall accommodate an intelligent photoelectric smoke detector having the same features specified for standard smoke detectors with the following additional features required below.
3. Provide sampling tubes and mounting hardware to match the duct to which it is attached. Sampling tube design and dimensions shall be as recommended by manufacturer for specific duct size, air velocity and installation conditions where applied. Where the detector housing is larger than the duct height, the Contractor shall fabricate a mounting bracket for the detector and attach according to the fire alarm manufacturer's recommendations.
4. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
5. Weatherproof Duct Housing Enclosure for outdoor locations: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.
6. Remote Indication: Provide a remote LED indicator device if detector is not visible from a floor standing position. If detector is located above a suspended ceiling, mount remote indicator in ceiling directly below detector with a white single-gang faceplate, labeled to indicate device type and mechanical equipment being monitored.

2.4 NOTIFICATION APPLIANCES

- A. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections.
- B. All wall-mounted audible, visual and combination notification devices shall be white in color, with red lettering.
- C. All ceiling-mounted audible, visual and combination notification devices shall be white in color, with red lettering.
- D. Audio Speaker Devices (4 inch Diameter Ceiling Mount or Wall Mount):
1. All speakers shall operate on 25V RMS system, have a minimum frequency range of 400 to 40000Hz, and shall be provided with field selectable output taps available in 3dBA increments.
  2. Speakers in corridors and public spaces shall produce a nominal sound output of 84 dBA at 10 feet.
  3. All speakers shall be capable of reproducing a clear signal consisting of a live or prerecorded voice, with intelligibility.
- E. Visual Notification Appliances:
1. Xenon strobe lights or equivalent in compliance with UL 1971 and ADAAG with clear or nominal clear lens for fire alarm systems.
  2. The maximum pulse duration shall be one flash per second with a maximum duty cycle of 40 percent. The flash rate shall be 1 Hertz.
  3. Visual alarm notification appliances shall be flash in a temporal pattern and fully synchronized with all other units.
  4. Rated Light Output:
    - a. 15/30/75/110 Candela, selectable in the field, as indicated on drawings.

5. Mounting: As indicated on drawings.
6. Strobe Leads: Factory connected to screw terminals.

F. Combination Audible/Visual Notification Appliances:

1. Single device with integral audible and visual notification, meeting the requirements for each component (audible and visual) per this specification.

## 2.5 ADDRESSABLE INTERFACE DEVICES

A. Addressable Relays:

1. Addressable relay module available for control of auxiliary devices, rated for the electrical load being controlled. Contractor shall provide additional slave relay(s) as required to achieve desired function.
2. Addressable relays shall connect directly to a SLC loop and receive power from a separate 24VDC circuit. Addressable relay shall supply 24VDC power to the device(s) being controlled, unless otherwise indicated on the drawings.

B. Addressable Monitor Modules:

1. Addressable monitor module available for monitoring of auxiliary devices. It shall interface initiating devices with the fire alarm control panel.
2. Addressable monitor modules shall connect directly to a SLC loop and receive power from a separate 24VDC circuit.
3. The addressable monitor module shall provide the required power to operate the monitored device(s).
4. At the Contractor's option, an integral relay capable of providing a direct signal auxiliary device may be provided within the monitor module.

## 2.6 NOTIFICATION APPLIANCE CIRCUIT EXTENDER PANELS

- A. This Contractor and Vendor shall be responsible for furnishing and installing notification appliance circuit extender panels as necessary to provide remote power supply for notification appliance circuits, based on calculations performed by the Vendor.
- B. Notification appliance circuit extender panels may be installed only in back-of-house areas such as janitor, electrical, mechanical and telecommunications closets. Coordinate final locations with Architect/Engineer prior to rough-in where not indicated on drawings. Indicate locations of extender panels on shop drawing submittals.
- C. Notification appliance circuit extender panels shall be self-contained remote power supplies with batteries and charger mounted in a surface or recessed lockable cabinet. Manufacturer shall match fire alarm control panel.
- D. Battery capacity shall be sufficient for operation for 24 hours of non-alarm state, followed by alarm for 15 minutes.
- E. Notification appliance circuit extender panels shall be provided with 25 percent spare capacity for future devices.
- F. Power for notification appliance extender panels shall be from a 120VAC circuit supplied by the nearest life safety panelboard. Extend two #12 conductors and 1#12 ground in 3/4 inch conduit to each notification appliance circuit extender panel from a

dedicated 20A, single pole circuit breaker. Provide red handle-lock device for each circuit breaker serving notification appliance extender panels.

## 2.7 WIRING

- A. All fire alarm wiring and cables shall be furnished and installed by the Contractor.
- B. Wiring shall be in accordance with local, state, and national codes. Number and size of conductors shall be as recommended by the fire alarm system manufacturer.
- C. All analog voice speaker and analog telephone circuits shall utilize twisted/shielded pair to eliminate cross talk.
- D. All wiring and cables shall be UL listed and labeled as complying with NFPA 70 Article 760.

## PART 3 - EXECUTION

### 3.1 EQUIPMENT INSTALLATION

- A. Comply with NFPA 70, NFPA 72, local and state codes and manufacturer recommendations for installation of fire-alarm equipment.
- B. Connection to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.
  - 1. Connecting new equipment to existing control panel in existing part of the building.
  - 2. Connecting new equipment to existing monitoring equipment at the supervising station.
  - 3. Provide all items, wiring, devices, components, programming, etc., to modify, supplement and expand the existing fire alarm system as necessary to extend existing fire alarm system. New components shall be capable of merging with existing configuration without degrading the performance of either system.
- C. Devices specified to be surface mounted shall be mounted on a manufacturer provided backbox, painted to match the color of the device. The backbox shall be the same size and shape of the device, and must not have visible knockouts.
- D. Signaling Line Circuit Devices:
  - 1. General:
    - a. Do not install pull stations, fire alarm annunciators and signaling appliances before all dust producing construction in the area has ceased.
    - b. Ceiling mounted devices shall be located where shown on the floor plans or reflected ceiling plans. Where a conflict arises with architectural elements or other items that will not allow installation in shown location, the Contractor shall adjust location of device such that the new location meets all NFPA 72 requirements and applicable building codes.
    - c. Coordinate the location of all ceiling devices with luminaires, sprinkler heads, piping, diffusers, grilles and other obstructions to maintain a neat and operable operation. Mounting locations and spacing must in accordance with NFPA 72.

- d. Center ceiling mounted devices within each ceiling tile where installed in a grid type ceiling. Devices installed within hard ceilings shall be arranged in a neat and uniform pattern.
  - e. Provide a means of isolating addressable devices connected to the SLC so that connection to the devices in no more than one zone would be lost by a single fault on a pathway, per NFPA-72 chapter 23.6.
    - 1) Zones are designated by fire or smoke barrier boundaries.
2. Manual Fire Alarm Boxes:
- a. Mount semi-flush in recessed back boxes, installed 48 inches above the finished floor.
3. Smoke Detectors:
- a. Detector heads shall not be installed until after the final construction cleaning, unless required by the Authority Having Jurisdiction. If detector heads must be installed prior to final cleaning, they may not be installed until they can be connected to a fully functional fire alarm control panel.
  - b. All smoke detectors must be installed in an accessible location, including in-duct smoke detectors. Provide access panels as required. Coordinate with General Contractor.
  - c. Provide a smoke detector at each Fire Alarm Panel and Notification Appliance Circuit Extender Panel location whether shown on drawings or not.
  - d. Smoke detectors must be located at least 3 feet-0 inches from each supply air diffuser and return grille.
  - e. Smoke detectors shall be installed at least 12 inches from any part of a lighting fixture.
4. Duct Smoke Detectors:
- a. Duct smoke detectors with respective sampling tubes shall be installed on the duct where shown on drawings in compliance with manufacturer's requirements. Sampling tubes shall extend the full width of the duct. All duct penetrations shall be sealed air-tight.
- E. Notification Appliance Devices:
- 1. Devices shall be located where shown on drawings.
  - 2. Wall mounted devices shall be installed on flush-mounted backboxes.
  - 3. Ceiling mounted devices shall be installed flush with ceiling, centered within ceiling tile if installed in a grid-type system. Devices installed within hard ceilings shall be arranged in a neat and uniform pattern.
- F. Addressable Interface Devices:
- 1. Addressable Relays:
    - a. Mount each addressable relay within an enclosure located in an accessible serviceable area as near as possible to the device(s) being controlled unless otherwise specifically noted. Provide all required mounting hardware, and label each enclosure to indicate relay function. Provide remote indicator to allow inspection of the device status from a floor standing location if device is not visible from a floor standing position.



2. Addressable Monitor Modules:

- a. Mount each addressable monitor module within an enclosure located in an accessible serviceable area as near as possible to the device(s) being controlled unless otherwise specifically noted. Provide all required mounting hardware, and label each enclosure to indicate device being monitored. Provide remote indicator to allow inspection of the device status from a floor standing location if device is not visible from a floor standing position.
- G. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.
- H. Device Location-Indicating Lights: Locate in public space near the device they monitor.

3.2 WIRING

- A. Fire alarm wiring shall be provided by the Contractor in accordance with the manufacturer's recommendations and in compliance with the National Fire Codes.
- B. Wiring shall be U.L. listed as fire alarm protection signaling circuit cable per NEC. Wire for analog loops will be a minimum of #18 AWG, twisted pair, shielded type FPL, FPLP, FPLR. Wire for notification circuits will be a minimum #14 AWG, type KF-2 or KFF-2. Alarm speaker wire will be a minimum #14 AWG, shielded type CM. Cable type may vary if recommended by the system manufacturer for compatibility with system warranty or design. When a "network" cable is installed between multiple fire alarm control units, verify the manufacturer's wiring requirements and install it in a dedicated conduit. No other wires can be installed in that conduit.
- C. All fire alarm system wiring will be installed in a dedicated raceway. Raceway may be EMT, RMC, FMC, LFMC (flexible type limited by NEC), and surface raceway (only in areas where not subject to damage).
- D. Connect all components together for a completely functional ready to operate system as shown on the drawings, as specified herein and as directed by the manufacturer.
- E. Install all fire alarm wiring in conduit.
  1. Wiring not associated with fire alarm detection, alarm or auxiliary fire protection functions shall not be routed in fire alarm conduits.
- F. This facility will employ partial evacuation and relocation of occupants during fire alarm events. All notification appliance circuits and network communication circuits must be installed and protected such that attack by fire within an evacuation zone does not impair control and operation outside of the evacuation signaling zone. "Circuit survivability" requirements shall be as described in NFPA 72.
  1. All circuits necessary for the operation of notification devices shall be installed in conduit, and protected by 2-hour fire-rated chases or enclosures, until they enter the zone they serve.
  2. Outgoing and return conductors for notification appliance and network communication circuits serving separate evacuation and signaling zones shall be routed separately, such that a one (1) foot separation exists vertically, and four

(4) feet of separation exists horizontally. Within ten (10) feet of the control panel, these circuits may be routed together.

- G. Fire alarm wiring splices shall be avoided to the extent possible. If needed, splices may only be made in accessible junction boxes, compliant with NFPA 70.
- H. Notification appliance circuits shall not span floors or smoke compartments. Refer to architectural drawings for smoke compartments.
- I. Signal line circuits connecting devices shall not span floors or two-hour smoke compartments. Refer to architectural drawings for smoke compartments.

### 3.3 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
- B. Paint all junction boxes associated with the fire alarm system red. Identify SLC and NAC circuit on junction box cover.
- C. Color Coding: Color code fire alarm conductors differently from the normal building power wiring. Differentiate the following circuit types by using different conductor colors with an overall red jacket.
  - 1. Alarm Circuits.
  - 2. Supervisory Circuits.
  - 3. Initiating Circuits.
  - 4. Notification Circuits.
  - 5. Door Release.
  - 6. Central Station.
  - 7. DC Power Supply.
  - 8. Power Branch Circuits.

### 3.4 GROUNDING

- A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100 and manufacturer written requirements. Install a ground wire from main service ground to fire alarm control unit.
- B. For audio circuits, minimize the following to the greatest extent possible: ground loops, common mode returns, noise pickup, cross talk and other impairments.

### 3.5 SEQUENCES OF OPERATION

- A. General:
  - 1. Refer to the Fire Alarm Operation Matrix within the drawings for basic requirements and system input/output relationships.
- B. Panel/Annunciator Alarm, Trouble, Supervisory Indication:
  - 1. Respective system Alarm, Trouble or Supervisory LED indicator light shall cycle on/off at the following locations:
    - a. Fire Alarm Control Panel.

2. Appropriate signal shall be transmitted to the central station via the digital communicator.
3. Event date, time and type of occurrence shall be recorded within the Fire Alarm Control Panel event history. Event shall also be recorded by means of the system printer.

C. Fire Alarm Visual Alarm Sequence:

1. Visual alarms throughout the building shall flash. Strobes within the building shall be synchronized.

D. Fire Alarm Audible Alarm Sequence:

1. Audible alarms throughout the building shall sound.

E. Air Handling Unit Shutdown Sequence:

1. Utilizing addressable relays, the fire alarm system shall directly shut down the air handling units through each unit's local motor controller.
2. Each air handling unit shall be individually shut down based on alarming device location and area served.
3. Once alarm state has been reset, air handling units shall automatically be re-energized and resume normal operation.

### 3.6 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by Owner's representative and authorities having jurisdiction.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Prior to final inspection, the AHJ approved inspector is responsible for verifying the fire alarm contractor has fully tested and certified the system in accordance with NFPA-72. A copy of the NFPA-72 Record of Completion shall be sent to the Engineer of Record and Owner's Representative.

D. Tests and Inspections:

1. Test fire alarm system in accordance with NFPA 72 Chapter 14, local Fire Marshal requirements and local building codes.
2. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
3. Contractor shall test and adjust the voice fire alarm system after all furnishings, wall and floor coverings and fixed equipment is in place and operating. Measurements should be taken at a height of five feet above the finished floor level.
  - a. Adjust speaker taps to the lowest tap setting that achieves a sound level higher than or equal to the following:

- 1) 15dBA above ambient levels as indicated in NFPA 72 table A.18.4.3
    - 2) 15dBA above measured ambient. 5dBA above the maximum measured sound level with duration of more than 60 seconds.
  4. Before partial occupancy, on all fire alarm installations or modification, manufacturer shall provide a written satisfactory completion of the required test outlined in NFPA 72. A copy of the NFPA 72 Record of Completion shall be sent to the Engineer of Record and the Owner's rep.
  - E. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
  - F. Fire-alarm system will be considered defective if it does not pass tests and inspections.
  - G. Contractor and Owner shall coordinate actual room numbers to be used within facility. Final room numbers should be used for fire alarm system programming and record documents.
- 3.7 SYSTEM TRAINING
- A. The contractor and/or the system manufacturer's representatives shall provide a typewritten "Sequence of Operation."

END OF SECTION 28 3111

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