

CENTENNIAL HALL IMPROVEMENTS AND RENOVATION  
RC000638

PROJECT MANUAL FOR: CENTENNIAL HALL IMPROVEMENTS AND RENOVATION

PROJECT NUMBER: RC000638

AT  
UNIVERSITY OF MISSOURI – **MISSOURI UNIVERSITY OF SCIENCE AND  
TECHNOLOGY**, MISSOURI

FOR:

THE CURATORS OF THE UNIVERSITY OF MISSOURI

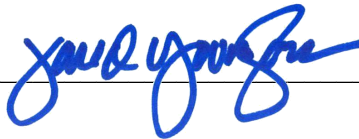
PREPARED BY:

Emily Biagioni-Paulette, Project Manager  
Paragon Architecture  
637 W. College St.  
Springfield, Missouri 65806  
417-885-0002

DATE: August 28, 2023

I hereby certify that these Drawings and/or 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: \_\_\_\_\_

A handwritten signature in blue ink, appearing to read "Emily Biagioni-Paulette", is written over a horizontal line.



**PARAGON**  
ARCHITECTURE

**PROJECT MANUAL**

**Missouri University of Science and Technology –  
Curators of the University of Missouri**

**CENTENNIAL HALL  
IMPROVEMENTS AND  
RENOVATION**

**300 W. 12<sup>th</sup> Street  
Rolla, Missouri 65409**

**Project # 22-703A  
RC000638**

**Issue Date | August 28, 2023**

**MISSOURI  
S&T**

## **PROJECT MANUAL**

### **PROJECT:**

Centennial Hall Improvements – RC000638  
Missouri University of Science and Technology  
300 W. 12<sup>th</sup> Street  
Rolla, Missouri 65409

### **OWNER:**

Missouri University of Science & Technology  
The Curators of the University of Missouri

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### **ARCHITECT OF RECORD: PARAGON ARCHITECTURE**

637 W. College Street  
Springfield, Missouri 65806  
Phone: 417.885.0002

**Project Contact:** Emily Biagioni-Paulette, Project Manager

---

### **MECHANICAL/ELECTRICAL ENGINEER OF RECORD: RTM ENGINEERING CONSULTANTS**

3333 E. Battlefield Rd, Suite 1000  
Springfield, Missouri 65804  
Phone: 417.881.0020

**Project Contact:** Jennifer Luce, Principal

---

### **ELEVATOR CONSULTANT: ATIS**

600 Emerson Rd, Suite 225  
Creve Coeur, Missouri 63141  
314.441.3999

**Project Contact:** Zach Perry, Engineer

---

### **CIVIL ENGINEER OF RECORD: ARCHER-ELGIN**

310 E. 6<sup>th</sup> Street  
Rolla, Missouri 65401  
573.364.6362

**Project Contact:** Cameron Schweiss, Engineer

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ARCHITECTURAL SPECIFICATION DISCLAIMER

PROJECT: Centennial Hall Improvements and Renovation – RC000638  
OWNER: Missouri University of Science & Technology – The Curators of the  
University of Missouri  
LOCATION: Centennial Hall  
Missouri University of Science and Technology  
300 W. 12<sup>th</sup> Street  
Rolla, Missouri 65409

ARCHITECT: PARAGON ARCHITECTURE, LLC  
637 W. COLLEGE STREET  
SPRINGFIELD, MO 65806  
P: 417.885.0002

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<u>DIVISION 2</u> 024100	<u>SITE WORK</u> Demolition
<u>DIVISION 3</u> 030100	<u>CONCRETE</u> Maintenance of Concrete
<u>DIVISION 4</u> 040100	<u>MASONRY</u> Maintenance of Masonry
<u>DIVISION 6</u> 061010 064100	<u>WOOD AND PLASTICS</u> Non-Structural Rough Carpentry Architectural Wood Casework
<u>DIVISION 7</u> 078400 079200	<u>THERMAL AND MOISTURE PROTECTION</u> Firestopping Joint Sealants
<u>DIVISION 8</u> 080671 081113 081416 087100	<u>DOORS, WINDOWS &amp; GLASS</u> Door Hardware Schedule Hollow Metal Doors and Frames Flush Wood Doors Door Hardware
<u>DIVISION 9</u> 090561 092116	<u>FINISHES</u> Common Work Results for Flooring Preparation Gypsum Board Assemblies



JARED A. YOUNGLOVE, ARCHITECT  
MO #: A-2017019282

093000	Tiling
095000	Acoustical Ceilings
096500	Resilient Flooring
099123	Interior Painting

DIVISION 10

101419	Dimensional Letter Signage
101423	Panel Signage
102113.19	Plastic Toilet Compartments
102600	Wall and Door Protection
102800	Toilet, Bath, and Laundry Accessories
104400	Fire Protection Specialties

SPECIALTIES

DIVISION 12

123600	Countertops
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FURNISHINGS

DIVISION 31

313116	Termite Control
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SITE WORK

**RC000638 – CENTENNIAL HALL IMPROVEMENTS AND RENOVATION**

MISSOURI UNIVERSITY OF SCIENCE AND TECHNOLOGY

**MEP SPECIFICATION DISCLAIMER**

PROJECT: Centennial Hall Improvements and Renovation – RC000638  
OWNER: Missouri University of Science and Technology – The Curators of  
the University of Missouri  
LOCATION: Centennial Hall  
300 W. 12<sup>th</sup> Street  
Rolla, MO 65409  
  
ENGINEER: RTM Engineering Consultants  
3333 E. Battlefield Rd, Suite 1000  
Springfield, MO 65804  
P: 417.881.0020

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**DIVISION 21 – FIRE PROTECTION**

21 0000 GENERAL FIRE SUPPRESSION REQUIREMENTS  
21 0517 SLEEVES AND SLEEVE SEALS FOR FIRE SUPPRESSION PIPING  
21 0518 ESCUTCHEONS FOR FIRE SUPPRESSION PIPING  
21 0523 GENERAL DUTY VALVES FOR WATER BASED FIRE SUPPRESSION PIPING  
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21 1100 FACILITY FIRE SUPPRESSION WATER SERVICE PIPING  
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22 0000 GENERAL PLUMBING REQUIREMENTS  
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22 0518 ESCUTCHEONS FOR PLUMBING PIPING  
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 1319.13 SANITARY DRAINS  
22 4000 PLUMBING FIXTURES

**RC000638 – CENTENNIAL HALL IMPROVEMENTS AND RENOVATION**  
MISSOURI UNIVERSITY OF SCIENCE AND TECHNOLOGY

**DIVISION 23 - HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)**

- 23 0000 GENERAL MECHANICAL REQUIREMENTS
- 23 0500 COMMON WORK RESULTS FOR HVAC
- 23 0529 HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT
- 23 0553 IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT
- 23 0593 TESTING, ADJUSTING, AND BALANCING FOR HVAC
- 23 0700 HVAC INSULATION
- 23 2113 HYDRONIC PIPING
- 23 3113 METAL DUCTS
- 23 3300 AIR DUCT ACCESSORIES
- 23 3346 FLEXIBLE DUCTS
- 23 3713 GRILLES, REGISTERS, AND DIFFUSERS

**DIVISION 26 - ELECTRICAL**

- 26 0000 GENERAL ELECTRICAL REQUIREMENTS
- 26 0519 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES
- 26 0526 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
- 26 0529 HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
- 26 0533 RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS
- 26 0553 IDENTIFICATION FOR ELECTRICAL SYSTEMS
- 26 0923 LIGHTING CONTROL DEVICES
- 26 2726 WIRING DEVICES
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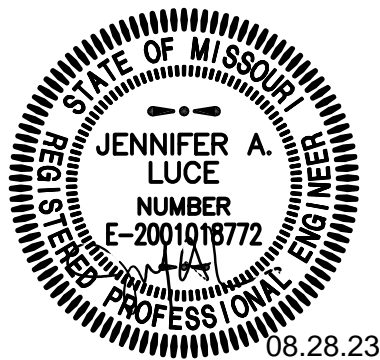
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- 27 0000 COMMUNICATIONS SYSTEMS

**DIVISION 28 – FIRE ALARM SYSTEMS**

- 28 4621 FIRE ALARM SYSTEMS

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CIVIL SPECIFICATION DISCLAIMER

PROJECT: Centennial Hall Improvements and Renovation – RC000638  
OWNER: Missouri University of Science & Technology – The Curators of the  
University of Missouri  
LOCATION: Centennial Hall  
Missouri University of Science and Technology  
300 W. 12<sup>th</sup> Street  
Rolla, Missouri 65409

CIVIL ENGINEER: CM Archer Group, P.C.  
dba Archer-Elgin (Engineering, Surveying & Architecture)  
310 East 6<sup>th</sup> Street  
Rolla, MO 65401

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<u>Section</u>	<u>Title</u>
32 13 00	Site Concrete
32 91 13	Soil Preparation
32 92 19	Seeding
33 14 16	Site Water Distribution Piping







PROJECT MANUAL FOR: CENTENNIAL HALL IMPROVEMENTS AND RENOVATION

PROJECT NUMBER: RC000638

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DIVISION 32

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329113  
329219

Site Concrete  
Soil Preparation  
Seeding

DIVISION 33  
331416

UTILITIES  
Site Water Distribution Piping

**END OF SECTION**

## ADVERTISEMENT FOR BIDS

Sealed Bids for:

**CENTENNIAL HALL IMPROVEMENTS AND RENOVATION  
MISSOURI UNIVERSITY OF SCIENCE AND TECHNOLOGY  
PROJECT NO. RC000638**

will be received by the Curators of the University of Missouri, Owner, at Missouri University of Science and Technology, Design and Construction Management, General Services Building, 1701 Spruce Drive, Rolla, Missouri 65409, until **11:30 a.m. on Thursday, October 5, 2023**, and immediately opened and publicly read aloud in Conference Room 151.

Drawings and specifications and other related contract information may be viewed and ordered online at <https://www.adsplanroom.net/> or by contacting American Document Solutions (ADS), 1400 Forum Boulevard, Suite 7A, Columbia, Missouri 65203, phone (573) 446-7768, or email [orders@adsmo.net](mailto:orders@adsmo.net) for a **refundable deposit of \$100, CHECK ONLY**, payable to ADS. Mailing cost are the responsibility of the purchaser. Only documents returned within fourteen (14) calendar days after the bid opening, in good condition will be refunded. A download is available for a (non-refundable) purchase. Neither owner nor Engineer will be responsible for full or partial sets of Bidding Documents, including Addenda (if any) obtained from sources other than the issuing office. All Contract Documents must be obtained by the Bidder from ADS to be an Eligible Bidder.

*A Pre-Bid Meeting will be held Thursday, September 21, 2023, at 1:30 p.m. in Room 151, General Services Building 1701 Spruce Drive, Rolla, MO 65409. A tour of the project site will follow the meeting.*

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

Questions regarding the scope of work and commercial conditions should be directed to Sarah Frost at (573) 341-7005 or [sfrost@mst.edu](mailto:sfrost@mst.edu).

Information regarding bid results will be available the day following the bid opening by calling (573) 341-7619 or by visiting <https://designconstruction.mst.edu/bidsrfpsrfqs>.

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

Base Bid Construction Estimate:      \$1,300,000

Advertisement Date:                      September 15, 2023

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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  
Missouri University of Science and Technology  
1701 Spruce Drive  
Rolla, Missouri 65409

1. Bidder, in compliance with invitation for bids for construction work in accordance with Drawings and Specifications prepared by PARAGON ARCHITECTURE entitled "CENTENNIAL HALL IMPROVEMENTS AND RENOVATION," project number **RC000638**, dated **August 28, 2023** 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 first and second floor restrooms banks, install full-building sprinkler system, and other minor improvements; 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) Excavation, as defined in Division 2, per cu. yd.

(a) Trenching,  
Base Bid quantity = \_\_\_\_\_ 60 \_\_\_\_\_ cu yd \$ \_\_\_\_\_ /cu yd

(7) Acoustical Ceiling Tile replacement, as defined in A0-series sheets  
As necessary to perform ceiling work \$ \_\_\_\_\_ /sf

(8) Acoustical Ceiling Grid replacement, as defined in A0-series sheets  
As necessary to perform ceiling work \$ \_\_\_\_\_ /sf

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 one hundred fifty (150) 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.

c. Special Scheduling Requirements:

(1) First floor STEM Center project (not in scope) is planned to be operational by **February 2024**. Contractor shall prioritize first floor sprinkler work and connections to provide operational system for occupancy of STEM Center. **This will likely require expediting fire sprinkler calculations and sprinkler design.** Contractor shall also prioritize completion of first floor restrooms to provide accessible restrooms for occupancy of STEM Center.

(2) Contractor shall coordinate with S&T CPM and GC for roofing replacement project (not in scope) for completion of second floor restrooms and ceiling/sprinkler work.

(3) Contractor shall coordinate with S&T CPM for all other Centennial building projects (not in scope) for location of material laydown and staging areas.

(4) Contractors shall coordinate with GC for elevator refurbishment project for completion of required building work.

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.

---

Work to be performed

Subcontractor Name,

City, State

---

**Fire Suppression**

---

**Plumbing**

---

**Electrical**

---

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 ninety (90) 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 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**

**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

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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\_\_\_\_\_

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Name of Organization

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Signature

---

Printed Name

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Title of Person Signing

END OF SECTION



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**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 Disable 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 and/or the Directory of Veterans maintained by the State of Missouri?

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

VII. 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.

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VIII. 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:

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Name:

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Title:

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Date:

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

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8. 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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9. 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 \_\_\_\_\_, 20\_\_\_\_,

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 \_\_\_\_\_

**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 \_\_\_\_\_, 20 \_\_\_\_\_.

My commission expires \_\_\_\_\_, 20 \_\_\_\_\_.

## 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., Suite 2000  
St. Louis, MO 63101  
314/657-3700; 314/613-7011 (Fax)  
CONTACT: Minority Business Development Manager

Metro  
One Metropolitan Square  
211 North Broadway, Suite 700  
St. Louis, MO 63102-2759  
314/982-1400  
CONTACT: Disadvantaged Business Enterprise Coordinator

St. Louis Minority Business Council  
211 N. Broadway, Suite 1300  
St. Louis, MO 63102  
314/231-5555  
CONTACT: Executive Director

U.S. Small Business Administration - St. Louis, MO  
8(a) Contractors, Minority Small Business  
1222 Spruce Street, Suite 10.103  
St. Louis, MO 63101  
314/539-6600; 202/481-6565 (Fax)  
CONTACT: Business Opportunity Specialist

Lambert St. Louis International Airport  
11495 Navaid  
Bridgeton, MO 63044  
314/551-5000; 314/551-5013 (Fax)  
CONTACT: Program Specialist

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  
816/513-1836; 816/513-1805 (Fax)  
CONTACT: Minority Business Specialist

Mid-States Minority Supplier Development Council  
One U.S. Bank Plaza #1820  
St. Louis, MO 63101  
317/923-2110  
CONTACT: [info@midstatesmsdc.org](mailto:info@midstatesmsdc.org)

U.S. Small Business Administration - Kansas City, MO  
8(a) Contractors, Minority Small Business  
1000 Walnut, Suite 500  
Kansas City, MO 64106  
816/426-4900; 816/426-4939 (Fax)  
CONTACT: Business Opportunity Specialist

Missouri Department of Transportation  
Division of Construction  
P.O. Box 270  
Jefferson City, MO 65102  
573/751-6801; 573/526-5640-6555 (Fax)  
CONTACT: Disadvantaged Business Enterprise Coordinator

Illinois Department of Transportation  
MBE/WBE Certification Section  
2300 Dirksen Parkway  
Springfield, IL 62764  
217/782-5490; 217/785-1524 (Fax)  
CONTACT: Certification Manager

State of Missouri-Office of Administration  
Office of Supplier & Workforce Diversity  
P.O. Box 809  
Jefferson City, MO 65102  
573/751-8130; 573/522-8078 (Fax)  
CONTACT: MBE/WBE Certification Coordinator  
<https://oeo.mo.gov/>

State of Missouri-Office of Administration  
Division of Purchasing  
301 West High Street, Room 630  
Jefferson City, MO 65102  
573/751-2387; 573/526-9815 (Fax)  
CONTACT: Administrator  
<https://oa.mo.gov/purchasing/vendor-information/missouri-service-disabled-veteran-business-enterprise-sdve-information>



## 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.stlameric.com](http://www.stlameric.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.: \_\_\_\_\_ email: \_\_\_\_\_  
 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 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.

General 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. 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 within 48 hours of the receipt of bids to the University Contracting Officer, 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, within 48 hours of the receipt of bids to the University Contracting Officer, 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 within 48 hours of the receipt of bids to the University Contracting Officer, 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** Within 48 hours of the receipt of bids, the apparent low bidder shall submit to the University Contracting Officer all Supplier Diversity Compliance Evaluation Form(s), and/or Application for Waiver with supporting information per 15.6 above, and 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. Failure to submit the documents in the time indicated may result in rejection of the bid.

## **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

December 2021 Edition

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## 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 Owner's Authorized Agent

When the term "Owner's Authorized Agent" is used herein, it shall refer to an employee or agency acting on the behalf of the Owner's Representative to perform duties related to code inspections, testing, operational systems check, certification or accreditation inspections, or other specialized work.

#### 1.1.6 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.

#### 1.1.7 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.

### 1.1.8 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 Serviced-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", "compliant", "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(s) 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 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, Regulations, Permits, Codes, and Inspections**

**3.2.1** The Contractor shall, without additional expense to the Owner, comply with all applicable laws, ordinances, rules, permit requirements, codes, 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 the 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 benchmark 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 workday 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 or inspection 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 compliant and 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 existing 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 and code 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 include, 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 Delegated Design**

**3.11.1** If the Contract Documents specify the Contractor is responsible for the design of any work as part of the project, then the Contractor shall procure all design services and certifications necessary to complete the Work as specified, from a design professional licensed in the State of Missouri. The signature and seal of that design professional shall appear on all drawings, calculations, specifications, certifications, shop drawings, and other submittals related to the Work. The design professional shall maintain insurance as required per Article 11.

### **3.12 Materials, Labor, and Workmanship**

**3.12.1** 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.

**3.12.2** 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.

**3.12.3** 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.

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

**3.12.5** Materials and workmanship shall be subject to inspection, examination, and testing 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.

**3.12.6** 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.

**3.12.7** 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.

### **3.12.8 Substitutions**

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

**3.12.8.2** 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 Document requirements and is code compliant, 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.

**3.12.8.3** Substitutions may be rejected without explanation at the 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.

**3.12.8.4** 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 substitution.

### **3.13 Approved Equal**

**3.13.1** 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 and is code compliant.

**3.13.2** 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.

**3.13.3** 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, device, 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.

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

**3.14.1** 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.

**3.14.2** 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.

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

**3.14.4** 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.

**3.14.5** 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.

**3.14.6** 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 provided, 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.

**3.14.7** 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.

**3.14.8** 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.

**3.14.9** 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.

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

**3.14.11** 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.

**3.14.12** 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.

**3.14.13** 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.

**3.14.14** 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.

### **3.15 Record Drawings**

**3.15.1** 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.

### **3.16 Operating Instructions and Service Manuals**

**3.16.1** 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.

### **3.16.2 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.

### **3.17 Taxes**

**3.17.1** 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.

**3.17.2** 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.

**3.17.3** 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.

**3.17.4** 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.

**3.17.5** 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.

### **3.18 Contractor's Construction Schedules**

**3.18.1** 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.

**3.18.2** 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.

**3.18.3** As time is of the essence to this contract, the University expects that the Contractor will take all necessary steps to ensure 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 schedule 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.

**3.18.4** 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, the Owner's Representative, and the Owner's Authorized Agent 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 working 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, non-compliant, 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 to 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' notice 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 a Bill of Sale and Bailment Agreement on forms provided by the Owner's

Representative, 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.
- .11 The Contractor shall furnish and maintain insurance covering the replacement cost of the material stored offsite against all losses and shall furnish proof of coverage with the application for payment for material stored offsite.
- .12 The Contractor is responsible for all costs related to storage and handling of material stored offsite unless otherwise directed by the Owner's Representative.

**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 or non-compliant 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 1.1.14 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, standards, codes, 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.

**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 officers, employees, and agents of 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/Other Requirements**

**11.5.1** Any Consultant/Contractor providing professional design services as part of the contract shall be required to provide and maintain, from the date of this Contract and for a period of ten (10) years after the date of Final Completion, Professional Liability insurance to cover any claims, including but not limited to errors, omissions, and negligence, which may arise from the Design and related Services performed by the Consultant. The minimum limits for such Policy shall be \$1,000,000.00 per occurrence/\$1,000,000.00 aggregate. The insurance afforded by the policy shall meet the requirements of this Section 11.2 and Section 11.5 relating to CGL Policies, and without limiting the foregoing, shall be extended to cover the liability of "The officers, employees, and agents of The Curators of the University of Missouri", who shall be named as additional insureds therein, and this liability is assumed in writing by the Contractor's Consultant under the written Subcontract described herein. 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, or non-compliant 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, codes, 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, the Owner's Authorized Agent, or entity acceptable to the Owner, and the Contractor shall bear related costs of tests, inspections, and approvals as required in the Contract Documents. The Contractor shall give the Architect, Owner's Representative, and the Owner's Authorized Agent timely notice of when and where tests and inspections are to be made so the

Architect, the Owner's Representative and/or the Owner's Authorized Agent may observe procedures or perform the necessary tests or inspections.

**13.3.2** If the Architect, Owner's Representative, or the Owner's Authorized Agent 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, the Owner's Representative or the Owner's Authorized Agent, of when and where tests and inspections are to be made so the Architect, Owner's Representative and/or the Owner's Authorized Agent, so may choose that the tests or inspections can be performed or observed. 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 and Owner's Authorized Agent'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 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** ICC International Fire Code
- .5** ICC International Fuel Gas Code
- .6** NFPA 70 National Electric Code (NEC)
- .7** Americans with Disabilities Act – Standards for Accessible Design.
- .8** 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
- .9** NFPA 101 Life Safety Code (as noted above)
- .10** American Concrete Institute (ACI)
- .11** American National Standards Institute (ANSI)
- .12** American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
- .13** American Refrigeration Institute (ARI)
- .14** American Society for Testing and Materials (ASTM)
- .15** Missouri Standard Specification for Highway Construction, Missouri State Highway Commission

- .16 National Electrical Manufacturers Association (NEMA)
- .17 Underwriter's Laboratories, Inc. (UL), Federal Specifications
- .18 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, codes, regulations or orders of an authority having jurisdiction;
- .5 disregards the authority of the Owner's Representative, Architect, or Owner's Authorized Agent;
- .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.

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## 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 **RC000638 Centennial Hall Improvements and Renovations, drawings dated August 28, 2023, released for bidding September 14, 2023.**

b. Architect  
Paragon Architecture  
637 W. College St.  
Springfield, Missouri 65806  
417-885-0002  
Emily Biagioni-Paulette, Project Manager  
Jared Younglove, Architect of Record

c. Mechanical & Electrical Engineer  
RTM Engineering Consultants  
3333 E. Battlefield Rd, Suite 1000  
Springfield, Missouri 65804  
417-881-0020  
Jennifer Luce, Principal

d. Elevator Consultant  
ATIS  
600 Emerson Rd, Suite 225  
Creve Coeur, Missouri 63141  
314-441-3999  
Zach Perry, Engineer

e. Civil Engineer  
Archer-Elgin Engineering, Surveying & Architecture  
310 East 6<sup>th</sup> Street  
Rolla, Missouri 65401  
573-364-6362  
Cameron Schweiss, Project Engineer

f. Other Definitions: See Article 1., General Conditions.

#### 2. SPECIAL SCHEDULING REQUIREMENTS

- a. Owner will retain a third-party contractor for the installation of the elevator. Contractor to coordinate scheduling of installation with third-party contractor.
- b. Contractor shall prioritize work on first floor sprinkler system and connections in order to facilitate occupancy of STEM Center by **January 15, 2024.**

### 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 restroom renovations, installation of a full-building fire sprinkler system, and elevator refurbishment.
  - (2) Demolition shall consist of full demolition of existing restrooms, selective ceiling demolition for sprinkler installation, and selective demolition for elevator refurbishment and repair.
  - (3) Architectural work shall consist of new restrooms, including new finishes, fixtures, ceilings, and accessories. Includes selective reinstallation/replacement of ceiling tiles and lights as related to fire sprinkler work, construction of new elevator machine room, and minor corridor improvements.
  - (4) Mechanical work shall consist of new plumbing fixtures and lines for restroom work, as well as sprinkler installation.
  - (5) Electrical work shall consist of new lighting and wiring for restroom renovation, electrical changes associated with elevator construction.
  - (6) Elevator work shall consist of repair, replacement, and refurbishment of existing elevator components as described in elevator specification and elevator building work document.

### 4. LOCATION

Work shall be performed under this Contract on campus of the University of Missouri – **Missouri University of Science and Technology**, at **Centennial Hall, 300 West 12<sup>th</sup> Street, Rolla, Missouri 65409**.

### 5. NUMBER OF CONSTRUCTION DOCUMENTS

- a. The Owner's Representative will furnish the Contractor a copy of executed Contract and **three (3)** complete sets of Drawings and Specifications.
- b. Additional sets may be obtained from the architect at cost of reproduction.
- c. The Owner will provide electronic sets of explanatory and changed Drawings at no cost to Contractor as issued during project.
- d. 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.2) for required submittal information.
- d. The Contractor shall submit to the Architect four (4) bound copies 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.3).
- e. The Contractor shall submit to the Owner's Representative all items referenced in the accompanying Closeout Log (1.E.4) 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: Contractor shall be issued parking permits for **two (2)** service vehicles to park in location directed by the Owner's Representative. Employee parking shall be on public streets or where directed by the Owner's Representative. The contractor parking lot (if available) may also be utilized for employee parking.

- (1) 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.
  - (2) 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.
- 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. 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: The Contractor shall provide and maintain, in a sanitary condition, chemical type portable toilet facilities at work site for use by his personnel. Toilets and toilet location shall be subject to approval by the Owner's Representative.
  - 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. 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.
  - h. All concrete waste material including washout water shall be totally contained and removed from the Owner's property.
  - i. 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.
  - j. **"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" after evaluation by a competent person; 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.

b. Construction Project Fencing:

- (1) Fencing requirements, as indicated on Drawings, shall be constructed of 9 or 11-gauge chain link not less than six (6) feet in height and not more than 2-inch mesh with posts spaced not more than ten (10) feet apart and all corner and gate posts imbedded in concrete. All other posts shall be sufficiently secured in ground to maintain proper and adequate support of fence. Fenced in area shall have at least two (2) access gates and all gates shall be lockable.
- (2) Using existing landmarks, lamp posts, trees, or other Owner property for support of fencing is strictly prohibited unless a written waiver is obtained from Owner's Representative.
- (3) Use of ribbon, snow fence, chicken wire, rope, and wooden barricades as fencing is prohibited.
- (4) Fencing shall be maintained in an "as-installed" condition throughout the life of the project.
- (5) The Contractor may use used fencing provided it is in good condition and is satisfactory to the Owner's Representative.

c. Preserving and Protecting Existing Vegetation:

- (1) Protection and compensation for damages:
  - (a) Trees and shrubs within work area designated to remain shall be protected from damage during construction by fixed chain link fencing or armoring as indicated on Drawings or specified herein. Plant protection devices shall

be installed before work has begun and shall be maintained for duration of work unless otherwise directed by Owner's Representative.

- (b) In the event that damage(s) to the Owner's trees, shrubs or vegetation occurs as a result of the Contractor's unauthorized operations, the Contractor shall pay or allow to the Owner compensation for said damage(s). Compensation 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.
- (2) Plants within work area designated for removal shall be removed by Contractor.
- (3) 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.
- (4) 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.
- (5) Only minimal grading or disturbance will be allowed to area within and adjacent to drip line of trees or shrubs designated to remain. Contractor shall obtain approval from Owner's Representative prior to starting any grading work in these areas. Unnecessary cutting of plant roots shall not be permitted. The Contractor shall stop work immediately and shall notify Owner's Representative immediately if root system is exposed or if any roots over 1 1/2" in diameter are encountered. Roots exposed and/or damaged during construction shall be immediately cut off cleanly behind exposed or damaged area, and cut surface treated in accordance with established horticultural standards and covered with topsoil.
- (6) Owner's Representative will stop work immediately when proper measures are not being employed to protect trees and shrubs. Contractor will be notified to resume work after required protection measures are implemented.
- (7) Pruning of limbs necessary to repair damage or provide clearance for work shall be 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.
- (8) Contractor shall repair tire ruts and other damages to existing lawn areas. Repairs shall match surrounding area.

#### 10. SUBSTITUTIONS and EQUALS

- 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 of any

item described in the Contract Documents will be allowed only prior to the receipt of bids provided that a request for approval has been 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. No substitutions and/or equal will be allowed for the following items:

<u>Item</u>	<u>Specification Section</u>
Lock Cylinders [Best]	087100

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 Rolla - Water, Storm, and Sanitary Sewer Standards - Department of Public Works.

12. PERMITS

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

a. Owner Furnished Materials – University shall provide the following toilet accessories: toilet tissue dispenser, manual roll towel dispenser, manual soap dispenser, restroom waste can.

14. PRE-BID MEETING / INSPECTION

A Pre-Bid Meeting will be held on **Wednesday, September 20, at 1:30 p.m.** in Room 151, General Services Building, 1701 Spruce Drive, Rolla, Missouri 65409. A tour of the construction site will occur after the meeting.

15. MODIFICATIONS TO INFORMATION TO BIDDERS

a. Information to Bidders:

(1) Referenced Information to Bidders, Page IFB/5.  
Add new Article 15.8.5 as follows:

**15.8.5** 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.

16. MODIFICATION TO INFORMATION FOR BIDDERS: BIDDERS STATEMENT OF QUALIFICATIONS

a. Information For Bidders

(1) Reference: Information for Bidders, Article 8.4

Insert new Article 8.4 to read as follows:

In addition to the Bidder's Statement of Qualifications, the Bidder must also submit evidence and meet the following qualifications:

The project requires the services of a prime contractor who has demonstrated success in completing process/power plant work in an operating plant environment with little or no interruption of plant operations.

(a) MINIMUM QUALIFICATIONS

- (i) The schedule for the project is aggressive and requires a contractor with a successful track record of managing projects **that require coordination with multiple projects that are being processed in tandem.**
- (ii) Successful completion of one project of similar type and scope.
- (iii) Successful and sustained track record of effectively utilizing project/schedule management software for at least the last two years.

(b) QUALIFICATION SUBMITTALS

- (i) Submitted qualification packages should include the following information:
  - Project and Schedule
    - Management Experience managing projects with equal or greater schedule demands.
    - Demonstrated and consistent on-time completion success
  - Project Organization / Personnel
    - Key project team members and their resume
    - Project team roles and responsibilities of team members
    - Reporting/accountability procedures
    - Quality control program and procedures
  - Organizational Support
    - Home office support
    - Labor and subcontractor relations
    - Submittal processing procedures
    - Material ordering/tracking/delivery Procedures
    - Cost accounting support

- Financial stability/capacity
- Record of mentoring and supporting Supplier Diversity Subcontractor Participation

(ii) Packages must include the following items:

- Summary of Similar Projects
- Sample progress reports and schedules
- Brief Narratives indicating how the Contractor intends to manage this project, including subcontractors.

(c) QUALIFICATION PROCEDURE

(i) All qualification information and supporting materials must be submitted with your bid. Following the bid date, the Owner reserves the right to request additional information material to evaluate qualifications. Failure of the Contractor to demonstrate their ability to comply with these qualifications may be grounds for the Owner not recommending aware of the Contract.

17. 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 1: Contractor Schedule (Small Projects only) – Contractor is responsible for the schedule and must comply with the Owner’s requirements. See Contractor Schedule Specification included in these documents.

18. 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.

19. PROJECT PARTNERING

a. Covenant of Good Faith and Fair Dealing:

This contract imposes an obligation of good faith and fair dealing in its performance and

enforcement. The Contractor, University of Missouri, and Consultants, with a positive commitment to honesty and integrity, agree to the following mutual duties:

- (1) Each will function within the laws and statutes applicable to their duties and responsibilities.
- (2) Each will assist in the other's performance.
- (3) Each will avoid hindering the other's performance.
- (4) Each will proceed to fulfill its obligations diligently.
- (5) Each will cooperate in the common endeavor of the contract.

## 20. VALUE ENGINEERING

- a. After execution of the contract with the successful contractor, the Owner will entertain value engineering initiatives from the contractor. These initiatives may include modifications to the drawings and specifications. The Owner will not entertain modifications that affect the functions or characteristics of the project, including but not limited to: service life of systems or components, economy of operations, ease of maintenance, appearance, or design and safety standards.
- b. Once a value initiative is recommended to the Owner's Representative, the Owner's Representative will determine if the proposal deserves further merit. If not, the Contractor will be notified the proposal has not been accepted. If the Owner's Representative determines the proposal should be considered, a team will be assembled consisting of the Owner's Representative, Architect, Contractor and other parties that may be necessary to appropriately review the initiative. The team will review the initiative and determine whether to proceed with a value engineering joint proposal. The Owner and Contractor must jointly agree to the merit of any value engineering initiative before the preparation of the value engineering joint proposal. The Owner will not be liable for the failure to accept any value engineering initiative.
- c. If the Owner and the Contractor jointly agree to the initiative, the Contractor shall prepare the value engineering joint proposal. The proposal shall contain, at a minimum, the following:
  - (1) An itemized list of existing contract requirements recommended to be changed and proposed language for modification.
  - (2) All construction documents and computations necessary for a thorough and expeditious evaluation.
  - (3) A detailed estimate of the cost of performing the work under the existing contract and under the proposed changes, including the cost of implementing the changes.
  - (4) Estimate of costs the Owner may incur related to the proposed changes such as maintenance and operating cost.
  - (5) Changes to the project schedule.



- (6) Estimate of any other project cost that may be incurred to develop the recommended changes, including Owner's professional fees.
- d. The Contractor shall submit the value engineering joint proposal to the Owner's Representative. The Contractor will be notified if the proposals have been accepted or if clarifications and/or negotiations are necessary.
- e. If the proposal is rejected, the issue is dismissed and each party is responsible for their own cost incurred.
- f. If the proposal is accepted in whole or in part, the Owner's Representative will prepare a Change Order to implement the proposal in the project.
  - (1) The net savings for the proposal will be calculated by subtracting from the total construction cost savings, the Owner's cost associated with the proposal including professional fees. The Owner will be the sole judge of the acceptability of a proposal, and the estimated net savings from the adoption of all or any part of the proposal. The Owner reserves the right to disregard the contract bid prices and/or the Contractor's breakdown of cost, if, in the Owner's judgment, such prices do not represent a fair measure of the value of the work to be performed or deleted.
  - (2) Savings resulting solely from the elimination or reduction in quantity of a bid item will not be considered as a value engineering initiative.
  - (3) Value Engineering initiatives will only be considered by the Owner within the first 150 days of the contract.
  - (4) For those initiatives accepted by the Owner, the Contractor will be paid 50 percent of the net savings.
  - (5) Upon acceptance of a value engineering joint proposal, any restriction imposed by the Contractor on its use or on disclosure of the information shall become void, and the Owner thereafter shall have the right to use all or any part of the proposal without obligation or compensation of any kind to the Contractor.

## 21. BUILDING SYSTEM COMMISSIONING

A third-party commissioning agent will be retained by the Owner. Contractor to provide personnel at site during the commissioning to assist in coordination.

## 22. 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

## 23. PROJECT MANAGEMENT/COMMUNICATION REQUIREMENTS

- a. The Contractor shall be represented at the site by both a competent full-time Project Manager and 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 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.

## 24. 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.

## 25. 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.
- b. The Contractor shall utilize the hot work permit decision tree and permit provided in the 2014 NFPA 51B for all Hot Work operations.

- c. 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.
- d. Notify the Owner's Representative 24 hours prior to starting hot work in buildings with operational fire alarm or fire suppression systems. The Owner's Representative will coordinate the appropriate system outage with Campus Maintenance personnel.
- e. Unless otherwise instructed by the Owner's Representative, the Contractor shall post a copy of each completed hot work permit to the Owner's project management file system the following business day.
- f. Special hot work requirements: Use thermal imaging cameras after hot work operations- describe criteria in detail (for historically significant buildings of wood construction); designate additional fire watch monitoring beyond the NFPA 30 minute post hot work requirement (project has a greater potential for reflash or smoldering fire due to concealed combustible building elements, etc.).

26. CONSTRUCTION WASTE MANAGEMENT

The goal of Construction Waste Management is to divert waste from the sanitary landfill. This shall be accomplished through reuse, recycling and/or salvage of non-hazardous construction and demolition debris to the greatest extent practical. Track and report all efforts related to reuse, recycling and/or salvage materials from the project (including clean fill material). Report all material types and weights, where material was diverted, type of diversion, documentation of diversion (eg: waste or recycling tickets), and applicable dates. In order to calculate the diversion percentage, total weights of all non-hazardous landfill material must be reported. Copies of all applicable receipts, tickets and tracking logs shall be uploaded to the Owner's information sharing website or reported as required by the Construction Project Manager.

27. 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**

## Option #1 – 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 to 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 ensure 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 SureTrack or P3, Microsoft Project, Oracle P6, or other standard industry scheduling software, approved by the Owner's Representative.

(2) Schedule Development

Within 2 weeks of the NTP, contractor shall prepare a schedule, preferably in CPM format, but in detailed bar chart format at a minimum, that reflects the contractor's and each subcontractor's 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 fragments 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 include 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.
- o) 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 REQUEST

- 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 Contractors 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.
- c) 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.

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## SHOP DRAWING AND SUBMITTAL LOG

Project: Centennial Hall Improvement and Renovation  
 Project Number: RC000638  
 Contractor:

Section	Description	Contractor	Date Received	# Copies to A/E	Date Sent to A/E	Date Returned to Contractor	Remarks (Accepted Rejected)	Date Sent to Owner	# Copies to Owner	File
021400	DEMOLITION – PLAN NOTING AREAS FOR TEMPORARY CONSTRUCTION AND FIELD OFFICES									
040100	MAINTENANCE OF MASONRY – PRODUCT DATA, SAMPLES OF BLOCKS FOR INFILL IN EXISTING WALL									
061010	NON-STRUCTURAL ROUGH CARPENTRY – PRODUCT DATA									
064100	ARCHITECTURAL WOODWORK – SHOP DRAWINGS, PRODUCT DATA, SAMPLES									
078400	FIRESTOPPING – FIRESTOPPING SCHEDULE, PRODUCT DATA									
079200	JOINT SEALANTS – PRODUCT DATA, COLOR CARDS FOR SELECTION, SAMPLES FOR VERIFICATION									
081113	HOLLOW METAL DOORS AND FRAMES – PRODUCT DATA, SHOP DRAWINGS, PRODUCT SCHEDULE									
081413	FLUSH WOOD DOORS – PRODUCT DATA, SHOP DRAWINGS, SAMPLES, WARRANTY									
087100	DOOR HARDWARE – PRODUCT DATA, SHOP DRAWINGS, KEYING SCHEDULE									
090561	COMMON WORK RESULTS FOR FLOORING PREPARATION – VISUAL OBSERVATION REPORT, PRODUCT LITERATURE FOR FLOOR COVERINGS AND ADHESIVES, TESTING REPORTS, ADHESIVE BOND AND COMPATIBILITY TEST REPORT, COPY OF RFCI (RWP)									



Section	Description	Contractor	Date Received	# Copies to A/E	Date Sent to A/E	Date Returned to Contractor	Remarks (Accepted Rejected)	Date Sent to Owner	# Copies to Owner	File
092116	GYPSUM BOARD ASSEMBLIES – PRODUCT DATA									
093000	TILING – PRODUCT DATA, SAMPLES									
095100	ACOUSTICAL CEILINGS – PRODUCT DATA									
096500	RESILIENT FLOORING – PRODUCT DATA, SAMPLES, CERTIFICATION DATA									
099123	INTERIOR PAINTING – PRODUCT DATA, SAMPLES,									
101419	DIMENSIONAL LETTER SIGNAGE – PRODUCT DATA, SHOP DRAWINGS									
101423	PANEL SIGNAGE – PRODUCT DATA, SHOP DRAWINGS, SELECTION SAMPLES									
102133 .19	PLASTIC TOILET COMPARTMENTS – PRODUCT DATA, SHOP DRAWINGS, SAMPLES									
102600	WALL AND DOOR PROTECTION – PRODUCT DATA, SAMPLES, WARRANTY									
102800	TOILET, BATH, AND LAUNDRY ACCESSORIES – PRODUCT DATA									
104400	FIRE PROTECTION SPECIALTIES – PRODUCT DATA									
123600	COUNTERTOPS – PRODUCT DATA, SHOP DRAWINGS, VERIFICATION SAMPLES									
142400	HYDRAULIC SERVICE ELEVATOR RENOVATION – PRODUCT DATA, SHOP DRAWINGS, SAMPLES, MAINTENANCE CERTIFICATION									
210517	SLEEVES AND SLEEVE SEALS FOR FIRE-SUPPRESSION PIPING – FIELD QUALITY-CONTROL REPORTS									
210518	ESCUTCHEONS FOR FIRE-PROTECTION PIPING – PRODUCT DATA									
210523	GENERAL-DUTYVALVES FOR WATER-BASED FIRE-SUPPRESSION PIPING – PRODUCT DATA									

Section	Description	Contractor	Date Received	# Copies to A/E	Date Sent to A/E	Date Returned to Contractor	Remarks (Accepted Rejected)	Date Sent to Owner	# Copies to Owner	File
210529	HANGERS AND SUPPORTS FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT – PRODUCT DATA, SHOP DRAWINGS, DELEGATED-DESIGN SUBMITTAL, WELDING CERTIFICATES									
211100	FACILITY FIRE-SUPPRESSION WATER-SERVICE PIPING – PRODUCT DATA, SHOP DRAWINGS, COORDINATION DRAWINGS, FIELD QUALITY-CONTROL REPORTS									
210131 3	WET-PIPE SPRINKLER SYSTEMS – PRODUCT DATA, SHP DRAWINGS, DELEGATED-DESIGN SUBMITTAL, COORDINATION DRAWINGS, QUALITIFCATION DATA, DESIGN DATA, FIELD TEST REPORTS, FIELD QUALITY-CONTROL REPORTS									
220523	GENERAL-DUTY VALVES FOR PLUMBING PIPING – PRODUCT DATA									
220553	IDENTIFICATION FOR PLUMBING PIPING NAD EQUIPMENT – PRODUCT DATA									
220719	PLUMBING PIPING INSULATION – PRODUCT DATA									
221316	SANITARY WASTE AND VENT PIPNG – PRODUCT DATA									
221319	SANITARY WASTE PIPING SPECIALTIES – PRODUCT DATA									
221319 .13	SANITARY DRAINS – PRODUCT DATA									
224000	PLUMBING FIXTURES – PRODUCT DATA, SHOP DRAWINGS									
230529	HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT – PRODUCT DATA									
230553	IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT – PRODUCT DATA									
230700	HVAC INSULATION – PRODUCT DATA									

Section	Description	Contractor	Date Received	# Copies to A/E	Date Sent to A/E	Date Returned to Contractor	Remarks (Accepted Rejected)	Date Sent to Owner	# Copies to Owner	File
233300	AIR DUCT ACCESSORIES – PRODUCT DATA									
233346	FLEXIBLE DUCTS – PRODUCT DATA, SHOP DRAWINGS									
233713	GRILLES, REGISTERS, AND DIFFUSERS – PRODUCT DATA, SAMPLES									
260519	LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES – PRODUCT DATA									
260529	HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS – PRODUCT DATA									
260553	IDENTIFICATION FOR ELECTRICAL SYSTEMS – PRODUCT DATA, SAMPLES, DELEGATED-DESIGN SUBMITTAL									
260923	LIGHTING CONTROL DEVICES – PRODUCT DATA, SHOP DRAWINGS									
262726	WIRING DEVICES – PRODUCT DATA, SHOP DRAWINGS, FIELD QUALITY-CONTROL DEVICES									
265119	LED INTERIOR LIGHTING – PRODUCT DATA, SHOP DRAWINGS, PRODUCT SCHEDULE									
265213	EMERGENCY AND EXIT LIGHTING – PRODUCT DATA, PRODUCT SCHEDULE									
270000	COMMUNICATION SYSTEMS – PRODUCT DATA, SHOP DRAWINGS, QUALIFICATION DATA									
284621 .11	ADDRESSABLE FIRE-ALARM SYSTEMS – APPROVED PERMIT SUBMITTAL, PRODUCT DATA, SHOP DRAWINGS									
313116	TERMITE CONTROL – PRODUCT DATA, EPA REGISTERED LABEL FOR TERMITICIDE PRODUCTS, WARRANTY									
321300	SITE CONCRETE – MIX DESIGNS, TESTING AND INSPECTION REPORTS									

Section	Description	Contractor	Date Received	# Copies to A/E	Date Sent to A/E	Date Returned to Contractor	Remarks (Accepted Rejected)	Date Sent to Owner	# Copies to Owner	File
329219	SEEDING – PRODUCT DATA									
331416	SITE WATER DISTRIBUTION PIPING – PRODUCT DATA, SHOP DRAWINGS, WATER LINE BACTERIAL AND PRESSURE TEST REPORTS									



OPERATING INSTRUCTIONS AND SERVICE MANUAL LOG

Project: Centennial Hall Improvements and Renovation  
 Project Number: RC000638  
 Contractor:

Section	Description	Catalog Data	Wiring Diagrams	Installation Instructions	Service & Maintenance Instructions	Parts List & Availability	Performance Curves	Startup & Operating Instructions
081416	FLUSH WOOD DOORS – MAINTENANCE DATA,							
087100	DOOR HARDWARE – MAINTENANCE DATA							
093000	TILING – MAINTENANCE DATA							
096500	RESILIENT FLOORING – MAINTENANCE DATA							
099123	INTERIOR PAINTING – MAINTENANCE DATA							
102113.19	PLASTIC TOILET COMPARTMENTS – MAINTENANCE DATA							
102600	WALL AND DOOR PROTECTION – MAINTENANCE DATA							
102800	TOILET, BATH, AND LAUNDRY ACCESSORIES – OPERATION AND MAINTENANCE DATA							
104400	FIRE PROTECTION SPECIALTIES – MAINTENANCE DATA							
123600	COUNTERTOPS – MAINTENANCE DATA							

Section	Description	Catalog Data	Wiring Diagrams	Installation Instructions	Service & Maintenance Instructions	Parts List & Availability	Performance Curves	Startup & Operating Instructions
142400	HYDRAULIC SERVICE ELEVATOR RENOVATION – MAINTENANCE MANUAL, ON-SITE WIRING DIAGRAMS, CERTIFICATES AND PERMITS							
210000	GENERAL FIRE PROTECTION REQUIREMENTS – OPERATIONS AND MAINTENANCE INSTRUCTIONS							
211313	WET-PIPE SPRINKLER SYSTEMS – OPERATION AND MAINTENANCE DATA							
224000	PLUMBING FIXTURES – OPERATIONS AND MAINTENANCE DATA							
233300	AIR DUCT ACCESSORIES – OPERATIONS AND MAINTENANCE DATA							
260923	LIGHTING CONTROL DEVICES – OPERATIONS AND MAINTENANCE DATA							
262726	WIRING DEVICES – OPERATIONS AND MAINTENANCE DATA							
265119	LED INTERIOR LIGHTING – WARRANTY INFORMATION, OPERATION AND MAINTENANCE DATA							
265213	EMERGENCY AND EXIT LIGHTING – WARRANTY INFORMATION, OPERATION AND MAINTENANCE DATA							

Section	Description	Catalog Data	Wiring Diagrams	Installation Instructions	Service & Maintenance Instructions	Parts List & Availability	Performance Curves	Startup & Operating Instructions
284621.11	ADDRESSABLE FIRE-ALARM SYSTEMS – OPERATIONS AND MAINTENANCE DATA							
331416	SITE WATER DISTRIBUTION PIPING – OPERATIONS AND MAINTENANCE DATA							





## CLOSEOUT LOG

Project: Centennial Hall Improvement and Renovation  
 Project Number: RC000638  
 Contractor:

Section	Description	Contractor/Subcontractor	Date Received	# 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.					
024100	DEMOLITION – RECORD DOCUMENTS SHOWING CAPEED AND ACTIVE UTILITIES AND SUBSURFACE CONSTRUCTION					
081416	FLUSH WOOD DOORS – WARRANTY FORM					
087100	DOOR HARDWARE – PROJECT RECORD DOCUMENTS, MAINTENANCE MATERIALS AND TOOLS					

Section	Description	Contractor/Subcontractor	Date Received	# of Copies	CPM Initials	Remarks
093000	TILING – EXTRA TILE (10 SF EACH SIZE/COLOR/FINISH COMBO), TRIM UNITS (3 PERCENT AMOUNT INSTALLED FOR EACH TYPE)					
095100	ACOUSTICAL CEILINGS – EXTRA ACOUSTICAL UNITS – 5 PERCENT TOTAL INSTALLED					
096500	RESILIENT FLOORING – EXTRA FLOORING (100 SF OR 10%, WHICHEVER IS GREATER), EXTRA WALL BASE – 10 LINEAR FEET EACH TYPE OR 10%, WHICHEVER IS GREATER					
099123	INTERIOR PAINTING – EXTRA PAINT (1 GALLON EACH COLOR, LABELLED)					
102600	WALL AND DOOR PROTECTION - WARRANTY					
142400	HYDRAULIC SERVICE ELEVATOR RENOVATION – DIAGNOSTIC DEVICE, KEYS, CERTIFICATE FRAME					

## SECTION 1.F

### INDEX OF DRAWINGS

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**August 28, 2023.**

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Sheet 2 of 56:	G0-1	Code Plans
Sheet 3 of 56:	G0-2	Code Continuation
Sheet 4 of 56:	G0-3	Accessibility Standards
Sheet 5 of 56	G0-4	Accessibility Standards
Sheet 6 of 56	G0-5	Interior Partition Types
Sheet 7 of 56	W1	Waterline Plan, Profile & Details
Sheet 8 of 56	A0-0	Keyplans
Sheet 9 of 56	A0-1	Demo Plans – Restrooms
Sheet 10 of 56	A0-2	First Floor Demo RCP
Sheet 11 of 56	A0-3	Second Floor Demo RCP
Sheet 12 of 56	A1-0	First Floor Plan and Elevations
Sheet 13 of 56	A1-1	Second Floor Plan and Elevations
Sheet 14 of 56	A1-2	Elevator Details
Sheet 15 of 56	A6-0	Door Schedule and Information
Sheet 16 of 56	A8-0	First Floor Reflected Ceiling Plan
Sheet 17 of 56	A8-1	Second Floor Reflected Ceiling Plan
Sheet 18 of 56	A8-2	Lower Level Mezzanine Reflected Ceiling Plan
Sheet 19 of 56	A9-0	Finish Plans
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Sheet 21 of 56	ME2-0	Site Utilities Plan
Sheet 22 of 56	FP0-1	Lower Level Sprinkler Demo Plan
Sheet 23 of 56	FP0-2	First & Second Level Sprinkler Demo Plan
Sheet 24 of 56	FP1-1	Lower Level and Mezzanine Sprinkler Plan
Sheet 25 of 56	FP1-2	First Level Sprinkler Plan
Sheet 26 of 56	FP1-3	Second Level Sprinkler Plan
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Sheet 28 of 56	P0-2	First Level Plumbing Demo Plan
Sheet 29 of 56	P0-3	Second Level Plumbing Demo Plan
Sheet 30 of 56	P0-4	Enlarged Plumbing Demo Plan
Sheet 31 of 56	P1-1	Lower Level Plumbing Plan

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Sheet 33 of 56	P1-3	Second Level Plumbing Plan
Sheet 34 of 56	P1-4	Enlarged Plumbing Plan
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Sheet 38 of 56	M0-4	Enlarged Mechanical Demo Plan
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Sheet 46 of 56	E0-3	Second Level Electrical Demo Plan
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Sheet 49 of 56	E1-2	First Level Electrical Plan
Sheet 50 of 56	E1-3	Second Level Electrical Plan
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Sheet 53 of 56	H201	First Floor HVAC Plan (For Reference)
Sheet 54 of 56	H202	Second Floor HVAC Plan (For Reference)
Sheet 55 of 56	H400	Basemenc Mech Plan (For Reference)
Sheet 56 of 56	H404	Mezzanine Mechanical Room HVAC Plan (For Reference)

END OF SECTION

# Missouri

## Division of Labor Standards

### WAGE AND HOUR SECTION



MICHAEL L. PARSON, Governor

# Annual Wage Order No. 30

Section 081  
**PHELPS 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

Todd Smith, Director  
Division of Labor Standards

Filed With Secretary of State: March 10, 2023

Last Date Objections May Be Filed: April 10, 2023

Prepared by Missouri Department of Labor and Industrial Relations

Building Construction Rates for  
PHELPS County

Section 081

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Asbestos Worker	\$62.54
Boilermaker	\$26.81*
Bricklayer	\$26.81*
Carpenter	\$59.77
Lather	
Linoleum Layer	
Millwright	
Pile Driver	
Cement Mason	\$56.83
Plasterer	
Communications Technician	\$58.02
Electrician (Inside Wireman)	\$55.36
Electrician Outside Lineman	\$77.26
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Elevator Constructor	\$26.81*
Glazier	\$26.81*
Ironworker	\$66.50
Laborer	\$46.30
General Laborer	
First Semi-Skilled	
Second Semi-Skilled	
Mason	\$26.81*
Marble Mason	
Marble Finisher	
Terrazzo Worker	
Terrazzo Finisher	
Tile Setter	
Tile Finisher	
Operating Engineer	\$67.64
Group I	
Group II	
Group III	
Group III-A	
Group IV	
Group V	
Painter	\$46.41
Plumber	\$69.68
Pipe Fitter	
Roofer	\$53.12
Sheet Metal Worker	\$70.50
Sprinkler Fitter	\$64.91
Truck Driver	\$26.81*
Truck Control Service Driver	
Group I	
Group II	
Group III	
Group IV	

\*The Division of Labor Standards received fewer than 1,000 reportable hours for this occupational title. The 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 as defined in RSMO Section 290.210.

Heavy Construction Rates for  
 PHELPS County

Section 081

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Carpenter	\$26.81*
Millwright	
Pile Driver	
Electrician (Outside Lineman)	\$77.26
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Laborer	\$47.13
General Laborer	
Skilled Laborer	
Operating Engineer	\$60.84
Group I	
Group II	
Group III	
Group IV	
Truck Driver	\$26.81*
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 fewer 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 024100 - DEMOLITION**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Selective demolition of building elements or structure for alteration purposes.
- B. Abandonment and removal of existing utilities and utility structures.

**1.2 REFERENCE STANDARDS**

- A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations 2022, with Errata (2021).

**1.3 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Site Plan: Indicate:
  - 1. Areas for temporary construction and field offices.
- C. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

**1.4 CLOSEOUT SUBMITTALS**

- A. Inventory of items that have been removed and salvaged.

**1.5 FIELD CONDITIONS**

- A. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- B. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

**PART 2 PRODUCTS -- NOT USED**

**PART 3 EXECUTION**

**3.1 GENERAL PROCEDURES AND PROJECT CONDITIONS**

- A. Comply with requirements in Section 017000.
- B. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
  - 1. Obtain required permits.
  - 2. Comply with applicable requirements of NFPA 241.
  - 3. Use of explosives is not permitted.
  - 4. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
  - 5. Provide, erect, and maintain temporary barriers and security devices.
  - 6. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
  - 7. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
  - 8. Do not close or obstruct roadways or sidewalks without permits from authority having jurisdiction.
  - 9. Conduct operations to minimize obstruction of public and private entrances and exits. Do not obstruct required exits at any time. Protect persons using entrances and exits from removal operations.
  - 10. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon, or limit access to their property.
- C. Do not begin removal until receipt of notification to proceed from Owner.
- D. Protect existing structures and other elements to remain in place and not removed.
  - 1. Provide bracing and shoring.

2. Prevent movement or settlement of adjacent structures.
  3. Stop work immediately if adjacent structures appear to be in danger.
- E. Minimize production of dust due to demolition operations. Do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
- F. Hazardous Materials:
1. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCBs, and mercury.
- G. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.

### 3.2 EXISTING UTILITIES

- A. Coordinate work with utility companies. Notify utilities before starting work, comply with their requirements, and obtain required permits.
- B. Protect existing utilities to remain from damage.
- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.
- E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.
- F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
- G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.
- H. Prepare building demolition areas by disconnecting and capping utilities outside the demolition zone. Identify and mark, in same manner as other utilities to remain, utilities to be reconnected.

### 3.3 SELECTIVE DEMOLITION FOR ALTERATIONS

- A. Existing construction and utilities indicated on drawings are based on casual field observation and existing record documents only.
1. Verify construction and utility arrangements are as indicated.
  2. Report discrepancies to Architect before disturbing existing installation.
  3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.
- B. Separate areas in which demolition is being conducted from areas that remain occupied.
1. Provide, erect, and maintain temporary dustproof partitions of construction a limits as construction as directed by Owner. .
- C. Maintain weatherproof exterior building enclosure, except for interruptions required for replacement or modifications; prevent water and humidity damage.
- D. Remove existing work as indicated and required to accomplish new work.
1. Remove items indicated on drawings.
- E. Services including, but not limited to, HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications: Remove existing systems and equipment as indicated.
1. Maintain existing active systems to remain in operation, and maintain access to equipment and operational components.
  2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
  3. Verify that abandoned services serve only abandoned facilities before removal.
  4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings. Remove back to source of supply where possible, otherwise cap stub and tag with identification.

- F. Protect existing work to remain.
  - 1. Prevent movement of structure. Provide shoring and bracing as required.
  - 2. Perform cutting to accomplish removal work neatly and as specified for cutting new work.
  - 3. Repair adjacent construction and finishes damaged during removal work.
  - 4. Patch to match new work.

**3.4 DEBRIS AND WASTE REMOVAL**

- A. Remove debris, junk, and trash from site.
- B. Leave site in clean condition, ready for subsequent work.
- C. Clean up spillage and wind-blown debris from public and private lands.

***END OF SECTION 024100***

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**SECTION 030100 - MAINTENANCE OF CONCRETE**

**PART 1 GENERAL**

**1.1 Section Includes**

- A. Cleaning of existing concrete surfaces.
- B. Repair of exposed structural, shrinkage, and settlement cracks.

**1.2 Related Requirements**

**PART 2 PRODUCTS**

**2.1 Cleaning Materials**

- A. Detergent: Non-ionic detergent.

**PART 3 EXECUTION**

**3.1 Cleaning Existing Concrete**

- A. Clean concrete surfaces of dirt or other contamination using the gentlest method that is effective.
  - 1. Try the gentlest method first, then, if not clean enough, use a less gentle method taking care to watch for impending damage.
  - 2. Clean out cracks and voids using same methods.
- B. The following are acceptable cleaning methods, in order from gentlest to less gentle:
  - 1. Water washing using low-pressure, maximum of 100 psi, and, if necessary, brushes with natural or synthetic bristles.
  - 2. Increasing the water washing pressure to maximum of 400 psi.
  - 3. Adding detergent to washing water; with final water rinse to remove residual detergent.
  - 4. Steam-generated low-pressure hot-water washing.

**END OF SECTION 030100**

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**SECTION 040100 - MAINTENANCE OF MASONRY**

**PART 1 GENERAL**

**1.1 Section Includes**

- A. Chemical cleaning of Unit Masonry surfaces.
- B. Replacement of Unit Masonry units.
- C. Repointing mortar joints.
- D. Repair of damaged masonry.

**1.2 Reference Standards**

- A. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures 2022, with Errata.

**1.3 Administrative Requirements**

- A. Preinstallation Meeting: Convene one week prior to commencing work of this section.
  - 1. Require attendance of parties directly affecting work of this section.
  - 2. Review conditions of installation, installation procedures, and coordination with related work.
  - 3. Post Meeting Record to Project Website.

**1.4 Submittals**

- A. Product Data: Provide data on cleaning compounds.
- B. Samples: Submit four samples of decorative block and face brick units to illustrate matching color, texture and extremes of color range.

**1.5 Mock-Ups**

- A. Restore and repoint an existing masonry wall area sized 8 feet long by 6 feet high; include in mock-up area instances of mortar, accessories, wall openings, and flashings.
- B. Clean a 10 ft by 10 ft panel of wall to determine extent of cleaning.
- C. Locate where directed.
- D. Acceptable panel and procedures employed will become the standard for work of this section.
- E. Mock-up may remain as part of the Work.

**1.6 Delivery, Storage, and Handling**

- A. Deliver masonry neatly stacked and tied on pallets. Store clear of ground with adequate waterproof covering.
- B. Store blast medium, acid solution, and restoration cleaner materials in manufacturer's packaging.

**1.7 Field Conditions - Masonry Work**

- A. Cold and Hot Weather Requirements: Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.
- B. Do not blast clean or use process creating dust, dirt, <> , when wind is over 10 mph.

**PART 2 PRODUCTS**

**2.1 Manufacturers**

- A. Restoration and Cleaning Chemicals:
  - 1. Diedrich Technologies, Inc: [www.diedrichtechnologies.com](http://www.diedrichtechnologies.com).
  - 2. HMK Stone Care System: [www.hmkstonecare.com](http://www.hmkstonecare.com).
  - 3. PROSOCO: [www.prosoco.com](http://www.prosoco.com).
  - 4. Substitutions: See Section 016000 - Product Requirements.

**2.2 Cleaning Materials**

- A. Cleaning Agent: Acid solution type.
- B. Acid Solution: Clean, stain free, commercial hydrochloric (muriatic) acid, mixed one part to 10 parts of potable water.
- C. Blasting Medium: \_\_\_\_\_.

**2.3 Mortar Materials**

- A. To match existing



**2.4 Masonry Materials**

- A. Replacement brick and block as noted in drawings

**PART 3 EXECUTION**

**3.1 Examination**

- A. Verify that surfaces to be cleaned are ready for work of this section.

**3.2 Preparation**

- A. Protect surrounding elements from damage due to restoration procedures.
- B. Carefully remove and store removable items located in areas to be restored, including fixtures, fittings, finish hardware, and accessories; reinstall upon completion.
- C. Separate areas to be protected from restoration areas using means adequate to prevent damage.
- D. Mask immediately adjacent surfaces with material that will withstand cleaning and restoration procedures.
- E. Close off adjacent occupied areas with dust proof and weatherproof partitions.
- F. Protect roof membrane and flashings from damage with 1/2 inch plywood laid on roof surfaces over full extent of work area and traffic route.
- G. When using cleaning methods that involve water or other liquids, install drainage devices to prevent runoff over adjacent surfaces unless those surfaces are impervious to damage from runoff.
- H. Do not allow cleaning runoff to drain into sanitary or storm sewers.

**3.3 Rebuilding**

- A. Cut out damaged and deteriorated masonry with care in a manner to prevent damage to any adjacent remaining materials.
- B. Support structure as necessary in advance of cutting out units.
- C. Cut away loose or unsound adjoining masonry and mortar as directed.
- D. Mortar Mix: Colored and proportioned to match existing work.
- E. Ensure that anchors are correctly located and built in.
- F. Install built in masonry work to match and align with existing, with joints and coursing true and level, faces plumb and in line. Build in all openings, accessories and fittings.

**3.4 Repointing**

- A. Perform repointing prior to cleaning masonry surfaces.
- B. Cut out loose or disintegrated mortar in joints to minimum 1/2 inch depth or until sound mortar is reached.
- C. Use power tools only after test cuts determine no damage to masonry units will result.
- D. Do not damage masonry units.
- E. When cutting is complete, remove dust and loose material by brushing.
- F. Premoisten joint and apply mortar. Pack tightly in maximum 1/4 inch layers. Form a smooth, compact concave joint to match existing.
- G. Moist cure for 72 hours.

**3.5 Cleaning Existing Masonry**

- A. Cleaning Detergent: Brush clean masonry surfaces at noted locations with cleaning agent in accordance with the manufacturer's instructions. Saturate masonry with clean water and flush loose mortar and dirt.

**3.6 Restoration Cleaning**

- A. Clean surfaces and remove large particles with wood scrapers or non-ferrous wire brush.
- B. Spray coat masonry with restoration cleaner, mixed into solution in accordance with manufacturer's instructions.
- C. Provide a second application if required to match mock-up area.
- D. Allow sufficient time for solution to remain on masonry and agitate with soft fiber brush or sponge.

- E. Rinse from the bottom up with potable water applied at 400 psi and at a rate of 4 gal/min.

**3.7 Aging**

- A. Rub in new masonry work to match, as close as possible, adjacent original work.
  - 1. Use carbon black in small amounts, rubbing in well with burlap rags.
- B. After each application, dust off surplus and wash down with low pressure hose. Allow surface to dry before proceeding with succeeding applications.
- C. Continue process until acceptance.

**3.8 Cleaning**

- A. Immediately remove stains, efflorescence, or other excess resulting from the work of this section.
- B. Remove excess mortar, smears, and droppings as work proceeds and upon completion.
- C. Clean surrounding surfaces.

**END OF SECTION 040100**

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**SECTION 061010 - NON-STRUCTURAL ROUGH CARPENTRY**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Non-structural dimension lumber framing.
- B. Miscellaneous framing and sheathing.
- C. Communications and electrical room mounting boards.
- D. Concealed wood blocking, nailers, and supports.
- E. Miscellaneous wood nailers, furring, and grounds.

**1.2 RELATED REQUIREMENTS**

**1.3 REFERENCE STANDARDS**

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2023.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2023.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023a.
- D. AWPA U1 - Use Category System: User Specification for Treated Wood 2023.
- E. PS 1 - Structural Plywood 2019.
- F. PS 20 - American Softwood Lumber Standard 2021.

**1.4 SUBMITTALS**

- A. Product Data: Provide technical data on non-structural wall sheathing.

**1.5 DELIVERY, STORAGE, AND HANDLING**

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation. Do not stack wood products in contact with ground.
- B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

**PART 2 PRODUCTS**

**2.1 GENERAL REQUIREMENTS**

- A. Dimension Lumber: Comply with PS 20.
  - 1. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee ([www.alsc.org](http://www.alsc.org)) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
  - 2. Lumber of other species or grades is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.
- B. Lumber fabricated from old growth timber is not permitted.

**2.2 DIMENSION LUMBER FOR CONCEALED APPLICATIONS**

- A. Sizes: Nominal sizes as indicated on drawings, S4S.
- B. Moisture Content: S-dry or MC19.
- C. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
  - 1. Lumber: S4S, No. 2 or Standard Grade.

**2.3 CONSTRUCTION PANELS**

- A. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

**2.4 ACCESSORIES**

- A. Fasteners and Anchors:
  - 1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
  - 2. Anchors: Toggle bolt type for anchorage to hollow masonry.

- B. Die-Stamped Connectors: Hot dipped galvanized steel, sized to suit framing conditions.
  - 1. For contact with preservative treated wood in exposed locations, provide minimum G185 galvanizing complying with ASTM A653/A653M.

## 2.5 FACTORY WOOD TREATMENT

- A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
  - 1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
  - 2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.
- B. Preservative Treatment:
  - 1. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative.
    - a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
    - b. Treat lumber exposed to weather.
    - c. Treat lumber in contact with masonry or concrete.
    - d. Treat lumber less than 18 inches above grade.
    - e. Treat lumber in other locations as indicated.
  - 2. Preservative Pressure Treatment of Plywood Above Grade: AWPA U1, Use Category UC2 and UC3B, Commodity Specification F using waterborne preservative.
    - a. Kiln dry plywood after treatment to maximum moisture content of 19 percent.
    - b. Treat plywood in contact with masonry or concrete.
    - c. Treat plywood less than 18 inches above grade.
    - d. Treat plywood in other locations as indicated.
  - 3. Preservative Pressure Treatment of Lumber in Contact with Soil: AWPA U1, Use Category UC4A, Commodity Specification A using waterborne preservative.
    - a. Preservative for Field Application to Cut Surfaces: As recommended by manufacturer of factory treatment chemicals for brush-application in the field.
    - b. Restrictions: Do not use lumber or plywood treated with chromated copper arsenate (CCA) in exposed exterior applications subject to leaching.

## PART 3 EXECUTION

### 3.1 PREPARATION

- A. Coordinate installation of rough carpentry members specified in other sections.

### 3.2 INSTALLATION - GENERAL

- A. Select material sizes to minimize waste.
- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

### 3.3 BLOCKING, NAILERS, AND SUPPORTS

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.
- B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.
- C. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.
- D. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is

explicitly indicated.

- E. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.
- F. Provide the following specific non-structural framing and blocking:
  - 1. Cabinets and shelf supports.
  - 2. Wall brackets.
  - 3. Handrails.
  - 4. Grab bars.
  - 5. Towel and bath accessories.
  - 6. Wall-mounted door stops.

### **3.4 INSTALLATION OF CONSTRUCTION PANELS**

- A. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.
  - 1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
  - 2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
  - 3. Install adjacent boards without gaps.

### **3.5 CLEANING**

- A. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.
- B. Prevent sawdust and wood shavings from entering the storm drainage system.

**END OF SECTION 061010**

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**SECTION 064100 - ARCHITECTURAL WOOD CASEWORK**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Specially fabricated cabinet units.
- B. Hardware.
- C. Factory finishing.
- D. Preparation for installing utilities.

**1.2 RELATED REQUIREMENTS**

- A. Section 061000 - Rough Carpentry: Support framing, grounds, and concealed blocking.
- B. Section 123600 - Countertops.

**1.3 REFERENCE STANDARDS**

- A. ANSI A208.1 - American National Standard for Particleboard 2022.
- B. BHMA A156.9 - Cabinet Hardware 2020.

**1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene a preinstallation meeting not less than one week before starting work of this section; require attendance by all affected installers.

**1.5 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
- C. Product Data: Provide data for hardware accessories.
- D. Samples: Submit actual sample items of proposed pulls, hinges, and locksets, demonstrating hardware design, quality, and finish.

**1.6 QUALITY ASSURANCE**

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

**1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Protect units from moisture damage.

**1.8 FIELD CONDITIONS**

- A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

**PART 2 PRODUCTS**

**2.1 CABINETS**

- A. Quality Standard: Custom Grade
- B. Plastic Laminate Faced Cabinets: Custom grade.
- C. Cabinets:
  - 1. Finish - Exposed Exterior Surfaces: Decorative laminate.
  - 2. Finish - Exposed Interior Surfaces: Decorative laminate.
  - 3. Finish - Semi-Exposed Surfaces: Decorative laminate
  - 4. Finish - Concealed Surfaces: Manufacturer's option.
  - 5. Door and Drawer Front Edge Profiles: Square edge with thin applied band.
  - 6. Door and Drawer Front Retention Profiles: Fixed panel.
  - 7. Casework Construction Type: Type A - Frameless.
  - 8. Interface Style for Cabinet and Door: Style 1 - Overlay; flush overlay.
  - 9. Adjustable Shelf Loading: 40 psf.
    - a. Deflection: L/144.
  - 10. Cabinet Style: Flush overlay.
  - 11. Cabinet Doors and Drawer Fronts: Flush style.

**2.2 WOOD-BASED COMPONENTS**

- A. Wood fabricated from old growth timber is not permitted.



**2.3 Panel Core Materials**

- A. Particleboard: Composite panel composed of cellulosic particles, additives, and bonding system; comply with ANSI A208.1.

**2.4 LAMINATE MATERIALS**

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
  - 1. Formica Corporation: [www.formica.com](http://www.formica.com).
  - 2. Panolam Industries International, Inc; Nevamar: [www.nevamar.com](http://www.nevamar.com).
  - 3. Wilsonart: [www.wilsonart.com/#sle](http://www.wilsonart.com/#sle).
  - 4. Pionite Decorative Surfaces: [www.panolam.com/pionite](http://www.panolam.com/pionite)
  - 5. Substitutions: See Section 016000 - Product Requirements.
- B. Provide specific types as follows:
  - 1. Horizontal Surfaces: HGS, 0.048 inch nominal thickness, through color, colors as indicated, finish as indicated.
  - 2. Vertical Surfaces: VGS, 0.028 inch nominal thickness, through color, colors as indicated, finish as indicated.
  - 3. Post-Formed Horizontal Surfaces: HGP, 0.039 inch nominal thickness, through color, colors as indicated, finish as indicated.
  - 4. Post-Formed Vertical Surfaces: VGP, 0.028 inch nominal thickness, through color, colors as indicated, finish as indicated.
  - 5. Cabinet Liner: CLS, 0.020 inch nominal thickness, through color, color as selected, finish as indicated.
  - 6. Laminate Backer: BKL, 0.020 inch nominal thickness, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.

**2.5 ACCESSORIES**

- A. Adhesive: Type recommended by fabricator to suit application.
- B. Plastic Edge Banding: Extruded PVC, flat shaped; smooth finish; self locking serrated tongue; of width to match component thickness.
  - 1. Color: As selected by Architect from manufacturer's standard range.
  - 2. Use at all exposed plywood edges.
  - 3. Use at all exposed shelf edges.
- C. Fasteners: Size and type to suit application.
- D. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.
- E. Concealed Joint Fasteners: Threaded steel.
- F. Grommets: Standard plastic grommets for cut-outs, in color verify color with Architect.

**2.6 HARDWARE**

- A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.
- B. Vanity Brackets: Fixed, ADA-compliant, face-of-stud mounting.
  - 1. Products:
    - a. A&M Hardware, Inc; ADA Vanity Brackets: [www.aandmhardware.com/#sle](http://www.aandmhardware.com/#sle).

**2.7 FABRICATION**

- A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.
- B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.
- C. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.

1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
2. Cap exposed plastic laminate finish edges with material of same finish and pattern.
- D. Matching Wood Grain: Comply with requirements of quality standard for specified Grade and as follows:
  1. Provide center matched panels at each elevation.
  2. Provide sequence matching across each elevation.
  3. Carry figure of cabinet fronts to toe kicks.
- E. Mechanically fasten back splash to countertops as recommended by laminate manufacturer at 16 inches on center.
- F. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

**2.8 SHOP FINISHING**

- A. Sand work smooth and set exposed nails and screws.
- B. For opaque finishes, apply wood filler in exposed nail and screw indentations and sand smooth.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

- A. Verify adequacy of backing and support framing.
- B. Verify location and sizes of utility rough-in associated with work of this section.

**3.2 INSTALLATION**

- A. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.
- B. Use fixture attachments in concealed locations for wall mounted components.
- C. Use concealed joint fasteners to align and secure adjoining cabinet units.
- D. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.
- E. Secure cabinets to floor using appropriate angles and anchorages.
- F. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

**3.3 ADJUSTING**

- A. Test installed work for rigidity and ability to support loads.
- B. Adjust moving or operating parts to function smoothly and correctly.

**3.4 CLEANING**

- A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

**END OF SECTION 064100**

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**SECTION 078400 - FIRESTOPPING**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Firestopping of joints and penetrations in fire-resistance-rated and smoke-resistant assemblies, whether indicated on drawings or not, and other openings indicated.

**1.2 RELATED REQUIREMENTS**

- A. Section 092116 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.

**1.3 REFERENCE STANDARDS**

- A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2013a (Reapproved 2017).
- B. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems 2015 (Reapproved 2019).
- C. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed Between Rated Wall Assemblies and Nonrated Horizontal Assemblies 2013 (Reapproved 2017).
- D. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi 2015, with Editorial Revision (2021).
- E. ITS (DIR) - Directory of Listed Products Current Edition.
- F. FM (AG) - FM Approval Guide Current Edition.
- G. UL 1479 - Standard for Fire Tests of Penetration Firestops Current Edition, Including All Revisions.
- H. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems Current Edition, Including All Revisions.
- I. UL (DIR) - Online Certifications Directory Current Edition.
- J. UL (FRD) - Fire Resistance Directory Current Edition.

**1.4 PREINSTALLATION MEETINGS**

- A. Preinstallation Conference: Conduct conference at Project Site.

**1.5 SUBMITTALS**

- A. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.
- B. Product Data: Provide data on product characteristics, performance ratings, and limitations.
- C. Installer's qualification statement.

**1.6 QUALITY ASSURANCE**

- A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
  - 1. Listing in UL (FRD) will be considered as constituting an acceptable test report.
  - 2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at [www.icc-es.org](http://www.icc-es.org) will be considered as constituting an acceptable test report.
  - 3. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.
- B. Installer Qualifications: Company specializing in performing the work of this section and:
  - 1. Trained by manufacturer.
  - 2. Verification of minimum three years documented experience installing work of this type.
  - 3. Verification of at least five satisfactorily completed projects of comparable size and type.

**1.7 FIELD CONDITIONS**

- A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.
- B. Provide ventilation in areas where solvent-cured materials are being installed.

## **PART 2 PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Firestopping Manufacturers: Subject to compliance with requirements provide products by one of the following:
  - 1. 3M Fire Protection Products: [www.3m.com/firestop](http://www.3m.com/firestop).
  - 2. A/D Fire Protection Systems Inc: [www.adfire.com](http://www.adfire.com).
  - 3. Hilti, Inc: [www.us.hilti.com](http://www.us.hilti.com).
  - 4. Specified Technologies Inc: [www.stifirestop.com](http://www.stifirestop.com).
  - 5. Tremco Commercial Sealants & Waterproofing: [www.tremcosealants.com](http://www.tremcosealants.com).
  - 6. Thermafiber, Inc.: [www.thermafiber.com](http://www.thermafiber.com).

### **2.2 MATERIALS**

- A. Firestopping Materials: Any materials meeting requirements.
- B. Mold and Mildew Resistance: Provide firestopping materials with mold and mildew resistance rating of zero(0) in accordance with ASTM G21.
- C. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.
- D. Fire Ratings: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed. Refer to drawings for fire-resistance ratings.

### **2.3 FIRESTOPPING ASSEMBLY REQUIREMENTS**

- A. Head-of-Wall (HW) Joint System Firestopping at Joints Between Fire-Rated Wall Assemblies and Non-Rated Horizontal Assemblies: Use system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of wall assembly.
  - 1. Movement: Provide systems that have been tested to show movement capability as indicated.
- B. Floor-to-Floor (FF), Floor-to-Wall (FW), Head-of-Wall (HW), and Wall-to-Wall (WW) Joints, Except Perimeter, Where Both Are Fire-Rated: Use system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.
  - 1. Movement: Provide systems that have been tested to show movement capability as indicated.
  - 2. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.
- C. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.
  - 1. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

### **2.4 FIRESTOPPING SYSTEMS**

- A. Firestopping: Penetrations in Fire-Resistance-Rated Walls.
  - 1. Fire Ratings: Use any system that is listed by UL (FRD) and tested in accordance with ASTM E814 or UL 1479 with F Rating equal to fire rating of penetrated assembly and minimum T Rating Equal to F Rating and in compliance with other specified requirements.
- B. Firestopping: Penetrations in Horizontal Assemblies.
  - 1. Fire Ratings: Use any system that is listed by UL (FRD) and tested in accordance with ASTM E814 or UL 1479 with F Rating of at least one hour, but not less than the fire rating of penetrated assembly and minimum T Rating Equal to F Rating and in compliance with other specified requirements.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify openings are ready to receive the work of this section.

**3.2 PREPARATION**

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.
- B. Remove incompatible materials that could adversely affect bond.

**3.3 INSTALLATION**

- A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
- B. Do not cover installed firestopping until inspected by authorities having jurisdiction.
- C. Install labeling required by code.

**3.4 FIELD QUALITY CONTROL**

- A. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

**3.5 CLEANING**

- A. Clean adjacent surfaces of firestopping materials.

**3.6 PROTECTION**

- A. Protect adjacent surfaces from damage by material installation.

***END OF SECTION 078400***

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**SECTION 079200 - JOINT SEALANTS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Nonsag gunnable joint sealants.
- B. Self-leveling pourable joint sealants.
- C. Joint backings and accessories.

**1.2 RELATED REQUIREMENTS**

- A. Section 092116 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.
- B. Section 093000 - Tiling: Sealant between tile and plumbing fixtures and at junctions with other materials and changes in plane.

**1.3 REFERENCE STANDARDS**

- A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer 2015 (Reapproved 2022).
- B. ASTM C834 - Standard Specification for Latex Sealants 2017 (Reapproved 2023).
- C. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications 2022.
- D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- E. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016 (Reapproved 2023).
- F. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants 2022.
- G. ASTM C1311 - Standard Specification for Solvent Release Sealants 2022.
- H. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness 2015 (Reapproved 2021).
- I. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension 2016 (Reapproved 2021).

**1.4 PREINSTALLATION MEETINGS**

- A. Preinstallation conference: Conduct conference at Project Site.

**1.5 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit manufacturer's technical datasheets for each product to be used; include the following:
  - 1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
  - 2. List of backing materials approved for use with the specific product.
  - 3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
  - 4. Substrates the product should not be used on.
  - 5. Substrates for which use of primer is required.
  - 6. Installation instructions, including precautions, limitations, and recommended backing materials and tools.
  - 7. Sample product warranty.
- C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.
- D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.
- E. Samples for Verification: Where custom sealant color is specified, obtain directions from Architect and submit at least two physical samples for verification of color of each required sealant.



**1.6 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.

**PART 2 PRODUCTS**

**2.1 MANUFACTURERS**

**2.2 JOINT SEALANT APPLICATIONS**

- A. Scope:
  - 1. Do Not Seal:
    - a. Intentional weep holes in masonry.
    - b. Joints indicated to be covered with expansion joint cover assemblies.
    - c. Joints where sealant is specified to be furnished and installed by manufacturer of product to be sealed.
    - d. Joints where sealant installation is specified in other sections.
    - e. Joints between suspended ceilings and walls.
  - B. Exterior Joints: Use non-sag non-staining silicone sealant, unless otherwise indicated.
    - 1. Control and Expansion Joints in Concrete Paving: Self-leveling polyurethane "traffic-grade" sealant.
  - C. Interior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.
    - 1. Wall and Ceiling Joints in Non-Wet Areas: Acrylic emulsion latex sealant.
    - 2. Wall and Ceiling Joints in Wet Areas: Non-sag polyurethane sealant for continuous liquid immersion.
    - 3. Floor Joints in Wet Areas: Non-sag polyurethane "non-traffic-grade" sealant suitable for continuous liquid immersion.
    - 4. Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; white.
    - 5. Narrow Control Joints in Interior Concrete Slabs: Self-leveling epoxy sealant.
    - 6. Other Floor Joints: Self-leveling polyurethane "traffic-grade" sealant.
  - D. Interior Wet Areas: Bathrooms and restrooms; fixtures in wet areas include plumbing fixtures, countertops, cabinets, and other similar items.

**2.3 JOINT SEALANTS - GENERAL**

- A. Colors: As selected by Architect from manufacturer's full range.

**2.4 NONSAG JOINT SEALANTS**

- A. Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses NT; not expected to withstand continuous water immersion or traffic.
  - 1. Movement Capability: Plus 100 percent, minus 50 percent, minimum.
  - 2. Nonstaining to Porous Stone: Nonstaining to light-colored natural stone when tested in accordance with ASTM C1248.
  - 3. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
  - 4. Color: To be selected by Architect from manufacturer's standard range.
  - 5. Cure Type: Single-component, neutral moisture curing.
  - 6. Service Temperature Range: minus 55 to 250 degrees F degrees F.
  - 7. Basis of Design Product: Subject to compliance with requirements, provide Dow Corning Corporation 790 Silicone Building Sealant or comparable product by one of the following:
    - a. Adfast USA Inc; Adseal LM 4600 Series: [www.adfastcorp.com/#sle](http://www.adfastcorp.com/#sle).
    - b. Adfast USA Inc; Adseal DWS 4580 Series: [www.adfastcorp.com/#sle](http://www.adfastcorp.com/#sle).
    - c. Dow Corning Corporation; 790 Silicone Building Sealant: [www.dowcorning.com/construction](http://www.dowcorning.com/construction).

- d. Momentive Performance Materials, Inc/GE Silicones; SCS9000 SilPruf NB - Non-Staining Silicone Weatherproofing Sealant: [www.siliconeforbuilding.com/#sle](http://www.siliconeforbuilding.com/#sle).
  - e. Pecora Corporation; <>: [www.pecora.com/#sle](http://www.pecora.com/#sle).
  - f. Sika Corporation; Sikasil WS-290: [www.usa-sika.com](http://www.usa-sika.com).
  - g. Sika Corporation; Sikasil 728NS: [www.usa.sika.com/#sle](http://www.usa.sika.com/#sle).
  - h. Tremco Commercial Sealants & Waterproofing; Spectrem 1: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
  - i. Tremco Commercial Sealants & Waterproofing; Tremsil 200: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
  - j. Substitutions: See Section 016000 - Product Requirements.
- B. Polyurethane Sealant: ASTM C920, Grade NS, Uses NT; single or multi-component; not expected to withstand continuous water immersion or traffic.
- 1. Movement Capability: Plus and minus 35 percent, minimum.
  - 2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
  - 3. Color: To be selected by Architect from manufacturer's standard range.
  - 4. Service Temperature Range: Minus 40 to 180 degrees F.
  - 5. Basis of Design Product: Subject to compliance with requirements, provide BASF Corp. - Construction Chemicals; MasterSeal NP 1 or comparable product by one of the following:
    - a. Pecora Corporation; DynaFlex: [www.pecora.com/#sle](http://www.pecora.com/#sle).
    - b. Sika Corporation; Sikaflex-1a: [www.usa.sika.com/#sle](http://www.usa.sika.com/#sle).
    - c. Sika Corporation; Sikaflex-15 LM: [www.usa.sika.com/#sle](http://www.usa.sika.com/#sle).
    - d. Sika Corporation; Sikaflex-2c NS: [www.usa.sika.com/#sle](http://www.usa.sika.com/#sle).
    - e. Tremco Commercial Sealants & Waterproofing; Dymonic 100: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
    - f. Tremco Commercial Sealants & Waterproofing; Dymeric 240 FC: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
    - g. W. R. Meadows, Inc; POURTHANE NS: [www.wrmeadows.com/#sle](http://www.wrmeadows.com/#sle).
    - h. Substitutions: See Section 016000 - Product Requirements.
- C. Polyurethane Sealant for Continuous Water Immersion: ASTM C920, Grade NS, Uses A, M, T and NT; multi-component; explicitly approved by manufacturer for continuous water immersion; suitable for traffic exposure when recessed below traffic surface .
- 1. Movement Capability: Plus and minus 25 percent, minimum.
  - 2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
  - 3. Color: To be selected by Architect from manufacturer's standard range.
  - 4. Service Temperature Range: Minus 40 to 180 degrees F.
  - 5. Basis of Design Product: Subject to compliance with requirements, provide BASF Corp. - Construction Chemicals; MasterSeal NP 2 or comparable product by one of the following:
    - a. Sika Corporation: [www.usa-sika.com](http://www.usa-sika.com).
    - b. Pecora Corporation: [www.pecora.com..](http://www.pecora.com..)
    - c. Substitutions: See Section 016000 - Product Requirements.
- D. Non-Sag "Traffic-Grade" Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion and traffic without the necessity to recess sealant below traffic surface.
- 1. Color: To be selected by Architect from manufacturer's standard range.
- E. Epoxy Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
- 1. Color: To be selected by Architect from manufacturer's standard range.
  - 2. Service Temperature Range: 40 to 120 degrees F.
  - 3. Products:

- a. Pecora Corporation; DynaPoxy EP-1200 Two-Part Epoxy Security Sealant: [www.pecora.com/#sle](http://www.pecora.com/#sle).
  - b. Substitutions: See Section 016000 - Product Requirements.
- F. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
1. Color: To be selected by Architect from manufacturer's standard range.
  2. Grade: ASTM C834; Grade 0 Degrees F (Minus 18 Degrees C).
  3. Products:
    - a. Everkem Diversified Products, Inc; EcoTex 25: [www.everkemproducts.com/#sle](http://www.everkemproducts.com/#sle).
    - b. Everkem Diversified Products, Inc; SilTex 40: [www.everkemproducts.com/#sle](http://www.everkemproducts.com/#sle).
    - c. Franklin International, Inc; Titebond GREENchoice Acoustical Smoke & Sound Sealant: [www.titebond.com/#sle](http://www.titebond.com/#sle).
    - d. Franklin International, Inc; Titebond Painter's Plus Caulk: [www.titebond.com/#sle](http://www.titebond.com/#sle).
    - e. Franklin International, Inc; Titebond Painter's Caulk: [www.titebond.com/#sle](http://www.titebond.com/#sle).
    - f. Hilti, Inc; CP 506 Smoke and Acoustical Sealant: [www.us.hilti.com/#sle](http://www.us.hilti.com/#sle).
    - g. Hilti, Inc; CP 572 Smoke and Acoustical Spray Sealant: [www.us.hilti.com/#sle](http://www.us.hilti.com/#sle).
    - h. Hilti, Inc; Lightweight Smoke and Acoustic Sealant CS-S SA Light: [www.us.hilti.com/#sle](http://www.us.hilti.com/#sle).
    - i. Master Builders Solutions; MasterSeal NP 520: [www.master-builders-solutions.com/en-us/#sle](http://www.master-builders-solutions.com/en-us/#sle).
    - j. Pecora Corporation; <>: [www.pecora.com/#sle](http://www.pecora.com/#sle).
    - k. Tremco Commercial Sealants & Waterproofing; Tremflex 834: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
    - l. Tremco Commercial Sealants & Waterproofing; Tremstop Smoke and Sound: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
    - m. Tremco Commercial Sealants & Waterproofing; Tremstop Smoke and Sound Spray: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
    - n. Substitutions: See Section 016000 - Product Requirements.
- G. Butyl Sealant: Rubber-based; ASTM C1311; single component, nonsag; not expected to withstand continuous water immersion or traffic.
1. Hardness Range: 10 to 30, Shore A, when tested in accordance with ASTM C661.
  2. Color: To be selected by Architect from manufacturer's standard range.
  3. Service Temperature Range: Minus 13 to 180 degrees F.
  4. Basis of Design Product: Subject to compliance with requirements, provide Pecora Corporation; BC-158 or comparable product by one of the following:
    - a. Bostik, Inc.: [www.bostik.com](http://www.bostik.com).

## 2.5 SELF-LEVELING JOINT SEALANTS

- A. Self-Leveling Polyurethane Sealant: ASTM C920, Grade P, Uses M and A; single or multi-component; explicitly approved by manufacturer for traffic exposure; not expected to withstand continuous water immersion .
1. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
  2. Color: To be selected by Architect from manufacturer's standard range.
  3. Service Temperature Range: Minus 40 to 180 degrees F.
  4. Products:
    - a. Pecora Corporation; <>: [www.pecora.com/#sle](http://www.pecora.com/#sle).
    - b. Sika Corporation; Sikaflex-1c SL: [www.usa.sika.com/#sle](http://www.usa.sika.com/#sle).
    - c. Sika Corporation; Sikaflex-2c SL: [www.usa.sika.com/#sle](http://www.usa.sika.com/#sle).
    - d. Substitutions: See Section 016000 - Product Requirements.
- B. Self-Leveling Polyurethane Sealant for Horizontal Expansion Joints: ASTM C920, Grade P, Uses T, M and O; multi-component; explicitly approved by manufacturer for horizontal

expansion joints.

1. Movement Capability: Plus and minus 25 percent, minimum.
  2. Hardness Range: 30 to 35, Shore A, when tested in accordance with ASTM C661.
  3. Color: To be selected by Architect from manufacturer's standard range.
  4. Tensile Strength: 200 to 250 psi in accordance with ASTM D412.
  5. Products:
    - a. Pecora Corporation; DynaTrol II-SG (Slope Grade): [www.pecora.com/#sle](http://www.pecora.com/#sle).
    - b. Pecora Corporation; Urexpan NR-200: [www.pecora.com/#sle](http://www.pecora.com/#sle).
    - c. Tremco Commercial Sealants & Waterproofing; THC-901: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
    - d. Substitutions: See Section 016000 - Product Requirements.
- C. Flexible Polyurethane Foam: Single-component, gun grade, and low-expanding.
1. Products:
    - a. ADFAST Corporation; Adfoam Flex 1865: [www.adfastcorp.com/#sle](http://www.adfastcorp.com/#sle).
    - b. Adfast USA Inc; Adfoam Flex 1865: [www.adfastcorp.com/#sle](http://www.adfastcorp.com/#sle).
    - c. DAP Products Inc; DRAFTSTOP 812 Foam: [www.dapspecline.com/#sle](http://www.dapspecline.com/#sle).
    - d. Tremco Commercial Sealants & Waterproofing; ExoAir Flex Foam: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
    - e. Tremco Commercial Sealants & Waterproofing; ExoAir LEF: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
    - f. Substitutions: See Section 016000 - Product Requirements.
- D. Semi-Rigid Self-Leveling Epoxy Joint Filler: Epoxy or epoxy/polyurethane copolymer; intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.
1. Composition: Multicomponent, 100 percent solids by weight.
  2. Durometer Hardness: Minimum of 85 for Type A or 35 for Type D, after seven days when tested in accordance with ASTM D2240.
  3. Color: To be selected by Architect from manufacturer's standard colors.
  4. Joint Width, Minimum: 1/8 inch.
  5. Joint Width, Maximum: 1/4 inch.
  6. Joint Depth: Provide product suitable for joints from 1/8 inch to 2 inches in depth including space for backer rod.
  7. Products:
    - a. Euclid Chemical Company; EUCO 700: [www.euclidchemical.com/#sle](http://www.euclidchemical.com/#sle).
    - b. Nox-Crete Inc; DynaFlex 502: [www.nox-crete.com/#sle](http://www.nox-crete.com/#sle).
    - c. W.R. Meadows, Inc; Rezi-Weld Flex: [www.wrmeadows.com/#sle](http://www.wrmeadows.com/#sle).
    - d. Substitutions: See Section 016000 - Product Requirements.

## 2.6 ACCESSORIES

- A. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
- B. Masking Tape: Self-adhesive, nonabsorbent, nonstaining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.
- C. Joint Cleaner: Noncorrosive and nonstaining type, type recommended by sealant manufacturer; compatible with joint forming materials.
- D. Primers: Type recommended by sealant manufacturer to suit application; nonstaining.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that joints are ready to receive work.
- B. Verify that backing materials are compatible with sealants.
- C. Verify that backer rods are of the correct size.

**3.2 PREPARATION**

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.
- E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in an inconspicuous area to verify that it does not stain or discolor slab.

**3.3 INSTALLATION**

- A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Provide joint sealant installations complying with ASTM C1193.
- C. Install acoustical sealant application work in accordance with ASTM C919.
- D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.
- E. Install bond breaker backing tape where backer rod cannot be used.
- F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- G. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
- H. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.
- I. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

**END OF SECTION 079200**

**SECTION 080671 - DOOR HARDWARE SCHEDULE**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Preliminary schedule of door hardware sets for swinging and other door types as indicated on drawings.

**1.2 RELATED REQUIREMENTS**

- A. Section 087100 - Door Hardware: Requirements to comply with in coordination with this section.

**1.3 REFERENCE STANDARDS**

- A. BHMA (CPD) - Certified Products Directory Current Edition.
- B. BHMA A156.3 - Exit Devices 2020.
- C. BHMA A156.5 - Cylinders and Input Devices for Locks 2020.
- D. BHMA A156.13 - Mortise Locks & Latches Series 1000 2022.
- E. BHMA A156.18 - Materials and Finishes 2020.
- F. DHI (H&S) - Sequence and Format for the Hardware Schedule 2019.

**1.4 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Comply with submittal requirements as indicated in Section 087100.

**PART 2 PRODUCTS**

**2.1 MANUFACTURERS**

- A. Only manufacturers listed in Door Hardware Schedule or Section 087100 are considered acceptable, unless noted otherwise.
- B. Obtain each type of door hardware as indicated from a single manufacturer and single supplier.
- C. Products are listed and certified compliant with specified standards by BHMA (CPD).
- D. Manufacturer's Abbreviations: Coordinate with manufacturers listed in Section 087100.
  - 1. AR - Adams Rite.
  - 2. BAS - Best Access Systems.
  - 3. BOM - Bommer Industries.
  - 4. CR - Corbin Russwin.
  - 5. CUR - Curries.
  - 6. DTX - Detex.
  - 7. DMA - Dorma.
  - 8. FC - Falcon.
  - 9. FOR - Forms+Surfaces.
  - 10. GJ - Glynn Johnson.
  - 11. HGR - Hager.
  - 12. HES - HES.
  - 13. HG - Hettich Grant.
  - 14. HIA - Hiawatha.
  - 15. IVE - Ives.
  - 16. JOH - Johnson Hardware.
  - 17. KNX - Knox Company.
  - 18. LCN - LCN.
  - 19. McK - McKinney.
  - 20. MED - Medeco.
  - 21. MKR - Markar.
  - 22. NGP - National Guard Products.
  - 23. NOR - Norton.
  - 24. PEM - Pemko.
  - 25. PH - Precision Hardware.

26. RIX - Rixson.
27. ROC - Rockwood.
28. SA - Sargent.
29. SCH - Schlage.
30. SEC - Securitron.
31. SDC - Stanley Door Closers.
32. SH - Stanley Hinges.
33. STH - Stanley Commercial Hardware.
34. TR - Trimco.
35. VD - Von Duprin.
36. YA - Yale.
37. ZRO - Zero Industries, Inc.

## **2.2 DESCRIPTION**

- A. Door hardware sets provided represent the design intent, they are only a guideline and should not be considered a detailed or complete hardware schedule.
1. Provide door hardware item(s) as required for similar purposes, even when item is not listed for a door in Door Hardware Schedule.
  2. Necessary items that are not included in a Hardware Set should be added and have the appropriate additional hardware as required for proper application and functionality.
  3. Door hardware supplier is responsible for providing proper size and hand of door for products required in accordance with Door Hardware Schedule and as indicated on drawings.
  4. Quantities listed are for each Pair (PR) of doors, or for each Single (SGL) door, as indicated in hardware sets.

## **2.3 LOCK FUNCTION CODES**

- A. Function Codes for Cylindrical Locks: Complying with BHMA A156.5.
1. Code F75; Passage: Latch retracted by knobs/levers at all times.
  2. Code F76; Privacy Lock: Outside knob/lever locked by pushbutton on inside knob/lever. Rotating inside knob/lever or closing door releases/unlocks button. Emergency release in outside knob/lever.
  3. Code F81; Office Lock: Turn button locking. Turning button on inside locks outside knob/lever until unlocked by key or by rotating the inside knob/lever. Inside knob/lever always free. Deadlocking latch bolt.
  4. Code F82; Entry Lock: Push button locking. Button on inside locks outside knob/lever until unlocked by key or by rotating the inside knob/lever. Inside knob/lever always free. Deadlocking latch bolt.
  5. Code F84; Classroom Lock: Outside knob/lever locked/unlocked by key in outside knob/lever. Inside knob/lever always free. Deadlocking latchbolt.
  6. Code F86; Storeroom Lock: Outside knob/lever always locked/rigid. Latchbolt retracted by key in outside knob/lever or by rotating inside knob/lever. Inside knob/lever always free. Deadlocking latchbolt.
  7. Code F90; Dormitory Lock: Deadlocking latch bolt by levers except when locked by push button in inside lever. Key in outside lever locks or unlocks outside lever and releases button. Closing door releases push button. Inside lever always free.
- B. Function Codes for Mortise Locks: Complying with BHMA A156.13.
1. Code F01; Passage/Closet Latchset: Latch bolt by knobs at all times.
  2. Code F02; Privacy Lock: Latch bolt by knobs, deadbolt by turn inside or emergency key outside.
  3. Code F04; Entry/Office Lock: Deadlocking latch bolt by knobs except when outside knob is locked by buttons in face (edge), then by key outside.

4. Code F05; Classroom Lock: Deadlocking latch bolt by knobs. Outside knob locked by key outside. Inside knob always free.
  5. Code F07; Storeroom/Exit Lock: Deadlocking latch bolt by inside knob or key outside. Outside knob rigid.
  6. Code F08; Front Door Lock: Latch bolt is operated by knob from either side except when outside knob is made inoperative by a stop or mechanical means other than key. Deadbolt is operated by turn inside. Key outside operates both locks.
  7. Codes F10, F12, and F20; Entry/Office Lock: Latch bolt by knobs except when outside knob is made inoperative by buttons in face. Deadbolt by key outside and turn inside. Rotating inside knob retracts both bolts. Deadlocking latch.
  8. Code F13; Dormitory Lock: Latch bolt by knobs except when outside knob is locked by projecting deadbolt. Key outside retracts deadbolt and unlocks outside knob. Rotating inside knob retracts both bolts.
- C. Function Codes for Exit Devices: Complying with BHMA A156.3.
1. Code 01; Exit Device: Exit only/no trim.
  2. Code 02; Exit Device: Entrance by pull/trim when actuating bar is locked down (Dogged-Down). Note-Fire Exit devices cannot be locked down.
  3. Code 03; Exit Device: Entrance by trim when latchbolt is retracted by key (pullside). Unit is locked when the key is removed.
  4. Code 04; Exit Device: Entrance by trim when latchbolt is retracted by key (pullside) or set in a retracted position by key.
  5. Code 05; Exit Device: Entrance by thumbpiece. Key (pullside) locks/unlocks thumbpiece.
  6. Code 06; Exit Device: Entrance by thumbpiece only when released by key (pullside). Unit is locked when the key is removed.
  7. Code 07; Exit Device: Entrance by thumbpiece. Inside key (on pushside/on active device case) locks/unlocks thumbpiece. Outside key (pullside) retracts latch.
  8. Code 08; Exit Device: Entrance by knob/lever. Key (pullside) locks/unlocks knob/lever.
  9. Code 09; Exit Device: Entrance by knob/lever with key (pullside) only. Unit is locked when the key is removed.
  10. Code 10; Exit Device: Entrance by knob/lever. Inside key (pushside) locks/unlocks knob/lever. Outside key (pullside) only retracts latch.
  11. Code 11; Exit Device: Entrance by auxiliary control turnpiece. Key (pullside) locks/unlocks auxiliary control.
  12. Code 12 ; Exit Device: Entrance by auxiliary control turnpiece only when released by turning key (pullside). Unit is locked when the key is removed.

## 2.4 FINISHES

- A. Finishes: Complying with BHMA A156.18.
1. Code 604: Zinc plated and dichromate sealed, with steel base material.
  2. Code 626: Satin chromium plated over nickel, with brass or bronze base material (former US equivalent US26D).
  3. Code 630: Satin stainless steel, with stainless steel 300 series base material (former US equivalent US32D).
  4. Code 652: Satin chromium plated over nickel, with steel base material (former US equivalent US26D).
  5. Code 689: Aluminum painted, with any base material (former US equivalent US28).

## PART 3 EXECUTION

### 3.1 DOOR HARDWARE SCHEDULE

- A. Organize listing of door hardware components within each hardware set in compliance with 10-Part scheduling sequence indicated in DHI (H&S), unless otherwise indicated.



**3.2 HARDWARE SET # 01: "PUBLIC RESTROOMS"**

A. Provide for each Single (SGL) door(s).

UNITS	ITEM	MODEL	FINISH	MFR
3	HEAVY DUTY HINGES	5-BB-1-HW-4.5x4.5	626	IVE
1	PUSH PLATE	8200	626	IVE
1	PULL BAR WITH PLATE	8302	626	IVE
1	WALL STOP	WS11	626	IVE
1	KICK PLATE	8400-10"x2"LDW	US32D	IVE
1	SURFACE-MOUNTED CLOSER	4011	626	LCN
3	SILENCER	SR64	GRAY	IVE

**3.3 HARDWARE SET # 02: "1ST FLOOR JANITOR/STORAGE"**

A. Provide for each Single (SGL) door(s).

UNITS	ITEM	MODEL	FINISH	MFR
3	HEAVY DUTY HINGES	5-BB-1-HW-4.5x4.5	626	IVES
1	CYLINDRICAL LOCK	ND80PD-BDC-RHO	626	SCH
1	CORE	SFIC		BAS
1	OVERHEAD STOP	70-40S	US26D	GJ
2	KICK PLATES	8400-10"x2"LDW	US32D	IVES
1	SURFACE-MOUNTED CLOSER	4011	626	LCN
3	SILENCER	SR64	GRAY	IVE

B. Keying to match owner's existing A3 key system. Provide disposable construction core..

**3.4 HARDWARE SET # 03: "2ND FLOOR JANITOR/STORAGE"**

A. Provide for each Single (SGL) door(s).

UNITS	ITEM	MODEL	FINISH	MFR
3	HEAVY DURY HINGES	5-BB-1-HW-4.5x4.5	626	IVE
1	CYOINDRICAL LOCK	ND80PD-BDC-RHO	626	SCH
1	CORE	SFIC		BAS
1	FLOOR STOP	FS13	GRAY	IVE
2	KICK PLATES	8400-10"x2"LDW	US32D	IVE
1	SURFACE-MOUNTED CLOSER	4011	626	LCN
3	SILENCER	SR64	GRAY	IVE

B. Keying to match owner's existing A3 key system. Provide disposable construction core..

**3.5 HARDWARE SET # 04: "ELEVATOR MACHINE ROOM"**

A. Provide for each Single (SGL) door(s).

UNITS	ITEM	MODEL	FINISH	MFR
3	HEAVY DUTY HINGES	5-BB-1-HW-4.5x4.5	626	IVE
1	CYLINDRICAL LOCK	ND80PD-BDC-RHO	626	SCH
1	CORE	SFIC		BAS
1	WALL STOP	WS11	626	IVE
2	KICK PLATES	8400-10"x2"LDW	US32D	IVE
1	SURFACE-MOUNTED CLOSER	4011	626	LCN
1	GASKET	488A	BK	ZRO

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22-703A

3	SILENCER	SR64	GRAY	
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B. Keying to match owner's existing A3 key system. Provide disposable construction core..  
**END OF SECTION 080671**

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**SECTION 081113 - HOLLOW METAL DOORS AND FRAMES**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Non-fire-rated hollow metal doors and frames.
- B. Hollow metal frames for wood doors.
- C. Fire-rated hollow metal doors and frames.

**1.2 RELATED REQUIREMENTS**

- A. Section 087100 - Door Hardware.
- B. Section 099123 - Interior Painting: Field painting.

**1.3 COORDINATION**

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.
- B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

**1.4 PREINSTALLATION MEETINGS**

- A. Preinstallation Conference: Conduct conference at Project site.

**1.5 ABBREVIATIONS AND ACRONYMS**

- A. ANSI: American National Standards Institute.
- B. ASCE: American Society of Civil Engineers.
- C. HMMA: Hollow Metal Manufacturers Association.
- D. NAAMM: National Association of Architectural Metal Manufacturers.
- E. NFPA: National Fire Protection Association.
- F. SDI: Steel Door Institute.
- G. UL: Underwriters Laboratories.

**1.6 REFERENCE STANDARDS**

- A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors 2022.
- C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100) 2017.
- D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames 2020.
- E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2023.
- F. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable 2021a.
- G. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2018a.
- H. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete 2020.
- I. ASTM C476 - Standard Specification for Grout for Masonry 2023.
- J. BHMA A156.115 - Hardware Preparation in Steel Doors and Frames 2016.
- K. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.
- L. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames 2002.
- M. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames 2011.
- N. NAAMM HMMA 840 - Guide Specifications For Receipt, Storage and Installation of Hollow Metal Doors and Frames 2017.
- O. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2022.
- P. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies 2022.

- Q. UL (DIR) - Online Certifications Directory Current Edition.
- R. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies Current Edition, Including All Revisions.

**1.7 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.
- C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.
- D. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on the Drawings. Coordinate with final door hardware schedule.

**1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project site storage. Do not use nonvented plastic.
  - 1. Provide additional protection to prevent damage to factory-finished units.
- B. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- C. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.
- D. Deliver welded frames with two removeable spreader bars across the bottom of frames, tack welded to jambs and mullions.
- E. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

**PART 2 PRODUCTS**

**2.1 MANUFACTURERS**

- A. Hollow Metal Doors and Frames: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Republic Doors, an Allegion brand: [www.republicdoor.com/#sle](http://www.republicdoor.com/#sle).
  - 2. Steelcraft, an Allegion brand: [www.allegion.com/#sle](http://www.allegion.com/#sle).

**2.2 PERFORMANCE REQUIREMENTS**

- A. Requirements for Hollow Metal Doors and Frames:
- B. Steel Sheet: Comply with one or more of the following requirements; galvanized steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
- C. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- D. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.
- E. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ATM E 136 for combustion characteristics.
- F. Accessibility: Comply with ICC A117.1 and ADA Standards.
- G. Fire-Rated Assemblies: Comply with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
- H. Door Edge Profile: Manufacturers standard for application indicated.

- I. Typical Door Face Sheets: Flush.
- J. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Mitered hairline joints.
  - 1. Provide stops and moldings flush with face of door, and with beveled stops unless otherwise indicated.
- K. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- L. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than 0.38 deg Btu/F x h x sq. ft. when tested according to ASTM C 518.
- M. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- N. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

**2.3 HOLLOW METAL DOORS**

- A. Door Finish: Factory primed and field finished.
- B. Interior Doors, Non-Fire Rated:
  - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    - a. Level 2 - Heavy-duty.
    - b. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
    - c. Model 1 - Full Flush.
    - d. Door Face Metal Thickness: 20 gauge, 0.032 inch, minimum.
  - 2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
  - 3. Door Thickness: 1-3/4 inches, nominal.
  - 4. Door Face Sheets: Flush.
  - 5. Door Type & Finish: As indicated in Door and Frame Schedule.
- C. Fire-Rated Doors:
  - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    - a. Level 2 - Heavy-duty.
    - b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
    - c. Model 1 - Full Flush.
    - d. Door Face Metal Thickness: 20 gauge, 0.032 inch, minimum.
  - 2. Fire Rating: As indicated on drawings, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
  - 3. Provide units listed and labeled by UL (DIR).
    - a. Attach fire rating label to each fire rated unit.
  - 4. Door Core Material: Manufacturers standard core material/construction in compliance with requirements.
  - 5. Door Thickness: 1-3/4 inches, nominal.
  - 6. Door Face Sheets: Flush.
  - 7. Door Type & Finish: As indicated in Door and Frame Schedule.

## 2.4 HOLLOW METAL FRAMES

- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
- B. Frame Finish: Factory primed and field finished indicated in Drawings.
- C. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
  - 1. Frame Metal Thickness: 16 gage, 0.053 inch, minimum.
- D. Door Frames, Fire-Rated: Full profile/continuously welded type.
  - 1. Fire Rating: Same as door, labeled.
  - 2. Frame Metal Thickness: 16 gage, 0.053 inch, minimum.
- E. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.
- F. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.
- G. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches high to fill opening without cutting masonry units.

## 2.5 FRAME ANCHORS

- A. Frame Anchors: ASTM A879/A 879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
  - 1. For anchors built into exterior walls, steel sheet comply with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M; hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- B. Jamb Anchors:
  - 1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
  - 2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24-inches of frame height above 7-feet.
  - 3. Post-installed Expansion Anchor: Minimum 3/8-inch diameter bolts with expansion shield or inserts, with manufacturer's standard pipe spacer.
- C. Floor Anchors: Provide floor anchors for each jamb and mullion that extend to floor.

## 2.6 FINISHES

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

## 2.7 ACCESSORIES

- A. Grout for Frames: Mortar grout complying with ASTM C476 with maximum slump of 4 inches as measured in accordance with ASTM C143/C143M for hand troweling in place; plaster grout and thinner pumpable grout are prohibited.
- B. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.
- C. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.

### 3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restor exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.
- B. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.
- C. Drill and tap doors and frames to receive mortised and surface-mounted door hardware.

**3.3 INSTALLATION**

- A. Install doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
- B. Install fire rated units in accordance with NFPA 80.
- C. Coordinate frame anchor placement with wall construction.
- D. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.
- E. Install door hardware as specified in Section 087100.
- F. Comply with glazing installation requirements of Section 088000.
- G. Coordinate installation of electrical connections to electrical hardware items.
- H. Touch up damaged factory finishes.

**3.4 TOLERANCES**

- A. Hollow-Metal Frames:
  - 1. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.
  - 2. Squareness: Plus or minus 1/16-inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
  - 3. Alignment: Plus or minus 1/16-inch, measured at jambs on a horizontal line parallel to plane of wall.
  - 4. Plumbness: Plus or minus 1/16-inch, measured at jambs at floor.
- B. Hollow-Metal Doors:
  - 1. Non-Fire-Rated Steel Doors: Comply with SDI A250.8 or NAAMM-HMMA 841 and NAAMM-HMMA guide specification indicated.
  - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

**3.5 ADJUSTING**

- A. Adjust for smooth and balanced door movement.

**3.6 CLEANING AND TOUCH-UP**

- A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- B. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

**END OF SECTION 081113**



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**SECTION 081416 - FLUSH WOOD DOORS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Flush wood doors; flush configuration; fire-rated and non-rated.

**1.2 RELATED REQUIREMENTS**

- A. Section 081113 - Hollow Metal Doors and Frames.
- B. Section 087100 - Door Hardware.

**1.3 REFERENCE STANDARDS**

- A. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2022.
- B. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies Current Edition, Including All Revisions.
- C. WDMA I.S. 1A - Interior Architectural Wood Flush Doors 2021, with Errata (2022).

**1.4 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
- C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
- D. Samples: For factory-finished veneers.
- E. Warranty, executed in Owner's name.

**1.5 CLOSEOUT SUBMITTALS**

- A. Owner's Manual and Maintenance Data.
- B. Manufacturer's Warranty Form.

**1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Package, deliver and store doors in accordance with specified quality standard.
- B. Accept doors on site in manufacturer's packaging, and inspect for damage.
- C. Protect doors with resilient packaging sealed with heat shrunk plastic; do not store in damp or wet areas or areas where sunlight might bleach veneer; seal top and bottom edges with tinted sealer if stored more than one week, and break seal on site to permit ventilation.
- D. Environmental Limitations: 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 ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

**1.7 WARRANTY**

**PART 2 PRODUCTS**

**2.1 MANUFACTURERS**

- A. Subject to compliance with requirements, provide product indicated in Drawings; or a comparable product by one of the following:
  - 1. Marshfield DoorSystems, Inc
  - 2. VT Industries.
  - 3. OshKosh Door Company.
  - 4. Substitutions: See Section 016000 - Product Requirements.

**2.2 DOORS**

- A. Doors: See drawings for locations and additional requirements.
  - 1. Quality Standard: Custom Grade, Heavy Duty performance, in accordance with WDMA I.S. 1A.
  - 2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.
- B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
  - 1. Provide solid core doors at each location.

2. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with UL 10C - Positive Pressure; Underwriters Laboratories Inc (UL) labeled without any visible seals when door is closed.
3. Wood veneer facing with factory transparent finish as indicated on drawings.

### 2.3 DOOR CORES

- A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.
- B. Fire-Rated Doors: Mineral core type, with fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

### 2.4 DOOR FACINGS

- A. Veneer Facing for Transparent Finish: As indicated in Drawings, HPVA Grade A, plain sliced (flat cut), with book match between leaves of veneer, balance match of spliced veneer leaves assembled on door or panel face; unless otherwise indicated.
  1. "Pair Match" each pair of doors; "Set Match" pairs of doors within 10 feet of each other when doors are closed.
  2. Transoms: Continuous match to doors.

### 2.5 DOOR CONSTRUCTION

- A. Fabricate doors in accordance with door quality standard specified.
- B. Glazed Openings: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
- C. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- D. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
- E. Provide edge clearances in accordance with the quality standard specified.

### 2.6 FINISHES - WOOD VENEER DOORS

- A. Finish work in accordance with WDMA I.S. 1A for grade specified and as follows:
  1. Transparent:
    - a. System - TR-6, Catalyzed Polyurethane.
    - b. Stain: As indicated on Drawings.
    - c. Sheen: Satin.
    - d. Grade: Premium.
    - e. Effect: Open-grain finish.
- B. Factory finish doors in accordance with approved sample.

### 2.7 ACCESSORIES

- A. Hollow Metal Door Frames: See Section 081113.
- B. Door Hardware: See Section 087100.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.
- D. 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.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions and specified quality standard.
  1. Install fire-rated doors in accordance with NFPA 80 requirements.

- B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
- C. Use machine tools to cut or drill for hardware.
- D. Coordinate installation of doors with installation of frames and hardware.

**3.3 TOLERANCES**

- A. Comply with specified quality standard for fit and clearance tolerances.
- B. Comply with specified quality standard for telegraphing, warp, and squareness.

**3.4 ADJUSTING**

- A. Adjust doors for smooth and balanced door movement.
- B. Adjust closers for full closure.
- C. 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 081416**

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**SECTION 087100 - DOOR HARDWARE**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Hardware for wood and hollow metal doors.
- B. Weatherstripping and gasketing.

**1.2 RELATED REQUIREMENTS**

- A. Section 079200 - Joint Sealants: Sealants for setting exterior door thresholds.
- B. Section 080671 - Door Hardware Schedule: Schedule of door hardware sets.
- C. Section 081113 - Hollow Metal Doors and Frames.
- D. Section 081416 - Flush Wood Doors.

**1.3 REFERENCE STANDARDS**

- A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- B. BHMA (CPD) - Certified Products Directory Current Edition.
- C. BHMA A156.1 - Standard for Butts and Hinges 2021.
- D. BHMA A156.2 - Bored and Preassembled Locks and Latches 2022.
- E. BHMA A156.4 - Door Controls - Closers 2019.
- F. BHMA A156.5 - Cylinders and Input Devices for Locks 2020.
- G. BHMA A156.6 - Standard for Architectural Door Trim 2021.
- H. BHMA A156.7 - Template Hinge Dimensions 2016.
- I. BHMA A156.8 - Door Controls - Overhead Stops and Holders 2021.
- J. BHMA A156.16 - Auxiliary Hardware 2018.
- K. BHMA A156.18 - Materials and Finishes 2020.
- L. BHMA A156.20 - Standard for Strap and Tee Hinges, and Hasps 2021.
- M. BHMA A156.22 - Standard for Gasketing 2021.
- N. BHMA A156.26 - Standard for Continuous Hinges 2021.
- O. BHMA A156.115 - Hardware Preparation in Steel Doors and Frames 2016.
- P. BHMA A156.115W - Hardware Preparation in Wood Doors with Wood or Steel Frames 2006.
- Q. DHI (H&S) - Sequence and Format for the Hardware Schedule 2019.
- R. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames 2004.
- S. DHI WDHS.3 - Recommended Locations for Architectural Hardware for Flush Wood Doors 1993; also in WDHS-1/WDHS-5 Series, 1996.
- T. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.
- U. ITS (DIR) - Directory of Listed Products Current Edition.
- V. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- W. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2022.
- X. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- Y. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives 2022.
- Z. UL (DIR) - Online Certifications Directory Current Edition.

**1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.
- B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.
- C. Preinstallation Meeting: Convene a preinstallation meeting one week prior to commencing work of this section; attendance is required by affected installers and the following:
  - 1. Hardware Installer.

- D. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.
- E. Keying Requirements Meeting:
  - 1. Schedule meeting at project site prior to Contractor occupancy.
  - 2. Attendance Required:
    - a. Contractor.
    - b. Owner.
    - c. Architect.
    - d. Hardware Installer.
    - e. Owner's Security Consultant.
  - 3. Agenda:
    - a. Establish keying requirements.
    - b. Verify locksets and locking hardware are functionally correct for project requirements.
    - c. Verify that keying and programming complies with project requirements.
    - d. Establish keying submittal schedule and update requirements.
  - 4. Incorporate "Keying Requirements Meeting" decisions into keying submittal upon review of door hardware keying system including, but not limited to, the following:
    - a. Access control requirements.
    - b. Key control system requirements.
    - c. Schematic diagram of preliminary key system.
    - d. Flow of traffic and extent of security required.
  - 5. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.
  - 6. Deliver established keying requirements to manufacturers.

#### 1.5 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.
- C. Shop Drawings - Door Hardware Schedule: Submit detailed listing that includes each item of hardware to be installed on each door. Use door numbering scheme as included in Contract Documents.
  - 1. Prepared by or under supervision of Architectural Hardware Consultant (AHC).
  - 2. Comply with DHI (H&S) using door numbers and hardware set numbers as indicated in construction documents.
    - a. Submit in vertical format; see Section 08 0671.
  - 3. List groups and suffixes in proper sequence.
  - 4. Provide complete description for each door listed.
  - 5. Provide manufacturer name, product names, and catalog numbers; include functions, types, styles, sizes and finishes of each item.
  - 6. Include account of abbreviations and symbols used in schedule.
- D. Shop Drawings - Electrified Door Hardware: Submit diagrams for power, signal, and control wiring for electrified door hardware that include details of interface with building safety and security systems. Provide elevations and diagrams for each electrified door opening as follows:
  - 1. Prepared by or under supervision of Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC).
  - 2. Elevations: Submit front and back elevations of each door opening showing electrified devices with connections installed and an operations narrative describing how opening operates from either side at any given time.

3. Diagrams: Submit point-to-point wiring diagram that shows each device in door opening system with related colored wire connections to each device.
- E. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
- F. Keying Schedule:
  1. Submit three (3) copies of Keying Schedule in compliance with requirements established during Keying Requirements Meeting unless otherwise indicated.
- G. Project Record Documents: Record actual locations of concealed equipment, services, and conduit.
- H. Maintenance Materials and Tools: Furnish the following for Owner's use in maintenance of project.
  1. See Section 016000 - Product Requirements, for additional provisions.
  2. Lock Cylinders: Ten for each master keyed group.
  3. Tools: One set of each special wrench or tool applicable for each different or special hardware component, whether supplied by hardware component manufacturer or not.

**1.6 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified for commercial door hardware with at least three years of documented experience and approved by manufacturer.
- C. Supplier Qualifications: Company with certified Architectural Hardware Consultant (AHC) to assist in work of this section.

**1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.

**1.8 WARRANTY**

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer's Warranty: Provide warranty against defects in material and workmanship for period indicated. Complete forms in Owner's name and register with manufacturer.
  1. Closers: Five years, minimum.
  2. Exit Devices: Three years, minimum.
  3. Locksets and Cylinders: Three years, minimum.
  4. Other Hardware: Two years, minimum.

**PART 2 PRODUCTS**

**2.1 DESIGN AND PERFORMANCE CRITERIA**

- A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.
- B. Provide individual items of single type, of same model, and by same manufacturer.
- C. Provide door hardware products that comply with the following requirements:
  1. Applicable provisions of federal, state, and local codes.
  2. Accessibility: ADA Standards and ICC A117.1.
  3. Applicable provisions of NFPA 101.
  4. Hardware on Fire-Rated Doors: Listed and classified by UL (DIR), ITS (DIR), or testing firm acceptable to authorities having jurisdiction as suitable for application indicated.
  5. Listed and certified compliant with specified standards by BHMA (CPD).
  6. Auxiliary Hardware: BHMA A156.16.
  7. Straps and Tee Hinges: BHMA A156.20.
  8. Hardware Preparation for Steel Doors and Steel Frames: BHMA A156.115.
  9. Hardware Preparation for Wood Doors with Wood or Steel Frames: BHMA A156.115W.



10. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified.
- D. Electrically Operated and/or Controlled Hardware: Provide necessary power supplies, power transfer hinges, relays, and interfaces as required for proper operation; provide wiring between hardware and control components and to building power connection in compliance with NFPA 70.
- E. Lock Function: Provide lock and latch function numbers and descriptions of manufacturer's series. See Door Hardware Schedule.
- F. Fasteners:
  1. Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications.
    - a. Aluminum fasteners are not permitted.
    - b. Provide phillips flat-head screws with heads finished to match door surface hardware unless otherwise indicated.
  2. Provide machine screws for attachment to reinforced hollow metal and aluminum frames.
    - a. Self-drilling (Tek) type screws are not permitted.
  3. Provide stainless steel machine screws and lead expansion shields for concrete and masonry substrates.
  4. Provide wall grip inserts for hollow wall construction.
  5. Provide spacers or sex bolts with sleeves for through bolting of hollow metal doors and frames.
  6. Fire-Rated Applications: Comply with NFPA 80.
    - a. Provide wood or machine screws for hinges mortised to doors or frames, strike plates to frames, and closers to doors and frames.
    - b. Provide steel through bolts for attachment of surface mounted closers, hinges, or exit devices to door panels unless proper door blocking is provided.
  7. Concealed Fasteners: Do not use through or sex bolt type fasteners on door panel sides indicated as concealed fastener locations, unless otherwise indicated.

## **2.2 HINGES**

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
  1. McKinney; an Assa Abloy Group company; <>: [www.assaabloydss.com](http://www.assaabloydss.com).
  2. Bommer Industries, Inc; <>: [www.bommer.com](http://www.bommer.com).
  3. Hager Companies; <>: [www.hagerco.com/#sle](http://www.hagerco.com/#sle).
  4. Stanley, dormakaba Group; <>: [www.stanleyhardwarefordoors.com/#sle](http://www.stanleyhardwarefordoors.com/#sle).
  5. Ives; an Allegion brand; [www.allegion.com/us](http://www.allegion.com/us).
  6. Substitutions: See Section 016000 - Product Requirements.
- B. Hinges: Comply with BHMA A156.1, Grade 1.
  1. Butt Hinges: Comply with BHMA A156.1 and BHMA A156.7 for templated hinges.
    - a. Provide hinge width required to clear surrounding trim.
  2. Continuous Hinges: Comply with BHMA A156.26.
  3. Provide hinges on every swinging door.
  4. Provide five-knuckle full mortise butt hinges unless otherwise indicated.
  5. Provide ball-bearing hinges at each door with closer.
  6. Provide non-removable pins on exterior outswinging doors.
  7. Provide non-removable pins on interior outswinging doors at locations as indicated.
  8. Provide power transfer hinges where electrified hardware is mounted in door leaf.
  9. Provide following quantity of butt hinges for each door:
    - a. Doors up to 60 inches High: Two hinges.
    - b. Doors From 60 inches High up to 90 inches High: Three hinges.

- c. Doors 90 inches High up to 120 inches High: Four hinges.
- d. Doors over 120 inches High: One additional hinge per each additional 30 inches in height.
- e. Dutch Doors: Two hinges each leaf.

### 2.3 LOCK CYLINDERS

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
  - 1. Best, dormakaba Group; <>: [www.bestaccess.com/#sle](http://www.bestaccess.com/#sle).
  - 2. Schlage; an Allegion brand; [www.allegion.com/us..](http://www.allegion.com/us..)
  - 3. Substitutions: See Section 016000 - Product Requirements.
- B. Lock Cylinders: Provide key access on outside of each lock, unless otherwise indicated.
  - 1. Provide standard, conventional, and small format interchangeable core (SFIC) type cylinders, Grade 1, with six-pin core in compliance with BHMA A156.5 at locations indicated.
  - 2. Provide cylinders from same manufacturer as locking device.
  - 3. Provide cams and/or tailpieces as required for locking devices.

### 2.4 CYLINDRICAL LOCKS

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
  - 1. Best, dormakaba Group: [www.bestaccess.com/#sle](http://www.bestaccess.com/#sle).
  - 2. Falcon, an Allegion brand; [www.allegion.com/us](http://www.allegion.com/us).
  - 3. Substitutions: See Section 016000 - Product Requirements.
- B. Cylindrical Locks (Bored): Comply with BHMA A156.2, Grade 1, 4000 Series.
  - 1. Bored Hole: 2-1/8 inch diameter.
  - 2. Latchbolt Throw: 1/2 inch, minimum.
  - 3. Backset: 2-3/4 inch unless otherwise indicated.
  - 4. Strikes: Provide manufacturer's standard strike for each latchset or lockset with strike box and curved lip extending to protect frame in compliance with indicated requirements.
    - a. Finish: To match lock or latch.
    - b. Flat-Lip Strikes: Provide for locks with three piece antifriiction latchbolts as recommended by manufacturer.
    - c. Aluminum-Frame Strike Box: Provide strike box fabricated for use with aluminum framing by framing manufacturer.
    - d. Rabbet Front and Strike: Provide on locksets for use with rabbeted meeting rails.
  - 5. Trim: Provide lever handle or pull trim on outside of each lock, unless otherwise indicated.

### 2.5 DOOR PULLS AND PUSH PLATES

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
  - 1. Rockwood; an Assa Abloy Group company: [www.assaabloydss.com/#sle](http://www.assaabloydss.com/#sle).
  - 2. Hiawatha, Inc, division of Activar Construction Products Group, Inc; <>: [www.activarcpg.com/hiawatha/#sle](http://www.activarcpg.com/hiawatha/#sle).
  - 3. [Ives, an Allegion brand; : [www.allegion.com/us.](http://www.allegion.com/us.)]
  - 4. Substitutions: See Section 016000 - Product Requirements.
- B. Door Pulls and Push Plates: Comply with BHMA A156.6.
  - 1. Pull Type: Straight, unless otherwise indicated.
  - 2. Push Plate Type: Flat, with square corners, unless otherwise indicated.
    - a. Edges: Beveled, unless otherwise indicated.
  - 3. Material: Aluminum, unless otherwise indicated.
  - 4. On solid doors, provide matching door pull and push plate on opposite faces.

5. On glazed storefront doors, provide matching door pulls/push plates on both faces unless otherwise indicated.

## 2.6 DOOR PULLS AND PUSH BARS

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
  1. Rockwood; an Assa Abloy Group company: [www.assaabloydss.com](http://www.assaabloydss.com).
  2. Hiawatha, Inc, division of Activar Construction Products Group, Inc; <>: [www.activarcpg.com/hiawatha](http://www.activarcpg.com/hiawatha).
  3. [Ives, an Allegion brand; : [www.allegion.com/us](http://www.allegion.com/us).]
  4. Substitutions: See Section 016000 - Product Requirements.
- B. Door Pulls and Push Bars: Comply with BHMA A156.6.
  1. Bar Type: Bar set, unless otherwise indicated.
  2. Material: Aluminum, unless otherwise indicated.

## 2.7 CLOSERS

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following: Surface Mounted:
  1. Sargent; an Assa Abloy Group company: [www.assaabloydss.com](http://www.assaabloydss.com).
  2. LCN, an Allegion brand: [www.allegion.com/us](http://www.allegion.com/us).
  3. Substitutions: See Section 016000 - Product Requirements.
- B. Closers: Comply with BHMA A156.4, Grade 1.
  1. Type: Surface mounted to door.
  2. Provide door closer on each exterior door.
  3. Provide door closer on each fire-rated and smoke-rated door.
    - a. Spring hinges are not an acceptable self-closing device, unless otherwise indicated.
  4. Where an overlapping astragal is included on pairs of swinging doors, provide coordinator to ensure door leaves close in proper order.
  5. At corridor entry doors, mount closer on room side of door.
  6. At outswinging exterior doors, mount closer on interior side of door.

## 2.8 OVERHEAD STOPS AND HOLDERS

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
  1. Glynn-Johnson, an Allegion brand: [www.allegion.com/us](http://www.allegion.com/us).
  2. Substitutions: See Section 016000 - Product Requirements.
- B. Overhead Stops and Holders (Door Checks): Comply with BHMA A156.8, Grade 1.
  1. Stop is not required if positive stop feature is specified for door closer; positive stop feature of door closer is not an acceptable substitute for a stop, unless otherwise indicated.

## 2.9 KICK PLATES

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
  1. Hiawatha, Inc, an Activar Construction Products Group company:
  2. Ives, an Allegion brand: [www.allegion.com/us/#sle](http://www.allegion.com/us/#sle).
  3. Trimco: [www.trimcohardware.com/#sle](http://www.trimcohardware.com/#sle).
  4. [Rockwood; an Assa Abloy Group company; [www.assaabloydss.com](http://www.assaabloydss.com).]
  5. Substitutions: See Section 016000 - Product Requirements.
- B. Kick Plates: Provide along bottom edge of push side of every door with closer, except aluminum storefront and glass entry doors, unless otherwise indicated.
  1. Size: 10 inch high by 2 inch less door width (LDW) on push side of door.

**2.10 FLOOR STOPS**

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
  - 1. Rockwood; an Assa Abloy Group company: [www.assaabloydss.com](http://www.assaabloydss.com).
  - 2. Hiawatha, Inc, division of Activar Construction Products Group, Inc: [www.activarcpg.com/hiawatha](http://www.activarcpg.com/hiawatha).
  - 3. Trimco: [www.trimcohardware.com](http://www.trimcohardware.com).
  - 4. Ives; an Allegion brand;.
  - 5. Substitutions: See Section 016000 - Product Requirements.
- B. Floor Stops: Comply with BHMA A156.16, Grade 1 and Resilient Material Retention Test as described in this standard.
  - 1. Provide floor stops when wall surface is not available; be cautious not to create a tripping hazard.
  - 2. Type: Manual hold-open, with pencil floor stop.
  - 3. Material: Aluminum housing with rubber insert.

**2.11 WALL STOPS**

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
  - 1. Rockwood; an Assa Abloy Group company: [www.assaabloydss.com/#sle](http://www.assaabloydss.com/#sle).
  - 2. Hiawatha, Inc, division of Activar Construction Products Group, Inc: [www.activarcpg.com/hiawatha](http://www.activarcpg.com/hiawatha).
  - 3. Trimco: [www.trimcohardware.com/#sle](http://www.trimcohardware.com/#sle).
  - 4. Substitutions: See Section 016000 - Product Requirements.
- B. Wall Stops: Comply with BHMA A156.16, Grade 1 and Resilient Material Retention Test as described in this standard.
  - 1. Provide wall stops to prevent damage to wall surface upon opening door.
  - 2. Type: Bumper, concave, wall stop.
  - 3. Material: Aluminum housing with rubber insert.

**2.12 WEATHERSTRIPPING AND GASKETING**

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
  - 1. Pemko; an Assa Abloy Group company: [www.assaabloydss.com](http://www.assaabloydss.com).
  - 2. Zero International, Inc: [www.zerointernational.com](http://www.zerointernational.com).
  - 3. Substitutions: See Section 016000 - Product Requirements.
- B. Weatherstripping and Gasketing: Comply with BHMA A156.22.
  - 1. Head and Jamb Type: Self-adhesive.
  - 2. Door Sweep Type: Encased in retainer.
  - 3. Material: Aluminum, with neoprene weatherstripping.
  - 4. Provide gasketing for smoke and draft control doors that complies with local codes, requirements of assemblies tested in accordance with UL 1784.

**2.13 SILENCERS**

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
  - 1. Ives, an Allegion brand: [www.allegion.com/us/#sle](http://www.allegion.com/us/#sle).
  - 2. Rockwood; an Assa Abloy Group company: [www.assaabloydss.com/#sle](http://www.assaabloydss.com/#sle).
  - 3. Substitutions: See Section 016000 - Product Requirements.
- B. Silencers: Provide at equal locations on door frame to mute sound of door's impact upon closing.
  - 1. Single Door: Provide three on strike jamb of frame.
  - 2. Pair of Doors: Provide two on head of frame, one for each door at latch side.
  - 3. Material: Rubber, gray color.

## 2.14 FINISHES

- A. Finishes: Provide door hardware of same finish, unless otherwise indicated.
  - 1. Primary Finish: 626; satin chromium plated over nickel, with brass or bronze base material (former US equivalent US26D); BHMA A156.18.
  - 2. Exceptions:
    - a. Where base material metal is specified to be different, provide finish that is an equivalent appearance in accordance with BHMA A156.18.
    - b. Hinges for Fire-Rated Doors: Steel base material with painted finish, in compliance with NFPA 80.
    - c. Door Closer Covers and Arms: Color as selected by Architect from manufacturer's standard colors unless otherwise indicated.
    - d. Aluminum Surface Trim and Gasket Housings: Anodized to match door panel finish, not other hardware, unless otherwise indicated.
    - e. Hardware for Aluminum Entrance Doors: Finished to match door panel finish, except at hand contact surfaces provide stainless steel with satin finish, unless otherwise indicated.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that doors and frames are ready to receive this work; labeled, fire-rated doors and frames are properly installed, and dimensions are as indicated on shop drawings.
- B. Verify that electric power is available to power operated devices and of correct characteristics.

### 3.2 INSTALLATION

- A. Install hardware in accordance with manufacturer's instructions and applicable codes.
- B. Install hardware on fire-rated doors and frames in accordance with applicable codes and NFPA 80.
- C. Install hardware for smoke and draft control doors in accordance with NFPA 105.
- D. Use templates provided by hardware item manufacturer.
- E. Do not install surface mounted items until application of finishes to substrate are fully completed.
- F. Door Hardware Mounting Heights: Distance from finished floor to center line of hardware item. As indicated in following list; unless noted otherwise in Door Hardware Schedule or on drawings.
  - 1. For Steel Doors and Frames: Install in compliance with DHI (LOCS) recommendations.
  - 2. For Wood Doors: Install in compliance with DHI WDHS.3 recommendations.
  - 3. Mounting heights in compliance with ADA Standards:
    - a. Locksets: 40-5/16 inch.
    - b. Push Plates/Pull Bars: 42 inch.
    - c. Deadlocks (Deadbolts): 48 inch.
    - d. Exit Devices: 40-5/16 inch.
    - e. Door Viewer: 43 inch; standard height 60 inch.
- G. Set exterior door thresholds with full-width bead of elastomeric sealant at each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel countersunk screws.

### 3.3 ADJUSTING

- A. Adjust hardware for smooth operation.
- B. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

### 3.4 CLEANING

- A. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.
- B. Clean adjacent surfaces soiled by hardware installation.

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- C. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.

**3.5 PROTECTION**

- A. Protect finished Work under provisions of Section 017000 - Execution and Closeout Requirements.
- B. Do not permit adjacent work to damage hardware or finish.

***END OF SECTION 087100***

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**SECTION 090561 - COMMON WORK RESULTS FOR FLOORING PREPARATION**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. This section applies to floors identified in Contract Documents that are receiving the following types of floor coverings:
  - 1. Thin-set ceramic tile and stone tile.
- B. Removal of existing floor coverings.
- C. Preparation of existing concrete floor slabs for installation of floor coverings.
- D. Testing of concrete floor slabs for moisture and alkalinity (pH).
- E. Remediation of concrete floor slabs due to unsatisfactory moisture or alkalinity (pH) conditions.
  - 1. Contractor shall perform all specified remediation of concrete floor slabs. If such remediation is indicated by testing agency's report and is due to a condition not under Contractor's control or could not have been predicted by examination prior to entering into the contract, a contract modification will be issued.
- F. Remedial floor coatings.

**1.2 PRICE AND PAYMENT PROCEDURES**

- A. Alternates: See Section 012300 - Alternates.
- B. Alternate for Remedial Floor Coating or Sheet Membrane: Do not include the cost of floor coating or underlayment in the base bid; state on the bid form the total additional cost for the floor coating, installed, in the event such remediation is required.
- C. Unit Prices: See Section 012200 - Unit Prices.
- D. Unit Price for Remedial Floor Coating or Sheet Membrane: Do not include the cost of the floor coating or underlayment in the base bid; state on the bid form the unit price per square foot for the floor coating or underlayment, installed, in the event such remediation is required.

**1.3 REFERENCE STANDARDS**

- A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50 mm] Cube Specimens) 2021.
- B. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters, and Gypsum Concrete 2020.
- C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring 2022.
- D. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride 2022.
- E. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes 2019a.
- F. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings 2018.

**1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.

**1.5 SUBMITTALS**

- A. Visual Observation Report: For existing floor coverings to be removed.
- B. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
  - 1. Moisture and alkalinity (pH) limits and test methods.
  - 2. Manufacturer's required bond/compatibility test procedure.
- C. Testing Report:
  - 1. Description of areas tested; include floor plans and photographs if helpful.
  - 2. Summary of conditions encountered.
  - 3. Moisture and alkalinity (pH) test reports.
  - 4. Copies of specified test methods.



5. Recommendations for remediation of unsatisfactory surfaces.
  6. Submit report to Architect.
  7. Submit report not more than two business days after conclusion of testing.
- D. Adhesive Bond and Compatibility Test Report.
- E. Copy of RFCI (RWP).
- 1.6 QUALITY ASSURANCE**
- A. Moisture and alkalinity (pH) testing shall be performed by an independent testing agency employed and paid by Contractor.
- B. Contractor may perform adhesive and bond test with Contractor's own personnel or hire a testing agency.
- C. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.
1. Submit evidence of experience consisting of at least 3 test reports of the type required, with project Owner's project contact information.
- D. Contractor's Responsibility Relating to Independent Agency Testing:
1. Provide access for and cooperate with testing agency.
  2. Confirm date of start of testing at least 10 days prior to actual start.
  3. Allow at least 4 business days on site for testing agency activities.
  4. Achieve and maintain specified ambient conditions.
  5. Notify Architect when specified ambient conditions have been achieved and when testing will start.
- 1.7 DELIVERY, STORAGE, AND HANDLING**
- A. Deliver, store, handle, and protect products in accordance with manufacturer's instructions and recommendations.
- B. Deliver materials in manufacturer's packaging; include installation instructions.
- C. Keep materials from freezing.
- 1.8 FIELD CONDITIONS**
- A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F or more than 85 degrees F.
- B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

**PART 2 PRODUCTS**

**2.1 MATERIALS**

- A. Patching Compound: Floor covering manufacturer's recommended product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:
1. Cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
  2. Compressive Strength: 3000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M or ASTM C472, whichever is appropriate.
- B. Remedial Floor Coating: Single- or multi-layer coating or coating/overlay combination intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.
1. Thickness: As required for application and in accordance with manufacturer's installation instructions.
  2. Products:
    - a. ARDEX Engineered Cements; ARDEX VB 100: [www.ardexamericas.com/#sle](http://www.ardexamericas.com/#sle).

- b. LATICRETE International, Inc; LATICRETE NXT Vapor Reduction Coating with LATICRETE NXT Level Plus: [www.laticrete.com/#sle](http://www.laticrete.com/#sle).
- c. Sika Corporation; Sikafloor Moisture Tolerance Epoxy Primer and Sikafloor Self-Leveling Moisture Tolerant Resurfacer: [www.sikafloorusa.com/#sle](http://www.sikafloorusa.com/#sle).
- d. Substitutions: See Section 016000 - Product Requirements.

### **PART 3 EXECUTION**

#### **3.1 CONCRETE SLAB PREPARATION**

- A. Perform following operations in the order indicated:
  - 1. Existing concrete slabs (on-grade and elevated) with existing floor coverings:
    - a. Visual observation of existing floor covering, for adhesion, water damage, alkaline deposits, and other defects.
    - b. Removal of existing floor covering.
  - 2. Preliminary cleaning.
  - 3. Moisture vapor emission tests; 3 tests in the first 1000 square feet and one test in each additional 1000 square feet, unless otherwise indicated or required by flooring manufacturer.
  - 4. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
  - 5. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
  - 6. Specified remediation, if required.
  - 7. Patching, smoothing, and leveling, as required.
  - 8. Other preparation specified.
  - 9. Adhesive bond and compatibility test.
  - 10. Protection.

#### **3.2 REMOVAL OF EXISTING FLOOR COVERINGS**

- A. Comply with local, State, and federal regulations and recommendations of RFCI (RWP), as applicable to floor covering being removed.
- B. Dispose of removed materials in accordance with local, State, and federal regulations and as specified.

#### **3.3 PRELIMINARY CLEANING**

- A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.
- B. Do not use solvents or other chemicals for cleaning.

#### **3.4 MOISTURE VAPOR EMISSION TESTING**

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
- C. Test in accordance with ASTM F1869 and as follows.
- D. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.
- E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per 1000 square feet per 24 hours.
- F. Report: Report the information required by the test method.

#### **3.5 INTERNAL RELATIVE HUMIDITY TESTING**

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

- B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
- C. Test in accordance with ASTM F2170 Procedure A and as follows.
- D. Testing with electrical impedance or resistance apparatus may not be substituted for the specified ASTM test method, as the values determined are not comparable to the ASTM test values and do not quantify the moisture content sufficiently.
- E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if any test value exceeds 75 percent relative humidity.
- F. Report: Report the information required by the test method.

**3.6 ALKALINITY TESTING**

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if alkalinity (pH) test value is over 10.

**3.7 PREPARATION**

- A. Protection of In-Place Conditions: Protect adjacent existing tile and carpet flooring.
- B. See individual floor covering section(s) for additional requirements.
- C. Comply with requirements and recommendations of floor covering manufacturer.
- D. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.
- E. Do not fill expansion joints, isolation joints, or other moving joints.

**3.8 ADHESIVE BOND AND COMPATIBILITY TESTING**

- A. Comply with requirements and recommendations of floor covering manufacturer.

**3.9 APPLICATION OF REMEDIAL FLOOR COATING**

- A. Comply with requirements and recommendations of coating manufacturer.

**3.10 PROTECTION**

- A. Cover prepared floors with building paper or other durable covering.

***END OF SECTION 090561***

**SECTION 092116 - GYPSUM BOARD ASSEMBLIES**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Performance criteria for gypsum board assemblies.
- B. Metal stud wall framing.
- C. Metal channel ceiling framing.
- D. Acoustic insulation.
- E. Gypsum wallboard.
- F. Joint treatment and accessories.

**1.2 RELATED REQUIREMENTS**

- A. Section 054000 - Cold-Formed Metal Framing: Structural steel stud framing.
- B. Section 061000 - Rough Carpentry: Building framing and sheathing.
- C. Section 061000 - Rough Carpentry: Wood blocking product and execution requirements.
- D. Section 078400 - Firestopping: Top-of-wall assemblies at fire-resistance-rated walls.
- E. Section 079200 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

**1.3 REFERENCE STANDARDS**

- A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members 2016, with Supplement (2020).
- B. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing 2020.
- C. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing 2015, with Errata (2020).
- D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2023.
- E. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members 2015.
- F. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board 2017 (Reapproved 2022).
- G. ASTM C514 - Standard Specification for Nails for the Application of Gypsum Board 2004 (Reapproved 2020).
- H. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing 2023.
- I. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products 2020.
- J. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board 2020.
- K. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base 2019.
- L. ASTM C1396/C1396M - Standard Specification for Gypsum Board 2017.
- M. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels 2019.
- N. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels 2019, with Editorial Revision (2020).
- O. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber 2021.
- P. GA-216 - Application and Finishing of Gypsum Panel Products 2021.
- Q. GA-600 - Fire Resistance and Sound Control Design Manual 2021.
- R. ICC (IBC) - International Building Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

#### 1.4 SUBMITTALS

- A. Product Data: Provide data on metal framing, gypsum board, glass mat faced gypsum board, accessories, and joint finishing system.
  - 1. Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

### PART 2 PRODUCTS

#### 2.1 GYPSUM BOARD ASSEMBLIES

- A. Provide completed assemblies complying with ASTM C840 and GA-216.
  - 1. See PART 3 for finishing requirements.
- B. Fire Rated Assemblies: Provide completed assemblies with the following characteristics:
  - 1. Fire Rated Partitions: UL listed assembly as indicated on Drawings.
  - 2. Fire Rated Shaft Walls: UL listed assembly as indicated on Drawings.
  - 3. ICC IBC Item Numbers: Comply with applicable requirements of ICC IBC for the particular assembly.
  - 4. Gypsum Association File Numbers: Comply with requirements of GA-600 for the particular assembly.

#### 2.2 METAL FRAMING MATERIALS

- A. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S220 or equivalent.
- B. Manufacturers - Metal Framing, Connectors, and Accessories:
  - 1. ClarkDietrich: [www.clarkdietrich.com/#sle](http://www.clarkdietrich.com/#sle).
  - 2. Jaimes Industries: [www.jaimesind.com/#sle](http://www.jaimesind.com/#sle).
  - 3. Marino: [www.marinoware.com/#sle](http://www.marinoware.com/#sle).
  - 4. R-stud, LLC: [www.rstud.com/#sle](http://www.rstud.com/#sle).
  - 5. SCAFCO Corporation: [www.scafco.com/#sle](http://www.scafco.com/#sle).
  - 6. Steel Construction Systems: [www.steelconsystems.com/#sle](http://www.steelconsystems.com/#sle).
  - 7. Substitutions: See Section 016000 - Product Requirements.
- C. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 7.5 psf.
  - 1. Studs: C-shaped with knurled or embossed faces.
  - 2. Runners: U shaped, sized to match studs.
  - 3. Ceiling Channels: C-shaped.
  - 4. Furring Members: Hat-shaped sections, minimum depth of 7/8 inch.
- D. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection and prevent rotation of studs while maintaining structural performance of partition.
  - 1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100.
  - 2. Material: ASTM A653/A653M steel sheet, SS Grade 50/340, with G60/Z180 hot-dipped galvanized coating.
  - 3. Provide components UL-listed for use in UL-listed fire-resistance-rated head of partition joint systems indicated on drawings.
  - 4. Provide mechanical anchorage devices as described above that accommodate deflection while maintaining the fire-resistance rating of the wall assembly.
    - a. Products:
      - 1) FireTrak Corporation; Posi Klip: [www.fire-trak.com/#sle](http://www.fire-trak.com/#sle).
      - 2) Metal-Lite, Inc; The System: [www.metal-lite.net/#sle](http://www.metal-lite.net/#sle).
      - 3) Substitutions: See Section 016000 - Product Requirements.

5. Provide top track preassembled with connection devices spaced to fit stud spacing indicated on drawings; minimum track length of 12 feet.
- E. Deflection and Firestop Track: Intumescent strip factory-applied to track flanges expands when exposed to heat or flames to provide a perimeter joint seal.
- F. Non-structural Framing Accessories:
  1. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
  2. Framing Connectors: ASTM A653/A653M G90 galvanized steel clips; secures cold rolled channel to wall studs for lateral bracing.
    - a. Products:
      - 1) ClarkDietrich; FastBridge Clip (FB33): [www.clarkdietrich.com/#sle](http://www.clarkdietrich.com/#sle).
  3. Flexible Wood Backing: Fire-retardant-treated wood with sheet steel connectors.
    - a. Products:
      - 1) ClarkDietrich; Danback: [www.clarkdietrich.com/#sle](http://www.clarkdietrich.com/#sle).
      - 2) Substitutions: See Section 016000 - Product Requirements.

### **2.3 BOARD MATERIALS**

- A. Manufacturers - Gypsum-Based Board: Subject to compliance with requirements, provide products by one of the following:
  1. American Gypsum Company: [www.americangypsum.com/#sle](http://www.americangypsum.com/#sle).
  2. CertainTeed Corporation: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
  3. Georgia-Pacific Gypsum: [www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).
  4. National Gypsum Company: [www.nationalgypsum.com/#sle](http://www.nationalgypsum.com/#sle).
  5. PABCO Gypsum: [www.pabcogypsum.com/#sle](http://www.pabcogypsum.com/#sle).
  6. USG Corporation: [www.usg.com/#sle](http://www.usg.com/#sle).
  7. Substitutions: See Section 016000 - Product Requirements.
- B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
  1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
  2. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
  3. Thickness:
    - a. Vertical Surfaces: 5/8 inch.
    - b. Ceilings: 5/8 inch.
    - c. Multi-Layer Assemblies: Thicknesses as indicated on drawings.
  4. Paper-Faced Products:
    - a. American Gypsum Company; FireBloc Type X Gypsum Wallboard: [www.americangypsum.com/#sle](http://www.americangypsum.com/#sle).
    - b. CertainTeed Corporation; Type X Drywall: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
    - c. Georgia-Pacific Gypsum; ToughRock Fireguard X: [www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).
    - d. Substitutions: See Section 016000 - Product Requirements.
  5. Mold-Resistant, Paper-Faced Products:
    - a. American Gypsum Company; M-Bloc Type X: [www.americangypsum.com/#sle](http://www.americangypsum.com/#sle).
    - b. CertainTeed Corporation; M2Tech 5/8" Type X Moisture & Mold Resistant Drywall: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
    - c. Georgia-Pacific Gypsum; ToughRock Fireguard X Mold-Guard: [www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).
    - d. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond XP Gypsum Board: [www.goldbondbuilding.com/#sle](http://www.goldbondbuilding.com/#sle).
    - e. Substitutions: See Section 016000 - Product Requirements.
- C. Abuse Resistant Wallboard:
  1. Application: High-traffic areas indicated.

2. Surface Abrasion: Level 2, minimum, when tested in accordance with ASTM C1629/C1629M.
  3. Indentation: Level 2, minimum, when tested in accordance with ASTM C1629/C1629M.
  4. Soft Body Impact: Level 2, minimum, when tested in accordance with ASTM C1629/C1629M.
  5. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
  6. Paper-Faced Type: Gypsum wallboard, as defined in ASTM C1396/C1396M.
  7. Type: Fire-resistance-rated Type X, UL or WH listed.
  8. Thickness: 5/8 inch.
  9. Edges: Tapered.
  10. Paper-Faced Products:
    - a. American Gypsum Company; M-Bloc AR Type X:  
[www.americangypsum.com/#sle](http://www.americangypsum.com/#sle).
    - b. CertainTeed Corporation; Extreme Abuse Resistant Drywall with M2Tech:  
[www.certainteed.com/#sle](http://www.certainteed.com/#sle).
    - c. Georgia-Pacific Gypsum; ToughRock Fireguard X Mold Guard Abuse-Resistant:  
[www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).
    - d. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond XP Hi-Abuse Gypsum Board: [www.goldbondbuilding.com/#sle](http://www.goldbondbuilding.com/#sle).
    - e. Substitutions: See Section 016000 - Product Requirements.
- D. Ceiling Board: Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Ceilings, unless otherwise indicated.
  2. Thickness: 1/2 inch.
  3. Edges: Tapered.
  4. Products:
    - a. CertainTeed Corporation; Interior Ceiling Drywall: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
    - b. Georgia-Pacific Gypsum; ToughRock Span 24 Ceiling Board:  
[www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).
    - c. Substitutions: See Section 016000 - Product Requirements.
- E. Shaftwall and Coreboard: Type X; 1 inch thick by 24 inches wide, beveled long edges, ends square cut.
1. Paper-Faced Type: Gypsum shaftliner board or gypsum coreboard as defined ASTM C1396/C1396M; water-resistant faces.
  2. Glass Mat Faced Type: Glass mat shaftliner gypsum panel or glass mat coreboard gypsum panel as defined in ASTM C1658/C1658M.
  3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
  4. Paper-Faced Products:
    - a. American Gypsum Company; M-Bloc Shaft Liner:  
[www.americangypsum.com/#sle](http://www.americangypsum.com/#sle).
    - b. CertainTeed Corporation; M2Tech Type X Shaftliner: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
    - c. Georgia-Pacific Gypsum; ToughRock Shaftliner: [www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).
    - d. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond Shaftliner XP: [www.goldbondbuilding.com/#sle](http://www.goldbondbuilding.com/#sle).
    - e. Substitutions: See Section 016000 - Product Requirements.
  5. Glass Mat Faced Products:
    - a. American Gypsum Company; M-Glass Shaft Liner:  
[www.americangypsum.com/#sle](http://www.americangypsum.com/#sle).
    - b. CertainTeed Corporation; GlasRoc Shaftliner Type X: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).

- c. Georgia-Pacific Gypsum; DensGlass Shaftliner (mold-resistant):  
[www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).
- d. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond eXP Shaftliner: [www.goldbondbuilding.com/#sle](http://www.goldbondbuilding.com/#sle).
- e. Substitutions: See Section 016000 - Product Requirements.

## 2.4 GYPSUM BOARD ACCESSORIES

- A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced. Thickness: 4 inch.
- B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
  - 1. Products:
    - a. Franklin International, Inc; Titebond Acoustical Smoke & Sound Sealant:  
[www.titebond.com/#sle](http://www.titebond.com/#sle).
    - b. Liquid Nails, a brand of PPG Architectural Coatings; \_\_\_\_\_:  
[www.liquidnails.com/#sle](http://www.liquidnails.com/#sle).
    - c. Substitutions: See Section 016000 - Product Requirements.
- C. Finishing Accessories: ASTM C1047, extruded aluminum alloy (6063 T5) or galvanized steel sheet ASTM A924/A924M G90, unless noted otherwise.
  - 1. Types: As detailed or required for finished appearance.
  - 2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead, L-bead, and LC-bead at exposed panel edges.
- D. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
  - 1. Paper Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.
  - 2. Joint Compound: Drying type, vinyl-based, ready-mixed.
    - a. Products:
      - 1) Substitutions: See Section 016000 - Product Requirements.
- E. Finishing Compound: Surface coat and primer, takes the place of skim coating.
  - 1. Products:
    - a. CertainTeed Corporation; Quick Prep Plus Interior Prep Coat:  
[www.certainteed.com/#sle](http://www.certainteed.com/#sle).
    - b. Substitutions: See Section 016000 - Product Requirements.
- F. Nails for Attachment to Wood Members: ASTM C514.
- G. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that project conditions are appropriate for work of this section to commence.

### 3.2 SHAFT WALL INSTALLATION

- A. Shaft Wall Framing: Install in accordance with manufacturer's installation instructions.
  - 1. Fasten runners to structure with short leg to finished side, using appropriate power-driven fasteners at not more than 24 inches on center.
  - 2. Install studs at spacing required to meet performance requirements.
- B. Shaft Wall Liner: Cut panels to accurate dimensions and install sequentially between special friction studs.
  - 1. On walls over sixteen feet high, screw-attach studs to runners top and bottom.
  - 2. Seal perimeter of shaft wall and penetrations with acoustical sealant.



### 3.3 FRAMING INSTALLATION

- A. Metal Framing: Install in accordance with ASTM C1007/AISI S220 and manufacturer's instructions.
- B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
  - 1. Level ceiling system to a tolerance of 1/1200.
  - 2. Laterally brace entire suspension system.
  - 3. Install bracing as required at exterior locations to resist wind uplift.
- C. Studs: Space studs at 16 inches on center.
  - 1. Extend partition framing as indicated in Drawings.
  - 2. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.
- D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.
- E. Standard Wall Furring: Install at concrete and masonry walls scheduled to receive gypsum board, not more than 4 inches from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches on center.
  - 1. Orientation: Horizontal.
  - 2. Spacing: As indicated.
- F. Acoustic Furring: Install resilient channels at maximum 24 inches on center. Locate joints over framing members.
- G. Blocking: Install wood blocking for support of:
  - 1. Framed openings.
  - 2. Wall-mounted cabinets.
  - 3. Plumbing fixtures.
  - 4. Toilet partitions.
  - 5. Toilet accessories.
  - 6. Wall-mounted door hardware.

### 3.4 ACOUSTIC ACCESSORIES INSTALLATION

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
  - 1. Place one bead continuously on substrate before installation of perimeter framing members.
  - 2. Place continuous bead at perimeter of each layer of gypsum board.
  - 3. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

### 3.5 BOARD INSTALLATION

- A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
  - 1. Exception: Tapered edges to receive joint treatment at right angles to framing.
- C. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.
- D. Installation on Metal Framing: Use screws for attachment of gypsum board.
- E. Installation on Wood Framing: For rated assemblies, comply with requirements of listing authority. For nonrated assemblies, install as follows:
  - 1. Single-Layer Applications: Screw attachment.

**3.6 INSTALLATION OF TRIM AND ACCESSORIES**

- A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
  - 1. Not more than 30 feet apart on walls and ceilings over 50 feet long.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

**3.7 JOINT TREATMENT**

- A. Paper Faced Gypsum Board: Use paper joint tape, embed with drying type joint compound and finish with drying type joint compound.
- B. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
  - 1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.
  - 2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
  - 3. Level 3: Walls to receive textured wall finish.
  - 4. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
  - 5. Level 1: Fire rated wall areas above finished ceilings, whether or not accessible in the completed construction.
  - 6. Level 0: Temporary partitions.
  - 7. Level 0: Surfaces indicated to be finished in later stage of project.
- C. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
  - 1. Feather coats of joint compound so that camber is maximum 1/32 inch.
  - 2. Taping, filling, and sanding are not required at surfaces behind adhesive applied ceramic tile and fixed cabinetry.
  - 3. Taping, filling, and sanding are not required at base layer of double-layer applications.
- D. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

**3.8 TOLERANCES**

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

***END OF SECTION 092116***

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**SECTION 093000 - TILING**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Tile for floor applications.
- B. Tile for wall applications.
- C. Cementitious backer board as tile substrate.
- D. Non-ceramic trim.

**1.2 RELATED REQUIREMENTS**

- A. Section 079200 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.
- B. Section 090561 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.

**1.3 REFERENCE STANDARDS**

- A. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium) 2019.
- B. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar 2017 (Reaffirmed 2022).
- C. ANSI A108.1b - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar 2017.
- D. ANSI A108.1c - Contractor's Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar 1999 (Reaffirmed 2021).
- E. ANSI A108.2 - American National Standard General Requirements: Materials, Environmental and Workmanship 2019.
- F. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesive or Water Cleanable Tile-Setting Epoxy Adhesive 2019.
- G. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar 2021.
- H. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grout Epoxy 1999 (Reaffirmed 2019).
- I. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout 1999 (Reaffirmed 2019).
- J. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout 1999 (Reaffirmed 2019).
- K. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework 2017 (Reaffirmed 2022).
- L. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units 2018.
- M. ANSI A108.12 - American National Standard for Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar 1999 (Reaffirmed 2019).
- N. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone 2005 (Reaffirmed 2021).
- O. ANSI A108.19 - American National Standard Specifications for Interior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs by the Thin-Bed Method Bonded with Modified Dry-Set Cement Mortar or Improved Modified Dry-Set Cement Mortar 2020.
- P. ANSI A108.20 - American National Standard Specifications for Exterior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs 2020.

- Q. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar 2019.
- R. ANSI A118.6 - American National Standard Specifications for Standard Cement Grouts for Tile Installation 2019.
- S. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units 2019.
- T. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone 2014 (Reaffirmed 2019).
- U. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation 2014 (Reaffirmed 2019).
- V. ANSI A137.1 - American National Standard Specifications for Ceramic Tile 2022.
- W. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring 2022.
- X. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride 2022.
- Y. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation 2023.

**1.4 ADMINISTRATIVE REQUIREMENTS**

**1.5 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.
- C. Samples: Mount tile and apply grout on two plywood panels, minimum 36 by 36 inches in size illustrating pattern, color variations, and grout joint size variations.
- D. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 016000 - Product Requirements, for additional provisions.
  - 2. Extra Tile: 10 square feet of each size, color, and surface finish combination.
  - 3. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

**1.6 QUALITY ASSURANCE**

- A. Maintain one copy of ANSI A108/A118/A136 and TCNA (HB) on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.
- C. Installer Qualifications:
  - 1. Company specializing in performing tile installation, with minimum of five years of documented experience.

**1.7 MOCK-UPS**

- A. See Section 014000 - Quality Requirements for general requirements for mock-up.
- B. Construct tile mock-up where indicated on drawings, incorporating all components specified for the location.
  - 1. Minimum size of mock-up is indicated on drawings. Mock ups to include wall and floor tile.
  - 2. Approved mock-up may remain as part of work.

**1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

**1.9 FIELD CONDITIONS**

- A. Maintain ambient and substrate temperature above 50 degrees F and below 100 degrees F during installation and curing of setting materials.

## **PART 2 PRODUCTS**

### **2.1 TILE**

- A. Manufacturers:
  - 1. American Olean Corporation: [www.americanolean.com/#sle](http://www.americanolean.com/#sle).
  - 2. Dal-Tile Corporation: [www.daltile.com/#sle](http://www.daltile.com/#sle).
  - 3. Emser Tile, LLC: [www.emser.com/#sle](http://www.emser.com/#sle).
  - 4. Fiandre Architectural Surfaces [www.granitifiandre.com](http://www.granitifiandre.com)
  - 5. Landmark Ceramics [www.landmarkceramics.com](http://www.landmarkceramics.com)
  - 6. Substitutions: See Section 016000 - Product Requirements.
- B. Porcelain Tile, Type T1: ANSI A137.1 standard grade.
  - 1. Size: As indicated on Drawings.
  - 2. Color(s): As indicated on Drawings.
  - 3. Pattern: As indicated on Drawings.
  - 4. Products: As indicated on Drawings.
- C. Ceramic Tile, Type T2: ANSI A137.1 standard grade.
  - 1. Size: As indicated on Drawings.
  - 2. Color(s): As indicated on drawings.
  - 3. Pattern: As indicated on Drawings..
  - 4. Products: As indicated on Drawings.
- D. Ceramic Tile, Type T3: ANSI A137.1 standard grade.
  - 1. Size: As indicated on Drawings.
  - 2. Color(s): As indicated on drawings.
  - 3. Pattern: As indicated on Drawings..
  - 4. Products: As indicated on Drawings.

### **2.2 TRIM AND ACCESSORIES**

- A. Non-Ceramic Trim: Satin natural anodized extruded aluminum, style and dimensions as indicated on drawings, for setting using tile mortar or adhesive.
  - 1. Applications:
    - a. Open edges of wall tile.
    - b. Open edges of floor tile.
    - c. Wall corners, outside and inside.
    - d. Transition between floor finishes of different heights.
    - e. Floor to wall joints.
    - f. Borders and other trim as indicated on drawings.
  - 2. Manufacturers:
    - a. Schluter-Systems: [www.schluter.com/#sle](http://www.schluter.com/#sle).
    - b. Substitutions: See Section 016000 - Product Requirements.

### **2.3 SETTING MATERIALS**

- A. Latex-Portland Cement Mortar Bond Coat: ANSI A118.4.
  - 1. Products:
    - a. ARDEX Engineered Cements; ARDEX X 5: [www.ardexamericas.com/#sle](http://www.ardexamericas.com/#sle).
    - b. Custom Building Products; ProLite Premium Rapid Setting Large Format Tile Mortar, with Multi-Surface Bonding Primer: [www.custombuildingproducts.com/#sle](http://www.custombuildingproducts.com/#sle).

### **2.4 GROUTS**

- A. Standard Grout: ANSI A118.6 standard cement grout.
  - 1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.
  - 2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.

3. Color(s): As indicated on drawings.
  4. Products: Subject to compliance with requirements provide products by one of the following:
    - a. Mapei Corporation [www.mapei.com](http://www.mapei.com)
    - b. Bostik; [www.bostik.com](http://www.bostik.com).
    - c. Substitutions: See Section 016000 - Product Requirements.
- B. Stain Resistant Grout Additive: Liquid admixture for sanded and unsanded cement-based grouts; mix with dry grout material in place of water.
1. Applications: all grout applications.

## 2.5 Maintenance Materials

- A. Tile Sealant: Gunnable, silicone, siliconized acrylic, or urethane sealant; moisture and mildew resistant type.
1. Applications: Between tile and plumbing fixtures.
  2. Color(s): As selected by Architect from manufacturer's full line.
  3. Products: Subject to compliance with requirements, provide products by one of the following:
    - a. ARDEX Engineered Cements; ARDEX SX: [www.ardexamericas.com/#sle](http://www.ardexamericas.com/#sle).
    - b. Custom Building Products; Commercial 100% Silicone Caulk: [www.custombuildingproducts.com/#sle](http://www.custombuildingproducts.com/#sle).
    - c. LATICRETE International, Inc; LATICRETE LATASIL: [www.laticrete.com/#sle](http://www.laticrete.com/#sle).
- B. Grout Sealer: Liquid-applied, moisture and stain protection for existing or new Portland cement grout.
1. Composition: Water-based colorless silicone.
  2. Products: Subject to compliance with requirements, provide products by one of the following:
    - a. Merkrete, by Parex USA, Inc; Merkrete Revive: [www.merkrete.com/#sle](http://www.merkrete.com/#sle).

## 2.6 ACCESSORY MATERIALS

- A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.
1. Crack Resistance: No failure at 1/8 inch gap, minimum.
  2. Fluid or Trowel Applied Type:
    - a. Material: Synthetic rubber, Synthetic rubber, Acrylic, or Acrylic.
    - b. Thickness: 20 mils, maximum.
    - c. Products:
- B. Waterproofing Membrane at Floors: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
1. Crack Resistance: No failure at 1/16 inch gap, minimum; comply with ANSI A118.12.
  2. Fluid or Trowel Applied Type:
    - a. Material: Synthetic rubber or Acrylic.
    - b. Thickness: 25 mils, minimum, dry film thickness.
    - c. Products:
      - 1) ARDEX Engineered Cements; ARDEX 8+9: [www.ardexamericas.com/#sle](http://www.ardexamericas.com/#sle).
      - 2) Custom Building Products; RedGard Crack Prevention and Waterproofing Membrane: [www.custombuildingproducts.com/#sle](http://www.custombuildingproducts.com/#sle).
      - 3) H.B. Fuller Construction Products, Inc; TEC HydraFlex Waterproofing Crack Isolation Membrane: [www.tecspecialty.com/#sle](http://www.tecspecialty.com/#sle).
      - 4) LATICRETE International, Inc; LATICRETE HYDRO BAN: [www.laticrete.com/#sle](http://www.laticrete.com/#sle).
- C. Backer Board: Cementitious type complying with ANSI A118.9; high density, glass fiber reinforced, 7/16 inch thick; 2 inch wide coated glass fiber tape for joints and corners.

1. Products:
  - a. Custom Building Products; WonderBoard Lite Backerboard:  
[www.custombuildingproducts.com/#sle](http://www.custombuildingproducts.com/#sle).

### **PART 3 EXECUTION**

#### **3.1 EXAMINATION**

- A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.
- C. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.
- D. Verify that required floor-mounted utilities are in correct location.

#### **3.2 PREPARATION**

- A. Protect surrounding work from damage.
- B. Vacuum clean surfaces and damp clean.
- C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
- D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.
- E. Blending: For tile exhibiting color variations, 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. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.20, manufacturer's instructions, and TCNA (HB) recommendations.
- B. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
- C. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
- D. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
- E. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.
- F. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
- G. Form internal angles square and external angles bullnosed.
- H. Install ceramic accessories rigidly in prepared openings.
- I. Install non-ceramic trim in accordance with manufacturer's instructions.
- J. Sound tile after setting. Replace hollow sounding units.
- K. Keep control and expansion joints free of mortar, grout, and adhesive.
- L. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
- M. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.
- N. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.



**3.4 INSTALLATION - FLOORS - THIN-SET METHODS**

- A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout, unless otherwise indicated.
  - 1. Where waterproofing membrane is indicated, install in accordance with TCNA (HB) Method F122, with latex-Portland cement grout.
- B. Over wood substrates, install in accordance with TCNA (HB) Method F142, with standard grout, unless otherwise indicated.
- C. Over wood substrate with backer board underlayment, install in accordance with TCNA (HB) Method F144, for cementitious backer boards, with standard grout.

**3.5 INSTALLATION - WALL TILE**

- A. On exterior walls install in accordance with TCNA (HB) Method W244, thin-set over cementitious backer units, with waterproofing membrane.
- B. Over cementitious backer units on studs, install in accordance with TCNA (HB) Method W244, using membrane at toilet rooms.
- C. Over interior concrete and masonry install in accordance with TCNA (HB) Method W202, thin-set with dry-set or latex-Portland cement bond coat.

**3.6 CLEANING**

- A. Clean tile and grout surfaces.

**3.7 PROTECTION**

- A. Do not permit traffic over finished floor surface for 4 days after installation.

**END OF SECTION 093000**

**SECTION 095100 - ACOUSTICAL CEILINGS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Suspended metal grid ceiling system.
- B. Acoustical units.
- C. Supplementary insulation above ceiling.

**1.2 REFERENCE STANDARDS**

- A. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings 2022.
- B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels 2019.
- C. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions 2022.
- D. ASTM E1264 - Standard Classification for Acoustical Ceiling Products 2023.

**1.3 ADMINISTRATIVE REQUIREMENTS**

- A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- B. Do not install acoustical units until after interior wet work is dry.

**1.4 PREINSTALLATION MEETINGS**

- A. Preinstallation Conference: Conduct conference at Project Site.

**1.5 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on suspension system components and acoustical units.
- C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 016000 - Product Requirements, for additional provisions.
  - 2. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

**1.6 FIELD CONDITIONS**

- A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

**PART 2 PRODUCTS**

**2.1 MANUFACTURERS**

- A. Acoustic Tiles/Panels:
  - 1. Armstrong World Industries, Inc: [www.armstrong.com/#sle](http://www.armstrong.com/#sle).
  - 2. CertainTeed Corporation: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
  - 3. Rockfon: [www.rockfon.com/#sle](http://www.rockfon.com/#sle).
  - 4. USG: [www.usg.com/#sle](http://www.usg.com/#sle).
  - 5. Chicago Metallic.
- B. Suspension Systems:
  - 1. Same as for acoustical units.

**2.2 ACOUSTICAL UNITS**

- A. Acoustical Units - General: ASTM E1264, Class A.
- B. Acoustical Tiles: Painted mineral fiber, with the following characteristics:
  - 1. Classification: ASTM E1264 Type III.
  - 2. Size: 24 by 24 inches.
  - 3. Thickness: 3/4 inch.
  - 4. Tile Edge: Square.
    - a. Joint: Kerfed and rabbeted.
  - 5. Suspension System: Concealed.

**2.3 SUSPENSION SYSTEM(S)**

- A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.
- B. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.

**2.4 ACCESSORIES**

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
- B. Hanger Wire: 12 gauge, 0.08 inch galvanized steel wire.
- C. Perimeter Moldings: Same metal and finish as grid.
- D. Acoustical Insulation: Specified in Section 072100.
  - 1. Thickness: 2 inch.
  - 2. Size: To fit acoustical suspension system.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.

**3.2 INSTALLATION - SUSPENSION SYSTEM**

- A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.
- B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- C. Locate system on room axis according to reflected plan.
- D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
  - 1. Use longest practical lengths.
- E. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- H. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.
- I. Do not eccentrically load system or induce rotation of runners.

**3.3 INSTALLATION - ACOUSTICAL UNITS**

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Fit border trim neatly against abutting surfaces.
- D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- E. Cutting Acoustical Units:
  - 1. Make field cut edges of same profile as factory edges.
- F. Lay acoustical insulation for a distance of 48 inches either side of acoustical partitions as indicated.
- G. Install hold-down clips on panels within 20 ft of an exterior door.

**3.4 TOLERANCES**

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

***END OF SECTION 095100***

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**SECTION 096500 - RESILIENT FLOORING**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Resilient sheet flooring.
- B. Resilient base.
- C. Installation accessories.

**1.2 RELATED REQUIREMENTS**

- A. Section 090561 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.

**1.3 REFERENCE STANDARDS**

- A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source 2019a, with Editorial Revision (2020).
- B. ASTM F1859 - Standard Specification for Rubber Sheet Floor Covering Without Backing 2021a.
- C. ASTM F1861 - Standard Specification for Resilient Wall Base 2021.
- D. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source 2023.

**1.4 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Verification Samples: Submit two full size samples, illustrating color and pattern for each resilient flooring product specified.
- D. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.
- E. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of subfloor is acceptable.
- F. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 016000 - Product Requirements, for additional provisions.
  - 2. Extra Flooring Material: 100 square feet of each type and color or 10%, whichever is greater.
  - 3. Extra Wall Base: 10 linear feet of each type and color, or 10%, whichever is greater.

**1.5 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing specified flooring with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience and approved by flooring manufacturer.

**1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
- B. Store all materials off of the floor in an acclimatized, weather-tight space.
- C. Maintain temperature in storage area between 55 degrees F and 90 degrees F.
- D. Protect roll materials from damage by storing on end.
- E. Do not double stack pallets.

**1.7 FIELD CONDITIONS**

- A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

**1.8 MOCK-UP**

- A. See Section 014000 - Quality Requirements, for general requirements for mock-up.

- B. Construct resilient floor mock-up where indicated on drawings, incorporating all components specified for the location.
  - 1. Minimum size of mock-up is indicated on drawings.
  - 2. Approved mock-up may remain as part of the Work.

**PART 2 PRODUCTS**

**2.1 SHEET FLOORING**

- A. Rubber Sheet Flooring: 100 percent rubber composition, color and pattern through total thickness.
  - 1. Manufacturers:
    - a. Roppe Corporation; Envire Rubber Sheet: [www.roppe.com/#sle](http://www.roppe.com/#sle).
  - 2. Minimum Requirements: Comply with ASTM F1859, Type 1, without backing.
  - 3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
  - 4. Thickness: 0.100 inch minimum.
  - 5. Seams: Heat welded.
  - 6. Surface Texture: Smooth.
  - 7. Pattern: As indicated on drawings.
  - 8. Color: As indicated on drawings.
- B. Welding Rod: Solid bead in material compatible with flooring, produced by flooring manufacturer for heat welding seams, and in color matching field color.

**2.2 RESILIENT BASE**

- A. Resilient Base: ASTM F1861, Type TV, vinyl, thermoplastic; top set Style B, Cove.
  - 1. Manufacturers: Subject to compliance with requirements provide products by one of the following:
    - a. Johnsonite, a Tarkett Company: [www.johnsonite.com/#sle](http://www.johnsonite.com/#sle).
    - b. Roppe Corporation; Contours Profiled Wall Base System: [www.roppe.com/#sle](http://www.roppe.com/#sle).
    - c. Substitutions: See Section 016000 - Product Requirements.
  - 2. Height: As indicated on Drawings.
  - 3. Length: Roll 120 feet.
  - 4. Color: As indicated on drawings.

**2.3 ACCESSORIES**

- A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
- B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.
- C. Adhesive for Rubber Flooring:
  - 1. Manufacturers:
    - a. Excelsior; U-705 Urethane; [excelsiorproducts.net](http://excelsiorproducts.net).
    - b. Substitutions: Section 01 6000 - Product Requirements.
- D. Moldings, Transition and Edge Strips: Same material as flooring.
  - 1. Manufacturers: Subject to compliance with requirements provide products by one of the following:
    - a. Burke Flooring: [www.burkeflooring.com/#sle](http://www.burkeflooring.com/#sle).
    - b. Johnsonite, a Tarkett Company: [www.johnsonite.com](http://www.johnsonite.com).
    - c. Roppe Corp: [www.roppe.com](http://www.roppe.com).

**PART 3 EXECUTION**

**3.1 EXAMINATION**

- A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.

- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.
- C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
  - 1. Test in accordance with Section 090561.
  - 2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.
- D. Verify that required floor-mounted utilities are in correct location.

**3.2 PREPARATION**

- A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
- B. Remove subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface.
- C. Prohibit traffic until filler is fully cured.

**3.3 Installation - General**

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install in accordance with manufacturer's written instructions.
- C. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.
- D. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
  - 1. Resilient Strips: Attach to substrate using adhesive.
- E. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.
- F. Install flooring in recessed floor access covers, maintaining floor pattern.
- G. At movable partitions, install flooring under partitions without interrupting floor pattern.

**3.4 Installation - Sheet Flooring**

- A. Lay flooring with joints and seams parallel to longer room dimensions, to produce minimum number of seams. Lay out seams to avoid widths less than 1/3 of roll width; match patterns at seams.
- B. Cut sheet at seams in accordance with manufacturer's instructions.
- C. Seal seams by heat welding where indicated.

**3.5 Installation - Resilient Base**

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.
- B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.
- C. Install base on solid backing. Bond tightly to wall and floor surfaces.
- D. Scribe and fit to door frames and other interruptions.

**3.6 CLEANING**

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean in accordance with manufacturer's written instructions.

**3.7 PROTECTION**

- A. Prohibit traffic on resilient flooring for 48 hours after installation.

**END OF SECTION 096500**



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**SECTION 099123 - INTERIOR PAINTING**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
- D. Do Not Paint or Finish the Following Items:
  - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
  - 2. Items indicated to receive other finishes.
  - 3. Items indicated to remain unfinished.
  - 4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
  - 5. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, and lead items.
  - 6. Marble, granite, slate, and other natural stones.
  - 7. Floors, unless specifically indicated.
  - 8. Ceramic and other tiles.
  - 9. Brick, architectural concrete, cast stone, integrally colored plaster, and stucco.
  - 10. Glass.
  - 11. Acoustical materials, unless specifically indicated.
  - 12. Concealed pipes, ducts, and conduits.

**1.2 RELATED REQUIREMENTS**

- A. Section 055000 - Metal Fabrications: Shop-primed items.
- B. Section 099113 - Exterior Painting.

**1.3 DEFINITIONS**

- A. Comply with ASTM D16 for interpretation of terms used in this section.

**1.4 REFERENCE STANDARDS**

- A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications 2019.
- B. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating 2023.
- C. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials 2020.
- D. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.
- E. SSPC-SP 1 - Solvent Cleaning 2015, with Editorial Revision (2016).
- F. SSPC-SP 6 - Commercial Blast Cleaning 2007.

**1.5 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
  - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").
  - 2. MPI product number (e.g., MPI #47).
  - 3. Cross-reference to specified paint system products to be used in project; include description of each system.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
  - 1. Where sheen is specified, submit samples in only that sheen.

2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens not required.
  - D. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.
  - E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
    1. See Section 016000 - Product Requirements, for additional provisions.
    2. Extra Paint and Finish Materials: 1 gal of each color; from the same product run, store where directed.
    3. Label each container with color in addition to the manufacturer's label.
- 1.6 QUALITY ASSURANCE**
- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.
- 1.7 MOCK-UP**
- A. See Section 014000 - Quality Requirements, for general requirements for mock-up.
  - B. Provide panel, 3 feet long by 5 feet wide, illustrating paint color, texture, and finish.
  - C. Locate where directed by Architect.
  - D. Mock-up may remain as part of the work.
- 1.8 DELIVERY, STORAGE, AND HANDLING**
- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
  - B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
  - C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.
- 1.9 FIELD CONDITIONS**
- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
  - B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
  - C. Do not apply materials when relative humidity exceeds 85 percent, at temperatures less than 5 degrees F above the dew point, or to damp or wet surfaces.
  - D. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.
  - E. Provide lighting level of 80 fc measured mid-height at substrate surface.
- PART 2 PRODUCTS**
- 2.1 MANUFACTURERS**
- A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
    1. Substitution of MPI-approved products by a different manufacturer is preferred over substitution of unapproved products by the same manufacturer.
    2. Substitution of a different paint system using MPI-approved products by the same manufacturer will be considered.
  - B. Paints:
    1. Behr Process Corporation: [www.behr.com/#sle](http://www.behr.com/#sle).
    2. PPG Paints: [www.ppgpaints.com/#sle](http://www.ppgpaints.com/#sle).
    3. Sherwin-Williams Company: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).
  - C. Primer Sealers: Same manufacturer as top coats.
- 2.2 PAINTS AND FINISHES - GENERAL**
- A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.

1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
  2. Supply each paint material in quantity required to complete entire project's work from a single production run.
  3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.
- C. Colors: As indicated on drawings.
1. Extend colors to surface edges; colors may change at any edge as directed by Architect.
  2. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling under which they are mounted.

### 2.3 PAINT SYSTEMS - INTERIOR

- A. Paint I-OP - Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board, concrete masonry units, wood, uncoated steel, shop primed steel, and galvanized steel.
1. Two top coats and one coat primer.
  2. Top Coat(s): Institutional Low Odor/VOC Interior Latex; MPI #143, 144, 145, 146, 147, or 148.
    - a. Products:
      - 1) Sherwin-Williams ProMar 200 HP Series, Eg-Shel. (MPI #145)
      - 2) Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Flat.
  3. Top Coat Sheen:
    - a. Flat: MPI gloss level 1; use this sheen for ceilings and other overhead surfaces.
    - b. Eggshell: MPI gloss level 3; use this sheen at all locations.
  4. Primer: As recommended by top coat manufacturer for specific substrate.
- B. Paint I-OP-MD-DT - Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals and wood:
1. Medium duty applications include doors and door frames.
  2. Two top coats and one coat primer.
  3. Top Coat(s): High Performance Architectural Interior Latex; MPI #138, 139, 140, or 141.
    - a. Products:
      - 1) Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, Eg-Shel. (MPI #139)
  4. Top Coat Sheen:
    - a. Satin: MPI gloss level 4; use this sheen at all locations.
  5. Primer: As recommended by top coat manufacturer for specific substrate.
- C. Paint I-OP-MD-WC - Medium Duty Vertical and Overhead: Including gypsum board, concrete masonry units, uncoated steel, shop primed steel, galvanized steel, and aluminum.
1. Two top coats and one coat primer.
  2. Top Coat(s): High Performance Architectural Interior Latex; MPI #138, 139, 140, or 141.
    - a. Products:
      - 1) Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, Eg-Shel. (MPI #139)
  3. Top Coat Sheen:
    - a. Eggshell: MPI gloss level 3; use this sheen at all locations.
  4. Primer: As recommended by top coat manufacturer for specific substrate.
- D. Paint I-OP-DF - Dry Fall: Metals; exposed structure and overhead-mounted services in utilitarian spaces, including shop primed steel deck, structural steel, metal fabrications, galvanized ducts, galvanized conduit, and galvanized piping.

1. Shop primer by others.
2. One top coat.
3. Top Coat: Latex Dry Fall; MPI #118, 155, or 226.
  - a. Products:
    - 1) Sherwin-Williams Waterborne Acrylic Dryfall, Flat. (MPI #118)
4. Top Coat Sheen:
  - a. Flat: MPI gloss level 1; use this sheen at all locations.

#### **2.4 ACCESSORY MATERIALS**

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

### **PART 3 EXECUTION**

#### **3.1 EXAMINATION**

- A. Do not begin application of paints and finishes until substrates have been adequately prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- D. Test shop-applied primer for compatibility with subsequent cover materials.
- E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:
  1. Gypsum Wallboard: 12 percent.
  2. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
  3. Interior Wood: 15 percent, measured in accordance with ASTM D4442.

#### **3.2 PREPARATION**

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or repair existing paints or finishes that exhibit surface defects.
- D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- E. Seal surfaces that might cause bleed through or staining of topcoat.
- F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- G. Concrete:
  1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
  2. Clean concrete according to ASTM D4258. Allow to dry.
- H. Masonry:
  1. Remove efflorescence and chalk. Do not coat surfaces if moisture content, alkalinity of surfaces, or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
  2. Prepare surface as recommended by top coat manufacturer.
- I. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- J. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.
- K. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- L. Copper: Remove contamination by steam, high-pressure water, or solvent washing.
- M. Galvanized Surfaces:

1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- N. Ferrous Metal:
  1. Solvent clean according to SSPC-SP 1.
  2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
  3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 Commercial Blast Cleaning. Protect from corrosion until coated.
- O. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.
- P. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

### **3.3 APPLICATION**

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- E. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- F. Sand wood and metal surfaces lightly between coats to achieve required finish.
- G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- H. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

### **3.4 CLEANING**

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

### **3.5 PROTECTION**

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

**END OF SECTION 099123**

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**SECTION 101419 - DIMENSIONAL LETTER SIGNAGE**

**PART 1 GENERAL**

**1.1 Section Includes**

- A. Dimensional letter signage.

**1.2 Reference Standards**

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines current edition.
- B. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- C. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

**1.3 Submittals**

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's product literature for each type of dimensional letter sign, indicating style, font, colors, locations, and overall dimensions of each sign.
- C. Shop Drawings:
  - 1. Include dimensions, locations, elevations, materials, text and graphic layout, and attachment details.

**1.4 Delivery, Storage, and Handling**

- A. Package dimensional letter signs as required to prevent damage before installation.
- B. Store under cover and elevated above grade.

**PART 2 PRODUCTS**

**2.1 Dimensional Letters**

- A. Applications: Interior Signage.
  - 1. Use individual wood letters.
  - 2. Mounting Location: Interior as indicated on drawings.
- B. WoodLetters:
  - 1. Material: Medium Density Fiberboard.
  - 2. Thickness: 1/8 inch minimum.
  - 3. Letter Height: As indicated on drawings.
  - 4. Text and Typeface: San Serif; Arial or similar.
  - 5. Finish: Primed for field painting.
  - 6. Mounting: Adhesive and finish nails.

**PART 3 EXECUTION**

**3.1 Examination**

- A. Verify that substrate surfaces are ready to receive work.
- B. Notify Architect if conditions are not suitable for installation of signs; do not proceed until conditions are satisfactory.

**3.2 Installation**

- A. Install in accordance with manufacturer's instructions.
- B. Install with horizontal edges level.
- C. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

**END OF SECTION 101419**



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**SECTION 101423 - PANEL SIGNAGE**

**PART 1 GENERAL**

**1.1 Section Includes**

- A. Panel signage.

**1.2 Reference Standards**

- A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- B. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

**1.3 Submittals**

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's product literature for each type of panel sign, indicating styles, font, foreground and background colors, locations, and overall dimensions of each sign.
- C. Shop Drawings:
  - 1. Include dimensions, elevations, materials, text and graphic layout, and attachment details.
- D. Selection Samples: Where colors, materials, and finishes are not specified, submit two sets of color selection charts or chips.

**1.4 Delivery, Storage, and Handling**

- A. Package signs as required to prevent damage before installation.
- B. Package room and door signs in sequential order of installation, labeled by floor or building.
- C. Store tape adhesive at normal room temperature.

**1.5 Field Conditions**

- A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.
- B. Maintain minimum ambient temperature during and after installation.

**PART 2 PRODUCTS**

**2.1 Manufacturers**

- A. Panel Signage:
  - 1. Best Sign Systems, Inc: [www.bestsigns.com/#sle](http://www.bestsigns.com/#sle).
  - 2. FASTSIGNS International, Inc: [www.fastsigns.com/#sle](http://www.fastsigns.com/#sle).
  - 3. Substitutions: See Section 016000 - Product Requirements.

**2.2 Regulatory Requirements**

- A. Accessibility Requirements: Comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most restrictive requirements.

**2.3 Panel Signage**

- A. Panel Signage:
  - 1. Application: Room and door signs.
  - 2. Description: Flat signs with engraved panel media, tactile characters.
  - 3. Sign Size: As indicated on drawings.
  - 4. Total Thickness: 1/8 inch.
  - 5. Color and Font, unless otherwise indicated:
    - a. Character Font: Helvetica, Arial, or other sans serif font.
    - b. Character Case: Upper and lower case (title case).
    - c. Background Color: As selected by Architect from manufacturer's standard range.
    - d. Character Color: Contrasting color.
  - 6. Material: Laminated colored plastic engraved through face to expose core as background color.
  - 7. Profile: Flat panel without frame.
    - a. Frame Finish: Black anodized.
  - 8. Tactile Letters: Raised 1/32 inch minimum.

- 9. Braille: Grade II, ADA-compliant.
- 10. One-Sided Wall Mounting: Tape adhesive.

**2.4 Accessories**

- A. Tape Adhesive: Double-sided tape, permanent adhesive.

**PART 3 EXECUTION**

**3.1 Examination**

- A. Verify that substrate surfaces are ready to receive work.
- B. Notify Architect if conditions are not suitable for installation of signs; do not proceed until conditions are satisfactory.

**3.2 Installation**

- A. Install in accordance with manufacturer's instructions.
- B. Install with horizontal edges level.
- C. Locate panel signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.
- D. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

**END OF SECTION 101423**

**SECTION 102113.19 - PLASTIC TOILET COMPARTMENTS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Solid plastic toilet compartments.
- B. Urinal screens.

**1.2 RELATED REQUIREMENTS**

- A. Section 061000 - Rough Carpentry: Blocking and supports.
- B. Section 102800 - Toilet, Bath, and Laundry Accessories.

**1.3 REFERENCE STANDARDS**

- A. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth 2019.

**1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination: Coordinate the work with placement of support framing and anchors in walls and ceilings.

**1.5 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on panel construction, hardware, and accessories.
- C. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.
- D. Samples: Submit two samples of partition panels, 6 by 6 inch in size illustrating panel finish, color, and sheen.
- E. Closeout Submittals: Maintenance data.

**PART 2 PRODUCTS**

**2.1 MANUFACTURERS**

- A. Solid Plastic Toilet Compartments: Basis of Design Product: Subject to compliance with requirements, provide Accurate Partitions Corporation, Solid Plastic Partitions, or comparable product by one of the following:
  - 1. Inpro: [www.inprocorp.com/#sle](http://www.inprocorp.com/#sle).
  - 2. Scranton Products; Hiny Hiders Partitions: [www.scrantonproducts.com/#sle](http://www.scrantonproducts.com/#sle).
  - 3. Global Partitions [globalpartitions.com](http://globalpartitions.com)
  - 4. Substitutions: Section 016000 - Product Requirements.

**2.2 PLASTIC TOILET COMPARTMENTS**

- A. Solid Plastic Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid molded high density polyethylene (HDPE), tested in accordance with NFPA 286; floor-mounted headrail-braced.
  - 1. Color: As indicated on drawings..
- B. Doors:
  - 1. Thickness: 1 inch.
  - 2. Width: 24 inch.
  - 3. Width for Handicapped Use: 36 inch, out-swinging.
  - 4. Height: 55 inch.
- C. Panels:
  - 1. Thickness: 1 inch.
  - 2. Height: 55 inch.
  - 3. Depth: As indicated on drawings.
- D. Pilasters:
  - 1. Thickness: 1 inch.
  - 2. Width: As required to fit space; minimum 3 inch.
- E. Screens: Without doors; to match compartments; mounted to wall with two panel brackets.

**2.3 ACCESSORIES**

- A. Pilaster Shoes: Stainless steel, satin finish, 3 inches high; concealing floor fastenings.
- B. Head Rails: Extruded aluminum, anti-grip profile.
- C. Wall and Pilaster Brackets: Stainless steel; manufacturer's standard type for conditions indicated on drawings.
- D. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.
- E. Hinges: Stainless steel, manufacturer's standard finish.
  - 1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.
- F. Door Hardware: Stainless steel, manufacturer's standard finish.
  - 1. Door Latch: Slide type with exterior emergency access feature.
  - 2. Provide door pull for outswinging doors.
- G. Coat Hook with Rubber Bumper: One per compartment, mounted on door.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify correct spacing of and between plumbing fixtures.
- C. Verify correct location of built-in framing, anchorage, and bracing.

**3.2 INSTALLATION**

- A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.
- B. Maintain 3/8 inch to 1/2 inch space between wall and panels and between wall and end pilasters.
- C. Attach panel brackets securely to walls using anchor devices.
- D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.
- E. Field touch-up of scratches or damaged finish will not be permitted. Replace damaged or scratched materials with new materials.

**3.3 TOLERANCES**

- A. Maximum Variation From True Position: 1/4 inch.
- B. Maximum Variation From Plumb: 1/8 inch.

**3.4 ADJUSTING**

- A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.
- B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.

**3.5 SCHEDULES**

**END OF SECTION 102113.19**

**SECTION 102600 - WALL AND DOOR PROTECTION**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Corner guards.

**1.2 REFERENCE STANDARDS**

- A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics 2023, with Editorial Revision.
- B. ASTM F476 - Standard Test Methods for Security of Swinging Door Assemblies 2023.

**1.3 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Indicate physical dimensions, features, wall mounting brackets with mounted measurements, anchorage details, and rough-in measurements.
- C. Samples: Submit samples illustrating component design, configurations, joinery, color and finish.
- D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- E. Maintenance Data: Manufacturer's instructions for care and cleaning of each type of product. Include information about both recommended and potentially detrimental cleaning materials and methods.

**1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver wall and door protection items in original, undamaged protective packaging. Label items to designate installation locations.
- B. Protect work from moisture damage.
- C. Protect work from UV light damage.
- D. Do not deliver products to project site until areas for storage and installation are fully enclosed, and interior temperature and humidity are in compliance with manufacturer's recommendations for each type of item.
- E. Store products in either horizontal or vertical position, in compliance with manufacturer's instructions.

**1.5 WARRANTY**

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.

**PART 2 PRODUCTS**

**2.1 MANUFACTURERS**

- A. Corner Guards:
  - 1. Babcock-Davis: [www.babcockdavis.com/#sle](http://www.babcockdavis.com/#sle).
  - 2. Inpro: [www.inprocorp.com/#sle](http://www.inprocorp.com/#sle).
  - 3. Koroseal Interior Products: [www.koroseal.com/#sle](http://www.koroseal.com/#sle).

**2.2 PERFORMANCE CRITERIA**

- A. Impact Strength: Unless otherwise noted, provide protection products and assemblies that have been successfully tested for compliance with applicable provisions of ASTM D256 and/or ASTM F476.

**2.3 PRODUCT TYPES**

- A. Corner Guards - Surface Mounted:
  - 1. Material: High impact vinyl with full height extruded aluminum retainer.
  - 2. Width of Wings: 1 1/2" or 2" inches.
  - 3. Corner: Square.
  - 4. Color: As selected from manufacturer's standard colors.
  - 5. Length: One piece 98 inches
  - 6. Preformed end caps.
- B. Corner Guards - Surface Mounted, Transparent Plastic:

1. Thickness: 0.075 inch.
  2. Width of Wings: 3/4 inches, with radiused corner and rounded wing tips.
  3. Corner Angle: 90 degrees.
  4. Length: One piece, as indicated on drawings.
- C. Adhesives and Primers: As recommended by manufacturer.
- D. Mounting Brackets and Attachment Hardware: Appropriate to component and substrate.

**2.4 FABRICATION**

- A. Fabricate components with tight joints, corners and seams.
- B. Pre-drill holes for attachment.
- C. Form end trim closure by capping and finishing smooth.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

- A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.
- B. Verify that substrate surfaces for adhered items are clean and smooth.

**3.2 INSTALLATION**

- A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.
- B. Position corner guard 4 inches above finished floor to ceiling.

**END OF SECTION 102600**

**SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Commercial toilet accessories.
- B. Utility room accessories.

**1.2 REFERENCE STANDARDS**

- A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- B. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service 2022.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2023.
- D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2023.
- E. ASTM B86 - Standard Specification for Zinc and Zinc-Aluminum (ZA) Alloy Foundry and Die Castings 2022.
- F. ASTM C1036 - Standard Specification for Flat Glass 2021.
- G. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror 2018.
- H. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

**1.3 ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate the work with the placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.

**1.4 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

**1.5 MOCK-UPS**

- A. Construct a mock up of toilet accessory configurations (men's stall, women's stall, standard, ADA) for Owner and Architect review and approval prior to installation.

**1.6 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data

**PART 2 PRODUCTS**

**2.1 MATERIALS**

- A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
  - 1. Grind welded joints smooth.
  - 2. Fabricate units made of metal sheet of seamless sheets with flat surfaces.
- B. Keys: Provide two (2) keys for each accessory to Owner; master key lockable accessories.
- C. Stainless Steel Sheet: ASTM A666, Type 304.
- D. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.
- E. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.
- F. Zinc Alloy: Die cast, ASTM B86.
- G. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.
- H. Adhesive: Two component epoxy type, waterproof.
- I. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.
- J. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

**2.2 FINISHES**

- A. Stainless Steel: Satin finish, unless otherwise noted.



### 2.3 Commercial Toilet Accessories

- A. Mirrors: Stainless steel channel framed, 1/4 inch thick annealed float glass; ASTM C1036.
  - 1. Annealed Float Glass: Silvering, protective and physical characteristics in compliance with ASTM C1503.
  - 2. Size: As indicated on drawings.
  - 3. Frame: 0.05 inch angle shapes, with mitered and welded and ground corners, and tamperproof hanging system; satin finish.
- B. Grab Bars: Satin stainless steel, nonslip grasping surface finish.
  - 1. Standard Duty Grab Bars:
  - 2. Push/Pull Point Load: 250 pound-force, minimum.
  - 3. Dimensions: 1 1/2" inch outside diameter, minimum 0.05 inch wall thickness, concealed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.
  - 4. Finish: Satin.
  - 5. Length and Configuration: 18", 36", and 42" as indicated on drawings and located complying with ADA requirements.
  - 6. Basis-of-Design: Subject to compliance with requirements, provide Bobrick Model 6806 Series grab bars or product by one of the following:
    - a. AJW Architectural Products
    - b. American Specialties, Inc.
    - c. Bradley Corporation
    - d. Gamco USA
- C. Combination Sanitary Napkin/Tampon Dispenser: Satin Stainless steel, surface-mounted.
  - 1. Door: Seamless 0.05 inch door with returned edges and tumbler lock.
  - 2. Cabinet: Fully welded, 0.03 inch thick sheet.
  - 3. Identify dispensers slots without using brand names.
  - 4. Minimum capacity: 20 napkins and 20 tampons.
  - 5. Basis-of-Design: Subject to compliance with requirements, provide Bobrick B-2706 or comparable product by one of the following:
    - a. AJW Architectural Products
    - b. American Specialties, Inc.
    - c. Bradley Corporation
    - d. Gamco USA
- D. Sanitary Napkin Disposal Unit: Stainless steel, surface-mounted, self-closing door, locking bottom panel with full-length stainless steel piano-type hinge, removable receptacle.
  - 1. Basis-of-Design: Subject to compliance with requirements, provide Bobrick B-254 sanitary napkin disposal of comparable product by one of the following:
    - a. AJW Architectural Products
    - b. American Specialties, Inc.
    - c. Bradley Corporation
    - d. Gamco USA

### 2.4 Utility Room Accessories

- A. Mop and Broom Holder: 0.05 inch thick stainless steel, Type 304, hat-shaped channel.
  - 1. Holders: Three spring-loaded rubber cam holders.
  - 2. Length: Twenty Four (24) inches.
  - 3. Basis-of-Design: Subject to compliance with requirements, provide Bobrick B-223 mop and broom holder or comparable product by one of the following:
    - a. AJW Architectural Products
    - b. American Specialties, Inc.
    - c. Bradley Corporation
    - d. Gamco USA

- B. Combination Utility Shelf/Mop and Broom Holder: 0.05 inch thick stainless steel, Type 304, with 1/2 inch returned edges, 0.06 inch steel wall brackets.
  - 1. Drying rod: Stainless steel, 1/4 inch diameter.
  - 2. Hooks: 2, 0.06 inch stainless steel rag hooks at shelf front.
  - 3. Mop/broom holders: Three spring-loaded rubber cam holders at shelf front.
  - 4. Length: Manufacturer's standard length for number of holders/hooks.
  - 5. Basis-of-Design: Subject to compliance with requirements, provide American Specialties, Inc. 1315-3 utility shelf/mop and broom holder or comparable product by one of the following:
    - a. AJW Architectural Products
    - b. Bradley Corporation
    - c. Gamco USA

**PART 3 EXECUTION**

**3.1 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.
- C. For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.
- D. Verify that field measurements are as indicated on drawings.

**3.2 PREPARATION**

- A. Provide templates and rough-in measurements as required.

**3.3 INSTALLATION**

- A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Mounting Heights: As required by accessibility regulations and as indicated on drawings.

**3.4 PROTECTION**

- A. Protect installed accessories from damage due to subsequent construction operations.

**END OF SECTION 102800**

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**SECTION 104400 - FIRE PROTECTION SPECIALTIES**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Fire extinguisher cabinets and brackets.
- B. Accessories.

**1.2 REFERENCE STANDARDS**

- A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2013a (Reapproved 2017).

**1.3 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide extinguisher operational features, extinguisher ratings and classifications, color and finish, anchorage details, and installation instructions for each type of product.
- C. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

**1.4 FIELD CONDITIONS**

- A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

**PART 2 PRODUCTS**

**2.1 MANUFACTURERS**

- A. Fire Extinguisher Cabinets and Accessories:
  - 1. Activar Construction Products Group: [www.activarcpg.com/#sle](http://www.activarcpg.com/#sle).
  - 2. Kidde, a unit of United Technologies Corp: [www.kidde.com](http://www.kidde.com).
  - 3. Larsen's Manufacturing Co: [www.larsensmfg.com](http://www.larsensmfg.com).
  - 4. Nystrom, Inc: [www.nystrom.com/sle](http://www.nystrom.com/sle).
  - 5. Guardian Fire Equipment, Inc..
  - 6. Substitutions: See Section 016000 - Product Requirements.

**2.2 FIRE EXTINGUISHER CABINETS**

- A. Fire Rating: Listed and labeled in accordance with ASTM E814 requirements for fire resistance rating of walls where being installed.
- B. Cabinet Construction: Non-fire rated.
- C. Fire Rated Cabinet Construction: One-hour fire rated.
- D. Cabinet Configuration: Semi-recessed type with multipurpose dry chemical fire extinguisher.
  - 1. Basis of Design Product: Subject to compliance with requirements, provide Larsens Manufacturing Company; 2409-R7 Architectural Series Vertical Duo or comparable product by one of the manufacturers listed above.
  - 2. Size to accommodate accessories.
  - 3. Trim: Square edge.
  - 4. Trim and Door Material: Steel sheet.
  - 5. Door Glazing: Clear transparent acrylic sheet.
  - 6. Identification: Identify fire extinguisher in fire protection cabinet with the words FIRE EXTINGUISHER. Comply with requirements of authorities having jurisdiction.
    - a. Location: Applied to cabinet door.
    - b. Application process: Pressure-sensitive vinyl letters.
    - c. Lettering color: Red.
    - d. Orientation: Vertical.
- E. Cabinet Configuration: Surface mounted type with multipurpose dry chemical fire extinguisher.
  - 1. Basis of Design Product: Subject to compliance with requirements, provide Larsens Manufacturing Company; 2409-SM Architectural Series Vertical Duo or comparable product by one of the manufacturers listed above.
  - 2. Size to accommodate accessories.

3. Trim: Not applicable.
  4. Trim and Door Material: Steel sheet.
  5. Door Glazing: Clear transparent acrylic sheet.
  6. Identification: Identify fire extinguisher in fire protection cabinet with the words FIRE EXTINGUISHER. Comply with requirements of authorities having jurisdiction.
    - a. Location: Applied to cabinet door.
    - b. Application process: Pressure-sensitive vinyl letters.
    - c. Lettering color: Red.
    - d. Orientation: Vertical.
- F. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.

**2.3 ACCESSORIES**

- A. Extinguisher Brackets: Formed steel, chrome-plated.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify rough openings for cabinet are correctly sized and located.

**3.2 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install cabinets plumb and level in wall openings, 60 inches from finished floor to top of cabinet, confirm height acceptable to authorities having jurisdiction.
- C. Secure rigidly in place.

**END OF SECTION 104400**

**SECTION 123600 - COUNTERTOPS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Countertops for architectural cabinet work.

**1.2 RELATED REQUIREMENTS**

- A. Section 064100 - Architectural Wood Casework.

**1.3 REFERENCE STANDARDS**

- A. ANSI A208.1 - American National Standard for Particleboard 2022.
- B. ANSI A208.2 - Medium Density Fiberboard (MDF) for Interior Applications 2022.
- C. ISFA 3-01 - Classification and Standards for Quartz Surfacing Material 2013.
- D. NEMA LD 3 - High-Pressure Decorative Laminates 2005.
- E. NSI (DSDM) - Dimensional Stone Design Manual, Version VIII 2016.
- F. PS 1 - Structural Plywood 2019.

**1.4 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Specimen warranty.
- C. Shop Drawings: Complete details of materials and installation; combine with shop drawings of cabinets and casework specified in other sections.
- D. Verification Samples: For each finish product specified, minimum size 6 inches square, representing actual product, color, and patterns.
- E. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

**1.5 QUALITY ASSURANCE**

- A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

**1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

**1.7 FIELD CONDITIONS**

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

**PART 2 PRODUCTS**

**2.1 COUNTERTOPS**

- A. Natural Quartz and Resin Composite Countertops: Sheet or slab of natural quartz and plastic resin over continuous substrate.
  - 1. Flat Sheet Thickness: 3/4 inch, minimum.
  - 2. Natural Quartz and Resin Composite Sheets, Slabs and Castings: Complying with ISFA 3-01 and NEMA LD 3; orthophthalic polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard stone fabrication tools; no surface coating; color and pattern consistent throughout thickness.
    - a. Manufacturers:
      - 1) E.I. du Pont de Nemours and Company: [www.dupont.com](http://www.dupont.com)
      - 2) Daltile; ONE: [www.daltilestonecenter.com](http://www.daltilestonecenter.com)
      - 3) Consentino; Silestone USA: [www.silestoneusa.com](http://www.silestoneusa.com)

- 4) Terrazzo & Marble Supply Companies; DIFINITI Quartz:  
www.tmsupply.com/#sle.
- 5) Wilsonart: www.wilsonart.com.
- b. Factory fabricate components to the greatest extent practical in sizes and shapes indicated; comply with NSI (DSDM).
- c. Finish on Exposed Surfaces: Polished.
- d. Color and Pattern: As indicated on drawings.
3. Other Components Thickness: 3/4 inch, minimum.
4. Exposed Edge Treatment: Built up to minimum 1-1/4 inch thick; square edge; use marine edge at sinks.
5. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.
6. Fabricate in accordance with manufacturer's standard requirements.

## **2.2 MATERIALS**

- A. Wood-Based Components:
  1. Wood fabricated from old growth timber is not permitted.
- B. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch thick; join lengths using metal splines.
- C. Particleboard for Supporting Substrate: ANSI A208.1 Grade 2-M-2, 45 pcf minimum density; minimum 3/4 inch thick; join lengths using metal splines.
- D. Medium Density Fiberboard for Supporting Substrate: ANSI A208.2.
- E. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.
- F. Joint Sealant: Mildew-resistant silicone sealant, clear.

## **2.3 FABRICATION**

- A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
  1. Join lengths of tops using best method recommended by manufacturer.
  2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
  3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
- B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
  1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
  2. Height: 4 inches, unless otherwise indicated.
- C. Solid Surfacing: Fabricate tops up to 144 inches long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

### **3.2 PREPARATION**

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

**3.3 INSTALLATION**

- A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
- B. Seal joint between back/end splashes and vertical surfaces.

**3.4 TOLERANCES**

- A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.
- B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.
- C. Field Joints: 1/8 inch wide, maximum.

**3.5 CLEANING**

- A. Clean countertops surfaces thoroughly.

**3.6 PROTECTION**

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

***END OF SECTION 123600***



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**MISSOURI S&T CENTENNIAL HALL IMPROVEMENTS**  
22-703A

*SECTION 142400 - HYDRAULIC SERVICE ELEVATOR RENOVATION*

**PART 1 GENERAL**

**1.1 RELATED DOCUMENTS**

- A. General Provisions of Contract, including general and supplementary conditions, special conditions and Division I Specification sections, apply to work of this section.
- B. Provide all labor, materials, services, and equipment necessary to complete the renovation of the elevator as specified herein.
- C. Anything not mentioned in these specifications or vice versa, as well as any work which is obviously necessary to complete the Project, within the limits established by the drawings, specifications and codes, although not shown on or described therein, shall be performed by the Contractor as part of their work.

**1.2 DESCRIPTION OF WORK**

- A. This section includes the substantial renovation of one (1) direct plunger hydraulic service elevator in Centennial Hall, 300 W. 12<sup>th</sup> Street, Rolla, Missouri as noted in the elevator schedule at the end of this section. The schedule indicates the elevator to be renovated, required performance, control, capacity, features, and finishes for the elevator.
- B. Hydraulic elevator is defined to include a plunger & cylinder unit connected to the elevator platform which will raise and lower the elevator by using pumping units using oil as the medium complete with components, controls and devices as indicated as required for safely operating elevator at rated speed and capacity.
- C. The Contractor in this section shall provide a written schedule, detailing specific tasks for the elevator and critical dates for the completion of related work. This schedule shall be acceptable to the Owner. The elevator shall be renovated per this schedule. Once work begins on site, the Elevator Contractor shall keep appropriate manpower onsite continuously until completion.

**1.3 SUBMITTALS**

- A. Refer to Division 1 for additional information regarding submittals, including submittal requirements, processing procedures, and limitations of review.
- B. Pre-Construction Submittals: The following shall be submitted for review prior to manufacturing of equipment.
  - 1. Product Data: Submit manufacturer's technical product data and instructions for each principal component or product. List and describe features of control system, performances, and operating characteristics. Submit brochures of all signal and operational fixtures, control and drive equipment, hoistway door equipment, door operator, and door protective device.
  - 2. Shop Drawings: Shop drawings shall be prepared by skilled draftsmen and presented in a clear and thorough manner as follows:
    - a. Job-specific Elevator Layout Drawings: Drawings shall include dimensional layout drawings for the elevator, showing plans, elevations, sections, and large scale details of machine room indicating service at each landing, coordination with building structure, and relationships with other construction including, but not limited to, electrical and HVAC equipment. Indicate capacities, speeds, sizes, performances, operations, safety features, controls, finishes, and similar information on the layout drawings.
    - b. Fixture drawings: Submit job-specific, straight line dimensional drawings of all signal and operational fixtures.
    - c. Cab Drawing: Submit job-specific plans, elevations, and details of the new cab enclosure and finishes.
    - d. Approval of shop drawings is for general arrangement only and does not include measurement, which is the contractor's responsibility, or approval of variations from the contract documents. The purpose of the shop drawing submittals by the contractor is to demonstrate to the owner the contractor understands the design concept and demonstrates an understanding of the equipment and materials to be furnished.
  - 3. Samples: Submit samples of exposed finishes of car enclosures, hoistway entrances, and signal equipment per Division 1.
  - 4. Maintenance Certification: The Contractor shall submit a written certification, signed by the Contractor and the manufacturer of the equipment, making a commitment to provide direct support to the Owner, or the Owner's elevator maintenance service representative, including availability of parts (for inventory, not on an "exchange only" basis), diagnostic tools, and

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technical & engineering support. In addition, all parts and support shall be provided at a reasonable cost in line for which the original manufacturer would charge to its own customer base and response shall be in a timely manner. This commitment shall remain in effect for a minimum of twenty-five (25) years after substantial completion of the project.

- C. Post Construction Submittals: Prior to completion and acceptance of the project, the following shall be submitted for review and acceptance.
1. Diagnostic Device: Upon completion of work provide diagnostic testing device, or maintenance terminal, suitable for all troubleshooting and testing procedures related to the specific type of microprocessor control. This diagnostic testing device, or maintenance terminal, shall conform to the operating procedures under the testing section of these specifications. If onboard diagnostics are provided in the controller to meet this requirement, provide Adjustors Manual for proper interpretation of onboard diagnostics (see 1.3.C.2.b below).
  2. Maintenance Manuals: Submit job-specific bound manuals for each elevator or group of elevators. Submit one (1) hard copy plus a minimum of one (1) electronic copy in .pdf format.
    - a. Operating and maintenance instructions, lubricating schedule and instructions, parts listing, recommended parts inventory listing for motor and critical components, diagnostic device operations manual, emergency instructions and similar information. Include description of any manufacturer specific safety features that are beyond code requirements.
    - b. The diagnostic device operations manual shall be complete with adjustment settings, sequence of operation, and other diagnostic technical data required for adjustments, tuning, maintenance, and operation of the elevators including performance of all required acceptance and periodic testing required by the Elevator Code. User's instruction manual shall include access codes required for accessing microprocessor equipment for adjusting or programming.
    - c. Detailed "Maintenance Control Program" - specific to the elevator as required by Elevator Code. The MCP shall be in place to maintain the equipment in compliance with Elevator Code. The MCP shall specify examinations, tests, cleaning, lubrication, and adjustments to applicable components at regular intervals and shall comply with Section 8.6.1 of the Elevator Code. The MCP shall include "On-Site Documentation" and a method for "Maintenance Records" and "On-Site Maintenance Records" as described in Elevator Code. One (1) hard copy of the "Maintenance Control Program," identical to the MCP provided in the Maintenance Manual, shall be placed for use in the elevator control room.
    - d. Wiring Diagrams: Complete electrical circuit diagrams for control and operational features as installed, showing location and wiring for power, signal and control systems. The diagrams shall differentiate clearly between manufacturer-installed wiring and field installed wiring.
  3. On-Site Wiring Diagrams: Provide job-specific wiring diagrams located near the elevator controller in the elevator control room. Provide one (1) hard copy sized at 11" x 17" minimum, clear-laminated wiring diagrams.
  4. Keys: Provide a total of six (6) sets of keys for each type of key fixture on the elevator equipment. Keys shall be tagged with permanent marking, identifying function and use.
  5. Certificate Frame: Provide a certificate frame in the elevator machine room mounted in a conspicuous location. Frame shall be made of a quality metal with a window size to house the operating certificate from the State of Missouri.
  6. Certificates and Permits: Provide Owner with copies of all inspection/acceptance certificates and operating permits as required by governing authorities to allow normal, unrestricted use of elevator.

**1.4 QUALITY ASSURANCE**

- A. Installer Qualification: The elevator manufacturer, or a licensee of the manufacturer, who has a record of successful experience with the renovation of similar elevators. The contractors shall have, as a minimum, the following qualifications and documentation verifying these qualifications shall be submitted prior to award:
1. Minimum of five (5) years successful experience in installing and servicing similar elevator renovations.

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2. Installed at least ten (10) completed and accepted elevator systems of similar size, scope, logic control, and motion control required by this contract.
  3. An existing in-house administrative and technical organization staffed with competent personnel who are experienced in the elevator related work required to install and service the elevator system as specified.
- B. Elevator Code: Except for more stringent requirements as indicated or imposed by governing regulations (which must be complied with), comply with applicable requirements of the ASME A17.1-2016 Safety Code for Elevators and Escalators hereinafter referred to as the "Elevator Code" as required by the local Authority Having Jurisdiction (AHJ) and the 2021 International Building Code, hereinafter referred to as the "Building Code".
1. The Authority Having Jurisdiction has waived the requirement for 3001.2 in Building Code. The elevator phone shall meet the requirements of Elevator Code as applicable.
- C. NEC Code: Comply with the NEC Code and specifically with sections relating to electrical work for elevators.
- D. Fire Resistance of Entrances: Comply with NFPA No. 80 and provide units bearing appropriate UL labels or other equivalent testing agency.
- E. Accessibility Standards: Comply with the 2009 ICC/ANSI A117.1 Accessible and Usable Buildings and Facilities. Comply with the 2010 ADA Standards for Accessible Design dated September 15, 2010.
- F. Performance Requirements: Provide an elevator that meets the following performance requirements:
1. Speed: +/- 5% of specified contract speed under a full load condition in either direction.
  2. Stopping Accuracy: 1/4 inch under any loading condition.
  3. Floor to Floor Performance Time: 20.5 seconds (based on a floor height of 15'-0" from 1 to 2) from start of doors closing until doors are 3/4 open and car is level and stopped at the next successive floor under any loading condition or travel direction.
  4. Door Close Time: 3.5 seconds.
  5. Door Open Time: 2.5 seconds.
  6. Door Open Dwell Time: 3.0 seconds car call / 5.0 seconds hall call. Dwell time shall be canceled upon activation of the door protection device or any car call button.
  7. Nudging: 45 seconds (adjustable and capable of turning on or off)
  8. Smooth acceleration and deceleration for comfort of ride.
- 1.5 INITIAL MAINTENANCE SERVICE AND WARRANTY
- A. Maintenance Service: Furnish maintenance and callback service on the one (1) hydraulic elevator for a period of twelve (12) months following date of final acceptance of all elevator work as specified herein. The maintenance and call back service shall include at a minimum, but not be limited to, the full maintenance requirements as follows:
1. Maintenance service shall be performed by skilled elevator personnel directly employed and supervised by the same company that furnished and installed the elevator equipment specified herein.
  2. This service shall include:
    - a. Monthly examination of the hydraulic unit as a minimum.
    - b. Lubricating, adjusting, repairing and replacing of all parts as necessary to keep the equipment, including battery packs, in a first class condition and proper working order.
    - c. Furnish all lubricants and parts required.
    - d. Assure smooth and consistent operation of automatic hoistway doors and car doors.
    - e. Assure smooth starting and stopping and accurate leveling at all times.
    - f. Provide all periodic annual and maintenance testing in accordance with the Elevator Code.
    - g. The contractor shall keep clean of all dirt and debris guide rails, top of car, bottom of platform, machine room, unit hoistway and pit. All necessary cleaning supplies and equipment shall be furnished by the contractor.
    - h. An annual inspection, as described in the Elevator Code and/or as required by governing authorities, shall be performed by the contractor. The units shall have the State annual inspection performed during the normal anniversary dates of the elevators in the building

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- during the Maintenance Service period identified above. Coordinate exact dates of required annual inspections with Owner's Representative and the Certified Inspector.
3. The maintenance service shall not include the performance of any work required as a result of improper use, accidents or negligence, for which the contractor is not directly responsible.
  4. All work shall be completed by trained employees of the elevator contractor and performed during normal working hours. Include 24 hour/day, 7 days/week emergency callback service. Owner is responsible for the difference between straight time cost and overtime cost of said callbacks. Exclude only repair/replacement due to misuse, abuse, accidents, or neglect caused by persons other than installer's personnel. Response to non-emergency service calls shall be within 2 hours of the call and response to emergency service calls shall be within 1 hour of the call.
  5. The contractor shall maintain a log in the elevator machine room. The log shall list the date and time of routine examinations and all trouble calls. Each trouble call shall be fully described including the nature of the call, necessary corrections performed and or parts replaced.
  6. Maintenance service shall conform to the requirements of Section 8.6 of Elevator Code. This shall include the provision of a written Maintenance Control Program and maintenance record keeping that is consistent with Elevator Code requirements.
  7. During the eleventh month of the new installation maintenance service period, a post warranty inspection shall be coordinated by the installing contractor to ensure the elevator is in a good state of maintenance repair and all maintenance manuals, diagnostic tools and Maintenance Control Program documents are in place. The inspection shall include the installing contractor, the Owner's current campus elevator maintenance contractor and the Owner's representative.
- B. General Warranty: The elevator warranty specified in this section shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- C. Warranty: Provide special project warranty, signed by contractor, installer, and Manufacturer, agreeing to replace, repair/restore defective materials and workmanship of elevator work during warranty period. "Defective" is hereby defined to include, but not by way of limitation, operation or control system failures, performances below required minimums, excessive wear, unusual deterioration or aging of materials or finishes, unsafe conditions, the need for excessive maintenance, abnormal noise or vibration, and similar unusual, unexpected and unsatisfactory conditions. The warranty period is twelve (12) months starting on date of final acceptance of the elevator and shall be extended until "defects" as defined in this warranty are corrected.

**PART 2 MATERIALS AND COMPONENTS**

**2.1 GENERAL**

- A. Provide manufacturer's base pre-engineered elevator system with modifications or added features that will comply with the elevator work requirements as specified herein or, at manufacturer's option, provide custom manufactured base elevator system that will comply with the requirements. Where components are not otherwise indicated, provide standard components, published by manufacturer as included in standard pre-engineered elevator systems, and as required for a complete system.

**2.2 ELEVATOR MACHINERY AND CONTROL EQUIPMENT**

- A. Hydraulic Power Unit: The existing pumping unit shall be removed and replaced with a new pumping unit of an integral design and shall include an electric motor connected to a pump, a hydraulic control system, storage tank, necessary piping connections, and a controller, all compactly designed as a self-contained unit. The new pumping unit shall be located in the elevator machine room and the controller shall be mounted on the end of the machine or mounted on the wall of the machine room to meet NEC working clearance requirements. The hydraulic power unit shall be securely fastened to the machine room floor to prevent the tank from being overturned or displaced. Elevator contractor shall verify location and dimensions in general layout of machine room. Provide proper isolation pads under the feet of the pumping unit to substantially eliminate vibrations from the operating unit to the building structure.

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1. The hydraulic control system shall be a compact design suitable for operation under the required pressures and it shall be mounted in the storage tank. The control valve will be a manifold type with up, down and check valve sections. A control section including solenoid valves will direct the main valve and control up and down starting, transition from full speed to leveling speed, up and down stops, pressure relief and manual lowering. Down speed and up and down leveling shall be controlled at the main valve sections. All of these functions shall be fully adjustable for maximum smoothness and to meet contract conditions. All control systems shall be pre-adjusted at the factory. A manual lowering feature shall be provided to permit lowering the elevator at slow speed in the event of power failure or for adjusting purposes.
  2. The pump shall be a positive displacement screw type to give smooth operation and shall be especially designed and manufactured for elevator service.
  3. The motor shall be of the alternating current, poly-phase squirrel cage induction, with solid-state, reduced starting current and shall be of a design especially adapted to electro-hydraulic requirements.
  4. The storage tank shall be constructed of steel and shall be provided with a removable cover and a means to gauge the proper level of the oil. The pump, motor and control valve shall be mounted on special reinforced isolation mounts. Provide a drip pan underneath the unit. All oil for the entire hydraulic system shall be new. An initial supply of new oil sufficient for proper operation shall be provided. Contractor in this section responsible for disposal of old oil.
  5. Provide a muffler in the discharge oil line near the pump unit designed to dampen and absorb pulsation and noise in the flow of hydraulic fluid.
  6. Provide a manual shut off valve in the supply line adjacent to the pump unit.
  7. The oil supply line may be retained and modified to accept the new hydraulic power unit in the elevator machine room. Any new oil supply line piping shall be installed above ground and be of adequate size and thickness, properly supported, per code requirements.
- B. Cylinder & Plunger (Jack Unit): The cylinder and plunger unit shall be retained and reused with the renovation. The jack packings shall be replaced with new with the renovation.
- C. Controller:
1. A microprocessor computer based control system shall be provided to perform all of the functions of safe elevator motion and elevator door control and shall be one of the following control systems or approved equal:
    - a. Motion Control Engineering – Motion 2000 (with onboard diagnostic keyboard and display)
    - b. Smartrise - Hydraulic Controller (with onboard diagnostic keyboard and display)
    - c. Vertitron – VHC-102 (with onboard diagnostic keyboard and display)
    - d. Elevator Controls – Pixel (with onboard diagnostic keyboard and display)
  2. The controller shall be designed with a split cabinet to separate high voltage from low voltage for efficiency and safety of future maintenance and troubleshooting of the unit.
  3. The controller shall include all the hardware required to connect, transfer, and interrupt power and protect car operational and group supervisory control. A three-phase overload device shall be provided to protect the motor against overloading.
  4. Identify each device, module and fuse (with ampere rating) by name, letter, or standard symbol, in an indelible and legible manner on the device or panel. Coordinate identification markings with identical markings on wiring diagrams. Use light emitting diodes (LED) for visual monitoring of individual modules. Components shall have interlocking circuits to assure fail-safe operation and to prevent unwarranted elevator movement should any component fail to function properly. Modules shall be of the type that plug into pre-wired mounting racks. Field wiring or alteration shall not be necessary in order to replace defective modules.
  5. The elevator shall be provided with an automatic leveling device that will bring the car to a stop within ¼" of the landing level regardless of load or direction of travel. Landing level will be maintained within the leveling zone irrespective of the hoistway doors being open or closed.

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6. A protective circuit shall be provided which will stop the motor and the pump and return the car to its lowest landing in the event that the car while traveling up, does not reach its designated landing within a predetermined time interval. This circuit shall permit a normal exit from the car but prevent further operation of the elevator until the trouble has been corrected.
7. Solid state, reduced current starting shall be furnished which shall limit both the initial starting current and peak current drawn by the motor.
8. The control equipment and hydraulic power unit enclosures shall be mechanically fastened to the machine room floor.
9. Design the system so that it will start properly when power is restored in the event of a power failure. Provide system memory so that data is retained in the event of power failure or disturbance.
10. Provide manufacturer's standard pre-engineered microprocessor system, which shall control car movements as a simplex collective operation. Provide automatic dispatching of the car in response to hall calls with automatic response of system to changes in demand.
11. A car control station shall be furnished for the elevator and shall contain a bank of buttons numbered to correspond to the landing served. At each terminal landing a single push button fixture shall be provided containing the appropriate up or down push button and at each intermediate landing a button fixture shall be provided containing up and down push buttons.
12. When a call is registered by momentary pressure on a car or landing button, that button shall become illuminated and remain illuminated until the call is answered. Illuminated buttons serve as a visual indication that a call has been registered and that the car will stop at that landing.
13. Operation shall be automatic by means of the car and landing buttons. Stops registered by the momentary actuating of the car and landing buttons shall be made in the order in which the landings are reached in each direction of travel after the buttons have been actuated. All stops shall be subject to the respective car or landing button being actuated sufficiently in advance of the arrival of the car at the landing to enable the stop to be made. The direction of travel for an idle car shall be established by the first car or landing button actuated.
  - a. "UP" landing calls shall be answered while the car is traveling in the up direction and "DOWN" landing calls shall be answered while the car is traveling in the down direction. The car shall reverse after the uppermost or lowermost car or landing call has been answered, and proceed to answer car calls and landing calls registered in the opposite direction of travel.
  - b. When the car, without registered calls arrives at a floor where both the "UP" and "DOWN" calls are registered, it shall initially respond to the hall call in the direction that the car was traveling. When no car call or hall call is registered for further travel in that direction, the car shall close its doors and immediately reopen them in response to the hall call in the opposite direction. The hall lantern shall indicate the changed direction when the doors reopen.
14. A diagnostic testing device, or maintenance terminal, suitable for all troubleshooting and testing procedures related to the specific type of microprocessor control, shall be installed on this project and provided at the final acceptance. This diagnostic testing device, or maintenance terminal, shall conform to the operating procedures under the testing section of these specifications.
  - a. After successful testing of the diagnostic device, in conjunction with the microprocessor control, the testing device shall become the property of the Owner. The diagnostic testing device shall not become inoperative after a period of time requiring factory rehabilitation. The contractor shall provide written certification that repair and support of the diagnostic tool components is readily available to the Owner in the future.
  - b. When repairs or replacement to the testing device become necessary prior to the final acceptance, the repairs, or replacement, shall be provided at no cost to the Owner.
  - c. Diagnostic device shall be installed in a lockable metal cabinet, mounted to the machine room wall.
15. Additional special operations shall be included with the elevator control system:

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- a. Independent Service: A key switch shall be provided in the car operating station of the elevator which, when actuated, shall disconnect the elevator from the hall buttons and permit operation from the car buttons only. Close doors by constant pressure on desired destination floor button. Open doors automatically upon arrival at selected floor.
- b. Top of Car Inspection Operation: Provide an operating fixture on top of the car containing continuous pressure "Up" and "Down" buttons for operating the elevator, an emergency stop button, a light and duplex GFCI receptacle, and a toggle switch that will make the top of car operating device operative.
- c. Fireman's Emergency Service: Furnish emergency operation to return the elevator to the main fire access Floor 1 and return to the alternate Floor 2 when emergency is at main fire access floor. Furnish "in car" control of the elevator during emergency operation by means of a key switch in the car.
  - 1) The appropriate signals from the fire alarm control system, as required to work in conjunction with the fireman's phase I recall operation, shall be provided in the machine room by other sections. Coordinate exact signal requirements with fire alarm contractor to ensure proper operation and code compliance.
- d. Emergency Communications System Failure Verification: For each elevator group, provide a means to verify operability of the telephone line, or other means of connection, serving the respective elevator group's emergency two-way communications system. This system shall verify telephone line operability on a daily basis and provide for a visual and audible alarm when the system determines that the telephone line is not functioning. The audible and visual alarm shall be located near the firemen's emergency service phase I key switch. The visual signal shall be an intermittent jewel illumination that shall not extinguish until the telephone line is functional. The audible signal shall be 10 dBA above ambient noise, but shall not exceed 80 dBA, as measured from the phase I recall key switch location. The audible alarm shall sound until authorized personnel silence it or until the telephone line is made functional. The means to silence the alarm shall be accessible only to authorized personnel. This system shall meet Elevator Code requirements.
- e. Hoistway Access Key Switch Operation: Key operated switches shall be provided in the car and at the top and bottom landings for selecting hoistway access operation. When the inspection switch in the car is turned to the "ON" position, the car is put on inspection operation and can only be run by use of the switch at the terminal landings.
  - 1) The car parks with the doors open and the closing circuit rendered inoperative. The inspector runs the car at low speed with the doors open by constant operation of the switch located in the elevator lobby.
  - 2) The car can be run down from the top floor to gain access to the top of the car or up from the bottom floor to gain access to the elevator pit. The movement of the car initiated and maintained by the upper access switch shall be limited in the down direction to a travel not greater than the height of the car crosshead above the car platform, and limited in the up direction so that the maximum travel is the point where the bottom of the platform guard is even with the hoistway entrance header.
  - 3) The car can be run up from the bottom landing to gain access to the pit. Travel is limited in the up direction by hoistway limit switches so that the maximum travel is the point where the bottom of the platform guard is even with the hoistway entrance header.
- f. Door Hold Operation: Provide a "Door Hold" button on the car control station panel on each elevator such that when the button is activated it shall illuminate and the door dwell time shall increase to 30 seconds for the movement of carts on and off the elevator. The timing devices shall be adjustable to increase or decrease the additional door dwell time from zero to one hundred twenty seconds. The increased door time shall be canceled upon initiation of any car button. After increased door dwell time has expired the doors shall close and the elevator shall return to normal operation.
- g. Security Access Operation: Special security access operation shall be provided for the elevator for floor 1R. A key switch shall be provided in the car control station panel in proximity of the floor 1R call button for special security access operation to that floor. The



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key switch, when activated, shall provide access to initiate the floor 1R call button in the car. Fireman's emergency service operation shall override the key switch operation per elevator code requirements.

**2.3 CAR STRUCTURE**

- A. Platform, Car Frame and Car Sills: The existing platform, car frame, and front car sill shall be retained. The rear sill shall be replaced with a new aluminum sill with non-slip wearing surfaces and grooves for door guides. All components shall be thoroughly cleaned.
- B. Platform Guard: The existing platform toe guard under the entrances of the car shall be replaced or modified to extend a minimum of 21 inches below the car sill before the bend. Upon completion, paint the guard with two (2) coats of a rust preventive paint, color to be black.
- C. Roller Guides: The existing slide guide assemblies shall be replaced with spring loaded, swivel slide guides with molybdenum infused replaceable inserts. Adjust the guides with the rails for smooth quality of ride upon completion of the renovation.
- D. Balance: After all components are assembled on the car structure, the elevator car shall be statically balanced in alignment with the guide rails to equalize pressure on the guides for a smooth ride upon completion of the renovation.
- E. Cleaning: Upon completion of all modifications on top of the car, clean the car structure and top of the new elevator car of all grease, lint, and dirt.

**2.4 HOISTWAY COMPONENTS**

- A. Guide Rails: The present guide rails shall be retained. Rails shall be cleaned and realigned as required to assure smoothness of ride.
- B. Hoistway Operating Devices: Normal terminal stopping devices shall be provided. When an emergency terminal speed-limiting device is furnished, the controller switches and circuitry shall be arranged in accordance with the requirements of the Elevator Code.
- C. Pit Switch: A new emergency stop switch shall be provided located in the elevator pit within reach of the pit access door, adjacent to the pit ladder, and 18 inches above the sill.
- D. Top of Car Operating Device: A new top of car operating device shall be provided for each car and made to work with the new control equipment. The device shall have the proper buttons, switches, and stop switch to operate the elevator on top of the car under inspection operation. The device shall be provided with a GFCI duplex receptacle and a guarded light providing 10 foot candles of illumination at any maintainable point on the car top. Provide additional lighting to meet required illumination as necessary.
  - 1. If the stop switch on the top of car operating device is not within reach of the hoistway landing, a second stop switch shall be provided on the car top that is within reach of the hoistway landing.
- E. Wiring: All hoistway and machine room wiring shall be installed new. The wiring and electrical interconnections shall comply with the governing codes. Insulated wiring shall have flame retardant and moisture-proof outer covering, and shall be run in conduit, tubing or electrical wireways. Assure all new wiring and conduits are located against a wall in the machine room or a minimum of 7'-0" above the machine room floor level.
- F. Traveling Cable: A new traveling cable shall be provided and shall be flexible, of a round construction, with a flame and moisture resistant outer cover, and shall be suspended to relieve strain on individual conductors. Include the required number in addition to three (3) spare sets of shielded communication wires and car lighting circuits from the machine room to the car connection points on the elevator. Provide 10% spare wires in traveling cable.
- G. Spring Buffers: The existing spring buffers and buffer channels shall be retained in the elevator pit as a means for retarding the movement of the car at the bottom limits of travel.
- H. Pit Ladder: The existing pit ladder can be retained, with the existing pit ladder handgrips extended to a minimum of 48-inches above the pit access floor to meet Elevator Code.

**2.5 DOOR OPERATING SYSTEM**

- A. Door Operator: Doors on the car and at the hoistway entrances shall be power operated by means of a new high speed, heavy duty, closed-loop, master door operator mounted on top of the car with all new associated operating linkages, door clutches, and gate switches. The motor shall have positive control over door movement for smooth operation. New infrared car door safety devices shall be used to cause instant reopening should an obstruction be detected during the

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closing cycle. Door operator shall be a harmonic door operator as manufactured by GAL or approved equal.

1. Door operation shall be automatic at each landing with door opening being initiated as the car arrives at the landing and closing taking place after expiration of a time interval. A car door electric contact shall prevent starting the elevator away from the landing unless the car door is in the closed position. Door close shall be arranged to start within a time consistent with accessibility requirements.
  2. The time interval for which the elevator doors remain open when a car stops at a landing shall be independently adjustable for response to car calls and response to hall calls.
- B. Interlocks: A new approved positive interlock shall be provided for each hoistway entrance which shall be made to work in conjunction with the new door operators. The interlocks shall prevent operation of the elevator unless all doors for that elevator are closed and shall maintain the doors in their closed position while the elevator is away from the landing.
- C. Car Door Safety Devices: The existing door safety devices shall be removed and discarded. New infrared, door protection devices shall be installed and made to work in conjunction with the new control equipment. Operation for all devices to be as follows:
1. The doors shall be prevented from closing from their full open position if a person or object comes within the zone of detection. The detection zone shall move with the doors and if a person or object enters the zone as the doors are closing, the doors shall reverse and reopen prior to physical contact. The doors shall reclose after a minimal time interval. After a stop is made, the doors shall remain open for a time interval to permit passenger transfer, after which the doors shall close automatically. This interval shall be less for a car call stop than for a hall call stop or a coincident car/hall call stop.
  2. If the doors are prevented from closing for a fixed time period an audible chime shall sound on the car. When the object is removed from the zone of detection the doors shall close at reduced power and speed to below 2 ft.-lbs. of kinetic energy. If an object enters the zone of detection while the doors are closing at reduced power and speed the doors shall stall and not reopen. Once the object is removed from the zone of detection the doors will continue to close at reduced power and speed. This operation will continue until the doors are totally closed. Normal operation shall resume at the next landing reached by the car.
- D. Car Door Restrictors: New car door restrictors shall be provided. The door operating mechanism shall be arranged so that the car and hoistway doors cannot be opened by hand more than four inches from within the elevator car when the car is outside the unlocking zone. Design of door restricting mechanism shall permit opening of car doors from outside of the elevator car without the use of special tools. Only mechanical type door restrictors are permitted.

**2.6 OPERATIONAL FIXTURES**

- A. Car Control Station: A new single car control station panel shall be provided on the front return panel of the elevator car.
1. The car control station panel shall contain a bank of mechanical illuminated buttons and Braille marked to correspond to the landings served and contain an illuminated alarm bell, illuminated door hold, door open & close buttons, fireman's phase II service key & fixtures, key switches for lights, fan, and other controls required for specified car operation and control. Mount the panel at height to comply with accessibility standards. Floor buttons shall be positioned in a single column. Braille plates shall not be the same shape as the floor call buttons.
  2. The car control station panel for each elevator shall incorporate the fireman's phase II key switch and associated fire operation fixtures inside a locked cabinet located at the upper portion of the panel. The fireman's keyswitch shall be of a tubular, 7 pin, style 137 construction and shall have a bitting code of 6143521. The key shall be coded "FEO-K1." The phase II key switch, instructions, call cancel button, fire jewel, door open and door close buttons, and stop switch shall all be located within this locked panel. The front of the cabinet shall be engraved with the label "FIREFIGHTERS' OPERATION". The cover to the cabinet shall be openable with the same key that is used to operate the phase II key switch. This cabinet shall meet Elevator Code requirements.
  3. A new digital car position indicator with direction arrows shall be provided in the top of the new car control station panel. The position of the car in the hoistway shall be shown by the

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- illumination of the indication corresponding to the landing at which the car is stopped or passing. Provide an electronic, adjustable, floor bypass tone to indicate to passengers that car is stopping at a particular floor served.
4. The car capacity shall be permanently engraved on the lower portion of the car control station panel or engraved on an inset panel at this location. Lettering shall not be less than 1/2" high and shall be black filled.
  5. The car control station panel shall also contain emergency car lights and the emergency power unit employing a sealed rechargeable battery and static circuits, or a portion of the cab ceiling lights shall be made to work on a similar emergency power unit. The battery shall be 6-volt minimum, sealed, maintenance free, of either lead acid or gel cell construction, and designed to give a life expectancy of not less than 5 years. Illumination for the elevator car and power for alarm bell shall be provided in the event of power failure.
  6. Car control station shall not contain plastic or polycarbonate components, labels or frames.
  7. The car control station shall also contain an integral emergency communication system located at ADA/accessibility height requirements. Provide operating switches with manufacturer's standard identification for required use or function. The activation button shall match the car operating panel button fixtures. The speaker shall be mounted behind the car operating panel with vandal resistant perforations drilled through the car operating panel.
    - a. The speakerphone shall be of the automatic dialing type and shall have the capability to automatically identify its location upon receipt of the call to the party answering the call.
    - b. Provide an activation button, with integral legend, and identification plate adjacent to the button. Illuminate button to indicate call registration. Provide means to indicate when call is answered. Provide engraved legend below indicator light explaining phone instruction. The speakerphone shall meet the requirements of ADA guidelines and shall operate in accordance with Elevator Code.
    - c. Necessary shielded wires shall be provided by the contractor from the speakerphone in the elevator car, through the traveling cables, and shall terminate in a junction box on the elevator controller in the elevator machine room. Connections to the building service system shall be provided by the Contractor.
- B. Hall Push Button Station: The existing riser of hall button fixtures shall be replaced with new at all floors. At each terminal landing, single type button fixtures shall contain the appropriate "Up" or "Down" buttons, and at each intermediate landing dual button type fixtures shall be provided, containing appropriate "Up" and "Down" buttons. All fixtures shall be installed at proper height to comply with the accessibility standards. The hall button fixture faceplates shall be the flat, applied type that is flush mounted with the wall. The hall buttons shall operate such that when a call is registered by any momentary pressure on the landing button, the button shall become illuminated and remain illuminated until the call is answered. The fixture faceplates shall be large enough to cover access holes remaining from the old fixture so that there is no need for patching.
1. The call buttons in the hall button fixture shall be centered at 42" above the finished floor.
  2. The hall button at the top and bottom landings shall contain the hoistway access key switch to activate Hoistway Access Operation.
  3. The call buttons in the hall button fixture shall be centered at 42 inches above the finished floor. Assure there is space between the actual hall buttons and any other items on the fixture to avoid any confusion as to which button is the hall call button.
- C. Emergency Services Fixture: A separate fixture shall be provided at floor 1 that shall contain the fireman's phase I, Emergency Communication Verification, and Emergency Power features. The fireman's keyswitch shall be of a tubular, 7 pin, style 137 construction and shall have a bitting code of 6143521. The key shall be coded "FEO-K1." The fireman's phase I instructions shall be permanently engraved on the face plate or on an inset plate mechanically fastened flush with the face of the hall button fixture. The fixture shall additionally contain the audible and visual alarm for the elevator group's "Emergency Communications System Failure Verification" in addition to the keyswitch for temporary silence of the alarm.
- D. "In-Car" Hall Lantern: A new in-car hall lantern shall be located in each car entrance jamb location at the ADA/accessibility required height. The lantern shall be the applied type with a flush-mounted faceplate and shall be on the side of the entrance opposite the hall button location. The lantern shall incorporate the appropriate triangular direction arrows for the up and down

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directions. The operating function of the lantern shall incorporate the appropriate directional tones per accessibility standards. An adjustable, electronic, audible tone shall sound to announce the arrival of the elevator car. The tone shall sound once for the "UP" direction and twice for the "DOWN" direction upon opening of the car doors. The fixture faceplates shall be large enough to cover access holes remaining from the old fixture so that there is no need for patching.

- E. Hall Position Indicator: A new hall position indicator shall be provided in the existing location relative to the hoistway entrances. The indicator shall contain a digital hall position indicator for the elevator. The position of the car in the hoistway shall be shown by the illumination of the indication corresponding to the landing at which the car is stopped or passing.
- F. Fixtures: The hall lantern and position indicators shall be of the standard digital type. All other newly provided fixtures shall be of the vandal resistant type. All newly provided fixtures shall be constructed of stainless steel with a no. 4 satin grain finish. Vandal resistant screws shall be provided for mounting all signal and operational fixture face plates. Fixtures shall be as manufactured by the following or approved equal:
  - 1. Otis - M3 Vandal Resistant
  - 2. TK Elevator - Vandal Resistant with V2 Buttons
  - 3. Innovation - Bruiser Line
  - 4. PTL - Centurion Series

**2.7 CAR ENCLOSURE**

- A. The existing car enclosure shall be removed and replaced in its entirety as follows:
  - 1. The car side and rear walls shall each consist of a formed, 14 gauge, rigidized stainless steel panels, bolted together to form the shell, with sound deadening exterior coating secured. Cab shell panels shall be a maximum of 36" wide.
  - 2. The front return panels shall contain integral entrance columns and be constructed of minimum 12 gauge brushed stainless steel. These panels, returns and strike jambs shall extend from the finished floor to the underside of the fascia. The side wall panels shall be arranged for mounting the applied car control station panels. A full width fascia of minimum 14 gauge brushed stainless steel shall be furnished over the return panel and car entrance.
  - 3. The car top shall be constructed of metal and contain a top emergency exit 17" x 24". The car top material shall be a minimum 12 gauge furniture steel suitably reinforced with matte white painted finish on the car side. Provide an interlock on the top of car emergency exit that will prevent operation of the elevator car if the exit cover is open more than 2". Interlock shall be designed in accordance with code requirements. A minimum of two (2) LED light fixtures shall be provided in the ceiling of the elevator car and shall be flush mounted with the car top interior. The light fixtures shall be of the two bulb type and the access lens to the bulbs shall be piano hinged for easy bulb replacement from inside the cab. The fixtures shall be protected with formed steel housings on the top of the car for step protection.
  - 4. A fan shall be provided for the elevator cab with smooth quiet operation. The car top beneath the fan shall be perforated with maximum 1/4 inch holes for passage of air from the cab by the fan. The fan shall be secured to the top of the cab with integral studs such that no fastening devices are exposed to the interior car top. Fan to be a Morrison Model "OE" or approved equal. The fan shall be provided with rubber mounting grommets to remove the vibration to the elevator cab.
  - 5. The car entrance shall be provided with a two-speed, side-opening car door with a brushed stainless steel facing on the car side suitably reinforced with applied hangers with track. The door shall be of hollow metal construction. Hangers shall be of the sheave type, two sheaves per door, rotating on a precision ball bearing. The roller shall be on an eccentric stud to provide adjustment. Car doors shall be provided with two phenolic gibs per car door panel.
  - 6. A stainless steel handrail shall be furnished on the side walls of the elevator cab and shall be mounted such that the top of the handrail is 34" above the finished floor. The handrail shall be a minimum of 3/8" by 2" square and the ends shall return back to the cab walls. Provide one continuous handrail on each wall. There shall be a minimum of four (4) supports on each rail. Handrails shall terminate within 6" of returns.
  - 7. The car sill shall be cleaned and any adjustment provided to verify new car floor and sill are flush without need for transition strips. Car flooring to be provided by the Owner. Exact

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flooring and subflooring thicknesses to be verified by contractor with Owner's flooring installer.

8. Pattern of rigidized stainless steel to be 5WL. All brushed stainless steel to have a no. 4, satin finish. The new car enclosure shall comply with Elevator Code.

**2.8 HOISTWAY ENTRANCES**

Service Elevator Entrance Summary

Total Number -	Three (3) openings
Type-	Retain Side Opening, Two Speed
Clear Opening	3'-6" W by 7'-3" H
Door Panels -	Retain Existing
Jambs & Sills -	Retain Side & Head jambs.
Door & Jamb Finish -	Retain existing.

- A. Frames: The existing frames shall be retained. Check to make certain all are secure to the building structure; make any necessary repairs to unsecured frames.
- B. Sills: The existing hoistway door sills at all floors shall be retained. The sills shall be cleaned upon substantial completion of the elevator renovation.
- C. Fascia Plates, Toe Guard and Dust Covers: The existing components may be retained. The contractor is responsible for checking the components and providing any additional required fastenings to assure they are totally secured to the hoistway structure. Any missing fascia or hanger covers shall be replaced with new. Upon reconditioning and cleaning, the fascia shall be painted with a low VOC paint by the Contractor in this section, color to be black.
- D. Headers and Struts: Headers and struts may be retained. The contractor is responsible for checking these components and providing any new required fastenings to assure they are totally secured to the hoistway structure.
- E. Hangers and Tracks: The existing tracks and hangers shall be provided with new applied equipment. Properly adjust all equipment for smooth door operation.
- F. Closers and Relating Equipment: The existing closers shall be replaced with new spirator type closers. All closers shall be adjusted to assure proper automatic closing of the doors when the car is away from the respective floor. Any worn relating parts shall be replaced. Adjust all equipment for smooth operation.
- G. Door Panels: The existing door panels shall be replaced with new fire rated door panels. The door panels shall be furnished with barrel type escutcheon plates for the door unlocking devices at each landing. Doors shall be provided with a stainless steel finish on the lobby side.
  1. The gibs on the bottoms of all doors shall be checked. Provide two (2) removable phenolic guides per door panel that run in the sill slots with minimum clearance. Provide one (1) door retainer gib per panel.
  2. The sight guards shall be checked. Damaged guards shall be repaired or replaced, and loose guards shall be tightened and secured to the door edge.
  3. Any missing door bumpers in the strike jambs shall be replaced for proper cushioning of the doors when closing.
  4. The Floor 2 rear entrance doors shall be secured against movement.
- H. Handicap Jamb Markings: Provide new stainless steel jamb marking plates with raised floor markings, a black background, and braille to identify each landing on both jambs of each hoistway entrance. Jamb marking plates shall be mechanically fastened to the entrance jambs utilizing stainless steel drive pins in the four corners of the plates.
- I. Fire Evacuation Signs: Provide applied laminate fire evacuation signs incorporating a pictograph as depicted in 2.27.9 of the Elevator Code and mount above each hall button in the elevator lobbies.
- J. Abandoned Openings: The openings at floors 1R and 2R are being abandoned with the project. The doors shall be permanently secured against movement from the hoistway side of the elevator doors.
- K. All stainless steel shall be provided with #4 brushed finish unless stated otherwise.

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*PART 3 EXECUTION*

3.1 PREPARATIONS

- A. Site Inspection: Prior to commencing elevator renovation inspect hoistway, hoistway openings, pit, and machine room as constructed. Contractor is responsible for all dimensions as field measured by the Contractor for proper installation and performance of elevator work.
  - 1. Contractor shall be responsible for inspecting and determining extent of work to be performed at the site to complete the work. Contractor must consider all requirements for installation of new work, access, code requirements, and removal or demolition, which additional work shall be performed without cost to the Owner.
- B. Demolition: The removal of all elevator equipment, which is not to be retained in the renovation, shall be completed by the contractor. The old elevator equipment removed becomes the property of the Contractor and it is their responsibility to remove this equipment from the project site. Include all work necessary to protect the public, residents, building employees, and building property during removal of demolished materials.
  - 1. When barricades are required for protection of the hoistway they shall be provided by the Contractor. Do not start demolition of an area until all temporary protection and temporary partitions are in place as furnished by the contractor.

3.2 INSTALLATION OF ELEVATOR SYSTEM

- A. General: Comply with manufacturer's instructions and recommendations for work required during installation, referenced codes, and specifications.
- B. Welded Construction: Provide welded connections for installation of elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance and replacement of worn parts. Comply with AWS standards for workmanship for qualifications of welding operators. Coordinate any welding or burning with the Owner's Representative.
- C. Coordination: There will be other building work that will be required to be performed by other as part of this elevator renovation project. It will be the elevator contractor's responsibility to provide an initial schedule and to update the schedule as changes occur. The contractor in this section shall also provide access for the owner or their contractor(s) for access to the elevator hoist way and/or elevator machine room so they can perform their work as part of the overall project. Some of the other work done by the owner or their contractor(s) will include fire alarm system construction and providing signals to the elevator controller as designated and requested by the elevator contractor. The elevator contractor shall coordinate and define the system interactions with the specific requirements for the supplied Elevator control system. Coordinate elevator work with other sections for proper time and sequence to avoid construction delays. The Contractor shall provide fully operational elevator system as stipulated in the construction schedule. The Contractor shall maintain full crews and continue work once elevator demolition begins until the elevator system is completed and operational and accepted by the Owner. The Contractor shall provide the number of crews required to maintain the schedule and shall provide additional manpower and work such additional hours as are necessary to bring the project back on schedule.
- D. Sound Isolation: Mount any new rotating vibrating elevator equipment and components on vibration absorption mounts, designed to effectively prevent transmission of vibrations to structure, and thereby eliminate sources of structure borne noise from elevator system.
- E. Guide Rails: The existing guide rails are being reused and it is the Contractor's responsibility to see they are adaptable to Contractor's equipment, erected plumb, properly aligned, and anchored securely to the existing structure.
- F. Hoisting: All required hoisting and movement of the elevator equipment shall be the responsibility of the Contractor in this section.
- G. Final Cleaning & Painting: Upon completion of all elevator work, provide total clean down of elevator machine room, hoistway, and pit areas to remove all dirt and construction debris. All newly provided steel components in machine room and hoistway shall be provided with touch up painting to remove all scratches and blemishes incurred during construction.

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**3.3 ELECTRIC WIRING**

- A. Conductors: Copper throughout with individual wires coded and all connections on identified studs or terminal blocks. Use no splices or similar connections on any wiring except at terminal blocks, control cabinets, junction boxes or conduits. Provide 10% spare conductors throughout.
- B. Conduit: Painted or galvanized steel or aluminum conduit and duct shall be used. Conduit size shall be 1/2" minimum, except that 3/8" can be used for runs containing only 2 wires. Flexible conduit exceeding 18" in length shall not be used. Flexible heavy-duty service cord, type SO, may be used between fixed car wiring and car door switches for safety edges.

**3.4 FIELD QUALITY CONTROL**

- A. Acceptance Testing: Upon nominal completion of the elevator work, and before permitting use of elevator (either temporary or permanent), perform acceptance tests as depicted in Rule 8.10.3, "Acceptance Inspection and Tests of Passenger & Freight Hydraulic Elevators", of the Elevator Code. Also perform other tests, if any, as required by governing regulations.
  - 1. Contractor is responsible for coordinating observance of final acceptance inspection with the Owner's representative and a representative of ATIS Elevator Consulting, as they have been retained by the Owner to represent the State of Missouri as the Licensed Elevator Inspector. Contractor is also responsible for coordinating any additional inspectors as required by local jurisdiction.
- B. Diagnostic Testing: The diagnostic testing device, or maintenance terminal, provided shall be demonstrated and tested during the final testing of the elevator installation. This diagnostic tool shall have the capability of troubleshooting and field programmability of all control variables providing interaction between the service man and the microprocessor controller including performance of all ongoing safety testing as required by the Elevator Code.

**3.5 INSTRUCTION AND MAINTENANCE**

- A. A maximum period of four hours shall be dedicated to instruct Owner's personnel in proper use, operation and daily maintenance of elevators. Review emergency provisions, including emergency access and procedures to be followed at time of failure in operation and other building emergencies. Train Owner's personnel in normal procedures to be followed in checking for sources of operational failures or malfunctions.
- B. At the time of substantial completion of elevator work (or portion thereof) provide suitable protective covering, barriers, devices, signs, or such other methods or procedures to protect elevator work from damage or deterioration. Maintain protective measures throughout remainder of construction period.

**3.6 ELEVATOR SCHEDULE**

Renovate	One (1) direct plunger, hydraulic service elevator
Type of Machine	Provide new hydraulic pumping unit in the machine room. Retain the existing hydraulic jack unit drive.
Capacity & Speed Operation	Retain 2,500 lbs. capacity at 100 fpm. Provide new microprocessor controller with simplex collective operation with: Fireman's Emergency Service Independent Service Hoistway Access Communication Verification Door Hold Emergency Power Key Switch Access
Approximate Travel	28'-0"
Number of Openings	Retain three (3) stops with front openings at floors ★1, and 2 and rear openings at floor B.
Opening Size Hoistway Entrances	Retain 3'-6" wide by 7'-3" high Retain side-opening, two-speed design. Retain frames and sills. Provide new

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Door Operating Equipment	hangers, track, panels, closers, unlocking devices and interlocks. The rear openings at Floors 1R and 2R shall be secured against movement. Provide new heavy-duty, closed loop door operators with new clutch and door restrictor device. Provide a new infrared, non-contact door reversal device.
Guide Rails	Retain and clean existing rails and re-align as necessary.
Car Structure	Retain existing car platform and sling. Retain front car door sill, replace rear. Provide new adjustable slide guide assemblies. Provide new top of car inspection station and top of car exit switch. Extend platform guards.
Buffers & Pit Equipment	Retain existing spring buffers and pit channels. Extend hand grips on pit ladder.
Car Enclosure	Replace car enclosure in its entirety with new rigidized stainless steel shell cab with stainless steel front return, header, strike jamb, hand rails and car door.
Signal Fixtures Car Control Station	Provide new single car control station with integral car position indicator, speakerphone, and emergency light in the front return panel.
Hall Buttons	Provide new, flush mounted hall button fixtures with Terminal landings to also contain hoistway access key switches.
Emergency Services Fixture	Provide new with Fireman's Phase I, Emergency Communication, and Emergency Power features.
In-car Hall Lantern	Provide new, In-car hall lantern with illuminating arrows and adjustable electronic direction tones.
Hall Position Indicator	Provide new digital hall position indicator above the entrance at each floor.
Warranty & Service	Twelve (12) months warranty. New installation maintenance service on the elevator for a period of 12 months after completion of work.

*END OF SECTION 142400*



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SECTION 21 0000 - GENERAL FIRE PROTECTION REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Common FIRE PROTECTION installation requirements.

1.2 SPECIFICATION FORM AND DEFINITIONS

- A. These Specifications are abbreviated form and contain incomplete sentences. Omissions of words or phrases such as “the Contractor shall,” “shall be,” “as noted on the drawings,” “according to the drawings,” “a,” “an,” “the,” and “all” are intentional. Omitted words and phrases shall be supplied by inference.
- B. When a word such as “proper,” “satisfactory,” “equivalent,” and “as directed” is used, it requires Engineer’s review.
- C. “Provide” means furnish and install.
- D. “Working Day” wherever used in these Specifications, shall mean the normal working days Monday through Friday, exclusive of Saturday, Sunday, and federally observed holidays.
- E. Architect/Engineer hereinafter abbreviated A/E shall mean both the Design Architects and the Design Engineers.
- F. Design Engineer hereinafter abbreviated D/E shall mean the engineering firm, RTM Engineering Consultants, 3333 E. Battlefield Suite 1000 Springfield, MO65804, Telephone (417) 881-0020.
- G. shall mean the person or company and their subcontractors who enter into contract with the Owner to perform the general division work.
- H. Electrical Contractor hereinafter abbreviated E/C shall mean the person or company and their subcontractors who enter into contract with the G/C to perform the division 26 work.
- I. Mechanical Contractor hereinafter abbreviated M/C shall mean the person or company and their subcontractors who enter into contract with the G/C to perform the division 23 work.
- J. Plumbing Contractor hereinafter abbreviated P/C shall mean the person or company and their subcontractors who enter into contract with the G/C to perform the division 22 work.
- K. Fire Protection Contractor hereinafter abbreviated FPC shall mean the person or company and their subcontractors who enter contract with the G/C to perform the division 21 work.

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- L. Equipment and/or materials manufacturer hereinafter abbreviated E/M shall mean the manufacturer of equipment or materials specified or referred to.

### 1.3 GENERAL EXTENT OF WORK

- A. Provide fire protection systems indicated on drawings, specified or reasonably implied. Provide every device and accessory for proper operation and completion of mechanical systems. In no case will claims for “Extra Work” be allowed for work about which FPC could have informed himself before bids were taken.
- B. FPC shall familiarize himself with equipment provided by other contractors.
- C. Refer to the construction documents for owner-supplied, contractor installed materials, equipment or fixtures. Contractor shall be prepared to receive materials and equipment arriving on the project site and shall be responsible for storing, removing from packaging and assembling on site prior to installation. Coordinate delivery times and all requirements with the owner through the general contractor. Contractor shall provide any and all necessary additional materials, supports, bracing, mounting brackets, back-boxes, etc. as required for installation of owner-supplied, contractor-installed materials, equipment or fixtures.

### 1.4 LOCAL CONDITIONS

- A. Visit site and determine existing local conditions affecting work in contract.
- B. Failure to determine site conditions or nature of existing or new construction will not be considered a basis for granting additional compensation.

### 1.5 CODES, ORDINANCES, RULES AND REGULATIONS

- A. Provide work in accordance with applicable codes, rules, ordinances, and regulations of Local, State, and Federal Governments and other authorities having lawful jurisdiction.
- B. Drawings and specifications indicate minimum construction standards, but should any work indicated be sub-standard to any ordinances, laws, codes, rules, or regulations bearing on work, FPC shall promptly notify A/E in writing before proceeding with work so that necessary changes can be made. However, if FPC proceeds with work knowing it to be contrary to any ordinances, laws, rules, and regulations, he shall thereby have assumed full responsibility for and shall bear all costs required to correct non-complying work.
- C. Conform to latest editions and supplements of the following codes, standards, or recommended practices.
  - 1. CITY CODES:
    - a. 2021 International Building Codes
    - b. 2021 International Fire Code
  - 2. SAFETY CODES:

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- a. National Electric Safety Code Handbook H30 – National Bureau of Standards.
  - b. Occupational Safety and Health Standards – Department of Labor.
  - c. Specifications for Making Buildings and Facilities Accessible To, and Usable By, the Physically Handicapped – American Standards Institute ANSI A117.1.
3. NATIONAL FIRE CODES:
- a. NFPA 54 Gas Appliance and Gas Piping Code.
  - b. NFPA 70 National Electric Code – 2020 Edition.
  - c. NFPA 89M Clearances, Heat Producing Appliances.
  - d. NFPA 90A Air Conditioning and Ventilation Systems.
  - e. NFPA 91 Blower and Exhaust Systems.
  - f. NFPA 101 Life Safety Code – 2012 Edition.

**1.6 CONTRACT CHANGE**

- A. Changes or deviations from contract; including those for extra or additional work must be submitted in writing for review of A/E. No verbal orders will be recognized.
- B. Changes in the work shall be submitted in accordance with AIA Document A201, General Conditions of the Contract for Construction.
- C. All change proposals shall be itemized indicating separately the costs for materials, labor, restocking charges, freight, bonds, insurance, overhead, and profit. All materials shall be listed separately with quantities and individual unit prices. Labor factors shall be from a nationally recognized source with appropriate adjustments.
- D. All submitted breakdowns shall be broken out individually for labor and material for each separate line item in the respective supplemental instruction, contract change directive, or proposal request. Items submitted with lump sums will be returned un-reviewed.
- E. The maximum allowable profit for any change order shall be ten percent (10%).
- F. See Example below:

**PRICING SHEET**

Project:	Library CLC Renovation			Date:	June 1, 2023	
Location:	Rolla, MO			Estimator:	Jane Doe	
Labor Rate:	\$22.00					
Material	Units	Unit Measure	Material Per Unit	Man Hours Per Unit	Total Man Hours	Materials Total
Add						
Drill & Patch Holes	1	lot	\$1,285.00	3.000	3.00	\$1,285.00
4" LB w/cover	6	ea	\$105.23	2.750	16.50	\$631.38
4" Compr. Conn	6	ea	\$87.70	1.000	6.00	\$526.20
4" GRC	40	ea	\$9.04	0.280	11.20	\$361.57

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4" cut & thread labor	4	ea	\$0.00	1.600	6.40	\$0.00
4" GRC-PVC Adptr.	16	ea	\$4.70	0.675	10.72	\$75.20
4" GRC 90 Ell	4	ea	\$56.34	1.500	6.00	\$225.36
4" Sch 40 PVC	460	ea	\$2.25	0.600	27.60	\$1,034.03
Resocking Fee 20%	1	lot	\$212.26	0.00	0.00	\$212.26
Return Freight	1	lot	\$26.40	0.000	0.000	\$26.40
Deduct						
4" EMT	-330	ea	\$2.46	0.045	(14.85)	(\$812.79)
4" EMT 90 Ell	-6	ea	\$26.64	1.100	(6.60)	(\$159.84)
4" EMT Cplg	--39	ea	\$2.27	0.270	(10.53)	(\$88.66)
SUBTOTAL					55.44	\$3316.12
SALES TAX					6.125%	\$203.11
LABOR	55.4	MH	\$21.74			\$1,205.27
5% OVERHEAD						\$236.23
8% PROFIT						396.86
TOTAL						\$5357.59

**1.7 LOCATIONS AND INTERFERENCES**

- A. Locations of equipment, piping, and other mechanical work are indicated diagrammatically by fire protection drawings. Lay out work from dimensions on Architectural and Structural Drawings. Verify equipment size from manufacturer's shop drawings.
- B. Study and become familiar with contract drawings of other trades and in particular the general construction drawings and details to obtain necessary information for figuring installation. Cooperate with other workmen and install work to avoid interference with their work. Minor deviations not affecting design characteristics, performance, or space limitations may be permitted if reviewed by A/E prior to installation.
- C. Any conduit, apparatus, appliance, or other fire protection item interfering with proper placement of other work as indicated on drawings, specified, or required shall be removed and if so shown, relocated and reconnected without extra cost. Damage to other work caused by the FPC, his subcontractor, his workmen, or by any cause whatsoever, shall be restored as specified for new work.
- D. Do not scale mechanical and fire protection drawings for dimensions. Accurately lay out work from dimensions indicated on architectural drawings unless such is found in error.

**1.8 SYSTEM PERFORMANCE**

- A. Final acceptance of work shall be subject to the condition that all systems, equipment, apparatus, and appliances operate satisfactorily as designed and intended; work shall include required adjustment of systems and control equipment installed under this specification.

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1.9 WARRANTY

- A. Unless noted otherwise in specifications, FPC warrants to Owner and Architect the quality of materials, equipment, workmanship, and operation of equipment provided under this specification division for a period of one (1) year from and after date of substantial completion of building and acceptance of mechanical systems by Owner.
- B. Where manufacturers' warranties expire before or during the one-year warranty period as specified in item 1, the FPC shall include provisions for extending the manufacturer's warranty as required to match the one-year period from substantial completion and shall include cost for warranty extension in his base bid.
- C. FPC warrants to Owner and Architect that on receipt of written notice from either of them within one (1) year warranty period following date of acceptance, all defects that have appeared in materials and/or workmanship shall be promptly corrected to condition required by contract documents at FPC's expense.
- D. The above warranty shall not supersede any separately stated warranty or other requirements by law or by these specifications.
- E. Keeps an itemized list of all equipment warranties listing equipment by name, mark, and type along with length and expiration date of each warranty. Submit two (2) copies to A/E with request for final inspection.
- F. If the Architect's specification includes a warranty requirement that exceeds the above warranty requirements, the Architect's warranty shall take precedence.

1.10 MATERIALS, EQUIPMENT AND SUBSTITUTIONS

- A. The intent of these specifications is to allow ample opportunity for FPC to use his ingenuity and abilities to perform the work to his and the Owner's best advantage, and to permit maximum competition in bidding on standards of materials and equipment required.
- B. Material and equipment installed under this contract shall be first class quality, new, unused, and without damage.
- C. In general, these specifications identify required materials and equipment by naming first the manufacturer whose product was used as the basis for the project design and specifications. The manufacturer's product, series, model, catalog, and/or identification numbers shall set quality requirements for comparing the equivalency of other manufacturer's products in general. Where models are listed or scheduled with information that does not match specified manufacturer's data for size or capacity, the larger, more expensive and/or restrictive requirement between the schedule and the manufacturer's data shall be met and included. Where other manufacturer's names are listed, they are considered an approved manufacturer for the product specified; however, the listing of their names implies no prior approval of any product unless specific model or catalog numbers are listed in these specifications or in subsequent addenda. The naming of a manufacturer, or even a model number, does not alleviate the contractor from being required to provide or submit equipment which meets all

of the criteria and items listed in the specifications or shown on the plans even if the specified model and/or manufacturer does not. All requirements on the drawings must be met, not just the specific model number or manufacturer. Where other than first named products are used for FPC's base bid proposal, it shall be his responsibility to determine prior to bid time that his proposed materials and equipment selections are products of approved manufacturers, which meet or exceed the specifications, fit physically in the spaces provided, are compatible with all other systems and are acceptable to the D/E.

- D. Where varying or conflicting information, notes or specifications may be shown in different locations on the drawings, schedules, or specifications, all requirements are required to be met and the worst case or more expensive and/or restrictive option should be included where duplicate information is not the same. Notify A/E for clarification.
- E. Where materials or equipment are described but not named, provide required items of first quality, adequate in every respect for intended use. Such items shall be submitted to A/E for review prior to procurement.
- F. **PRIOR TO RECEIPT OF BIDS, IF FPC WISHES TO INCORPORATE PRODUCTS OTHER THAN THOSE NAMED IN SPECIFICATIONS IN HIS BASE BID, HE SHALL SUBMIT A WRITTEN REQUEST FOR REVIEW OF SUBSTITUTIONS TO D/E NOT LESS THAN SEVEN (7) WORKING DAYS PRIOR TO BID TIME. D/E WILL REVIEW REQUESTS AND ACCEPTABLE ITEMS WILL BE LISTED IN AN ADDENDUM ISSUED TO PRINCIPAL BIDDERS.**
- G. Materials and equipment proposed for substitutions shall be equal to or superior to that specified in construction, efficiency, utility, aesthetic design, and color, as determined by A/E, whose decision shall be final and without further recourse. Physical size of substitute brand shall be no larger than space provided including allowances for access for installation and maintenance of installed equipment, as well as other systems shared in the same space. Requests must be accompanied by two (2) copies of complete descriptive and technical data including E/M's name, model, and catalog number, photographs or cuts, physical dimensions, operating characteristics, and any other information needed for comparison.
- H. In proposing a substitution prior to or subsequent to receipt of bids, include in such proposal cost of altering other elements of project, including (but not limited to) adjustments in mechanical, electrical, FIRE PROTECTION, controls, fire alarm and/or any other service requirements necessary to accommodate such substitution; whether such affected elements are under this contract or under separate contracts.
- I. Within seven (7) working days after bids are received, apparent lower bidder shall submit to A/E for approval three (3) copies of a list of all major items of equipment he intends to provide. As soon as practicable and within 30 working days after award of contract, FPC shall submit shop drawings for equipment and materials to be incorporated in work, for A/E review. Where 30 day limit is insufficient for preparation of detailed shop drawings on major equipment or assemblies, FPC shall submit manufacturer's descriptive catalog data and indicate date such detailed shop drawings will be submitted along with manufacturer's certification that order was placed within 30 working day limit.

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- J. After execution of contract, substitution of product brands for those named in Specifications will be considered, only if:
  - 1. Request is received within 30 days after contract date and request includes statement showing credit due Owner, if any, if substitution products are used, or
  - 2. Owner requests consideration be given to substitute brands.

### **1.11 SHOP DRAWINGS, OPERATION AND MAINTENANCE INSTRUCTION**

- A. Unless noted differently in the general requirements of the specifications, FPC shall furnish one of the following options, whichever format is preferred:
  - 1. Electronic PDF submittals to the Architect. Shop drawings submitted electronically shall be returned electronically via the same path.
  - 2. A minimum of six (6) paper copy sets of shop drawings of all materials and equipment, A/E will retain two (2) sets.
- B. Where catalog cuts are submitted for review, conspicuously mark or provide schedule of equipment, capacities, controls, fittings, sizes, etc., that are to be provided. Mark equipment to match equipment labels provided on the drawings, schedules or specifications. Mark each submitted item with applicable section and paragraph numbers of these specifications, or plan sheet number, when item does not appear in specifications. Where equipment submitted does not appear in base specifications or specified equivalent, submittals shall be marked with applicable alternate numbers, change order numbers, or letters of authorization where said equipment was approved. Each submittal shall contain at least two (2) sets of original catalog cuts. Each catalog sheet shall bear E/M's name and address. All shop drawings on materials and equipment listed by UL shall indicate UL approval on submittal.
- C. FPC shall check all shop drawings to verify that they meet specifications and/or drawing requirements before forwarding submittals to the A/E for their review. All shop drawings submitted to A/E shall bear FPC approval stamp which shall indicate that FPC has reviewed submittals and that they meet specification and/or drawing requirements. FPC's submittal review shall specifically check for, but not be limited to, the following: equipment capacities, physical size in relation to space allowed; fire protection characteristics, provisions for supply, return, and drainage connections to building systems. All shop drawings not meeting FPC's approval shall be returned to his supplier for resubmittal.
- D. No shop drawing submittals will be considered for review by the A/E without FPC's approval stamp, or that have extensive changes made on the original submittal as a result of FPC's review.
- E. A/E will not be responsible for the cost of returning shop drawing submittals that are submitted to them without FPC's review and approval stamp. A letter will be sent to FPC by either the Architect or Engineer indicating receipt of an improper submittal. FPC shall acknowledge receipt of letter and indicate his plans for pick-up or resubmitting. A/E will hold improper submittals for pick-up by FPC or supplier for 15 working days after date of receipt. If not picked up by the 16th working day, submittals will be disposed of by A/E.
- F. A/E's review of shop drawings will not relieve FPC of responsibility for deviations from drawings and specifications unless such deviations have been specifically approved in writing



by Owner or his representative, nor shall it relieve FPC of responsibility for errors in shop drawings. No work shall be fabricated until A/E's review has been obtained. Any time delay caused by correcting and resubmitting shop drawings will be FPC's responsibility.

- G. A/E shall make every effort to provide shop drawing review in a timely fashion, but in no case shall the A/E be held responsible for delays in project construction or completion without prior notification of scheduling requirements specifically for return of shop drawings at least 8 weeks in advance. In no case shall less than 10 working days after A/E receipt of shop drawings be counted on by the contractor for A/E shop drawing review without prior notification and approval.
- H. Operating and Maintenance Instructions:
  - 1. Submit with shop drawings of equipment: copies of installation, operating, maintenance instructions, and parts list for equipment provided. Instructions shall be prepared by E/M.
  - 2. Keep in safe place keys and wrenches furnished with equipment under this contract. Present to Owner and obtain a receipt for same upon completion of project.
  - 3. Contractor shall provide all final documents including drawings, shop drawings, etc., in PDF format on a single disk to Owner. A total of five (5) CD's shall be provided, three (3) to the Owner and two (2) to A/E. No exceptions will be allowed to this requirement. Videotaping, as specified in other parts of this specification, will also be required at closeout.

#### 1.12 PROPOSED VALUE ENGINEERING/PROJECT SCOPE REVISIONS

- A. Where design revisions are requested/required based on value-engineering or proposed changes in project scope, the contractor shall include in his proposed cost savings or adds the necessary MEP design fees that are required for modifying construction documents and associated meetings. In order to determine that value to be included, the contractor shall submit to the A/E the proposed scope of the work required for the changes at least 7 days prior to required pricing submittal so that the design fees can be accurately determined and included. Design work and drawing changes will only commence once the design fee is established and a signed agreement returned to the A/E for inclusion.
- B. Where the contractor proposes to use different size equipment, feeders, feeder materials, circuit breakers, fuses or significant difference in routing of feeders or branches than shown in the construction documents, the contractor shall include the necessary MEP design fees that are required for modifying or creating construction drawings necessary either for construction or submission to the authority having jurisdiction and required for additional review. Design work and drawing changes will only commence once the design fee is established and a signed agreement returned to the A/E for inclusion.

#### 1.13 CAD FILE REQUESTS

- A. CAD files are the property of the D/E. CAD files are only available upon documented written request which must be forwarded to the D/E office. Prior to receiving any CAD files, the contractor shall sign a Second Party User Agreement and Drawing Request Form (available

upon request) which must be forwarded back to the D/E office prior to any CAD files being released. BIM/Revit models will not be made available.

1.14 CUTTING AND PATCHING

- A. Contractor shall do cutting, and patching of building materials required for installation of work herein specified. Cut no structural members without Architect's approval and in a manner approved by him.
- B. Patching shall be by mechanics of particular trade involved and shall meet approval of Architect.
- C. Drilling and cutting of openings through building materials requires Architect's review and approval. Make openings in concrete with concrete hole saw or concrete drill. Do not use star drill or air hammer for this work.

1.15 MUTILATION

- A. Mutilation of building finishes, caused by installation of fire protection equipment, fixtures, outlets, and other fire protection devices shall be repaired at FPC's expense to approval of Architect.

1.16 SETTING, ADJUSTMENT AND EQUIPMENT SUPPORTS:

- A. The following are general specifications. Refer to section 210529 Hangers and Supports for Fire protection Systems for additional requirements.
- B. Work shall include mounting, alignment, and adjustment of all systems and equipment. Set equipment level on adequate foundations and provide proper anchor bolts and isolation. Level, shim, and grout equipment bases as recommended by E/M. Mount motors, align and adjust drive shafts and belts according to E/M's instructions. Equipment failures resulting from improper installation or field alignment shall be repaired or replaced by FPC at no cost to Owner.
- C. Provide concrete bases for all floor and slab mounted equipment, regardless of whether specifically noted on the drawings or not.
- D. Provide each piece of equipment or apparatus suspended from ceiling or mounted above floor level with suitable structural support, platform, or carrier in accordance with best recognized practice and the E/M. FPC shall arrange for attachment to building structure, unless otherwise indicated on drawings or specified. Provide hangers with vibration eliminators. Contractor shall verify with structural engineer that structural members of buildings are adequate to support equipment. Submit details of hangers, platforms, mounting brackets and supports together with total weights of mounted equipment to structural engineer and A/E for review before proceeding with fabrication or installation.

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- E. Supports and/or support wires for fire protection equipment, raceways, light fixtures, etc. shall be designated (painting is acceptable) separately from supports and/or support wires for other building systems. All supports and/or support wires shall be designated the same throughout the project.

### 1.17 START-UP, CHANGE-OVER, TRAINING AND OPERATIONAL CHECKS

- A. FPC shall perform initial start-up of systems and equipment. Personnel qualified to start-up and service this equipment, including E/M's technicians, when specified, and Owner's operating personnel shall be present during these operations.
- B. FPC shall be responsible for training Owner's operating personnel to operate and maintain systems and equipment installed. Keep a record of training provided to Owner's personnel listing the date, subject covered, instructor's name, names of Owner's personnel attending, and the total hours given each individual.
- C. FPC shall report in person to Owner's designated operating personnel at end of first month of operation and thereafter at end of sixth and 12<sup>th</sup> months after date of substantial completion of building to check operation of equipment that was installed under contract. Contractor shall answer operating personnel's questions regarding system operation and shall ascertain that systems are operating normally and are being properly maintained by Owner. If FPC finds that systems are not being operated and maintained as designed, he shall inform the building engineer/Owner and A/E in writing.
- D. After each inspection, FPC shall submit written report to A/E indicating condition of equipment and including any recommended changes in operation of system or other information which will be helpful to Owner.

### 1.18 MAINTENANCE OF SYSTEMS

- A. FPC shall be responsible for operation, maintenance, and lubrication of equipment installed under his contract. All equipment and systems shall be fully operational when turned over to the owner at project substantial completion.

### 1.19 PROTECTION AND CLEANING OF SYSTEMS AND EQUIPMENT

- A. It shall be FPC's responsibility to protect and prevent damage to all fire protection materials and equipment stored and/or installed under this contract. All work, materials, and equipment shall be adequately protected by any and all means necessary to prevent damage by weather, flooding, condensation, construction debris, fire, and construction equipment and vehicles.
- B. Equipment not rated for outdoor use shall be protected from moisture damage before and during construction. Covering equipment with a tarp on site is not considered a means of providing protection from moisture. Any equipment not rated for outdoor use exposed to moisture for any duration shall be replaced with new equipment at the contractor's expense.

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- C. Where job conditions, or work of other contractors produce the potential for damage to fire protection systems and equipment, FPC shall immediately notify the G/C so that corrective action can be taken.
- D. FPC shall take extra precautions to protect fire protection equipment containing solid state electronics, open relays, and contacts from damage by water, dust, dirt, construction debris, and the formation of condensate. All equipment so damaged shall be replaced by FPC with new equipment at no cost to Owner.
- E. FPC shall periodically inspect and clean all systems and equipment to ensure all systems and equipment remain in like new condition during construction, free from dust and debris. All cleaning shall be done in accordance with E/M's recommendation where available and applicable.
- F. Before request for final inspection, all systems and equipment shall be properly cleaned, vacuumed, polished, painted, etc., as required to return equipment to like new appearance.
- G. All equipment requiring painting or touch-up shall be properly prepared and painted in accordance with this specification.
- H. FPC shall keep a written record listing systems and equipment cleaned. Where special procedures or chemicals were used or where partial or complete disassembly of factory assembled equipment was necessary, FPC shall list special procedures and/or disassembly required and equipment components affected. Prior to final inspection, FPC shall submit two (2) copies of cleaning record to A/E for their records.

### 1.20 PAINTING OF MATERIAL

- A. In all interior areas without finish ceilings, or where exposed conduit, junction boxes, hangers, supports, mounting brackets or device back-boxes are installed on walls, floors or exposed on finish ceilings, the contractor shall be responsible for painting all exposed materials to match building finishes. Refer to the Architect's specifications for additional requirements. Colors shall be as selected by Architect.
- B. In all exterior areas where conduit, junction boxes, hangers, supports, mounting brackets or device back boxes are exposed and/or surface-mounted, the contractor shall be responsible for painting all exposed materials to match building finishes. Refer to the Architect's specifications for additional requirements. Colors shall be as selected by Architect.
- C. Equipment and materials exposed to interior dry environment shall have a minimum of one (1) primer and one (1) finish coat. Equipment and materials mounted in exterior location shall have a minimum of one (1) primer and two (2) finish coats.
- D. After installation, damage to painted surfaces of equipment shall be properly prepared and primed with primers equal to factory materials. Finish coating shall be same color and type as factory finish. Where extensive refinishing of factory applied finishes is required, equipment shall be completely repainted. A/E will make final determination of extent of refinishing required.

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1.21 RECORD DOCUMENTS

- A. Record Drawings: Unless noted otherwise in architectural documents, maintain a reproducible set of contract drawings and shop drawings in clean, undamaged condition, with mark-up of actual installations which vary substantially from the work as originally shown. Mark whichever drawing is most capable of showing “field” condition fully and accurately; however, where shop drawings are used for mark-up, record a cross-reference at corresponding location on working drawings. Mark with red erasable red pencil and, where feasible, use other colors to distinguish between variations in separate categories of work. Mark-up new information, which is recognized to be of importance to Owner, but was for some reason not shown on either contract drawings or shop drawings. Give particular attention to concealed work, which would be difficult to measure and record at a later date. Note related change order numbers where applicable. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates, and other identification on cover of each sheet.
- B. The Contractor shall provide a full set of photographs showing the entire underground equipment. The photographs shall be taken prior to any concrete being poured. The underground equipment shall consist of, but not be limited to, piping.
- C. The Contractor shall provide the photographs in an 8.5-inch by 11-inch format for record keeping purposes with the maintenance manuals. The photos shall all be digital, and a disk or CD shall be provided to the Owner as a permanent record.
- D. As-built documents shall be submitted for approval prior to final payment. Copies of “in-progress” as-built drawings shall be submitted at each pay request.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION 21 0000

SECTION 21 0517 - SLEEVES AND SLEEVE SEALS FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Sleeves.
  2. Sleeve-seal systems.
  3. Grout.
  4. Silicone sealants.

1.2 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral water-stop.
- B. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, anticorrosion coated or galvanized, with plain ends and integral welded water-stop collar.
- C. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.2 SLEEVE-SEAL SYSTEMS

- A. Description:
1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
  2. Designed to form a hydrostatic seal of 20 psig minimum.
  3. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size.
  4. Pressure Plates: Carbon steel.
  5. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, ASTM B633 or Stainless steel of length required to secure pressure plates to sealing elements.

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### **2.3 GROUT**

- A. Description: Non-shrink, for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

### **2.4 SILICONE SEALANTS**

- A. Silicone, S, NS, 25, NT: Single-component, non-sag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant, ASTM C920, Type S, Grade NS, Class 25, Use NT.
- B. Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T and NT. Grade P Pourable (self-leveling) formulation is for opening in floors and other horizontal surfaces that are not fire rated.

## **PART 3 - EXECUTION**

### **3.1 SLEEVE INSTALLATION**

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas, kitchens, or other wet areas 2 inches above finished floor level.
  - 2. Using grout or silicone sealant, seal space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
  - 1. Cut sleeves to length for mounting flush with both surfaces.

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2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
  3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.
- E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 078413 "Penetration Firestopping."

### 3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

### 3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.
- B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

### 3.4 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
  1. Exterior Concrete Walls above Grade:
    - a. Piping Smaller Than NPS 6: Cast-iron pipe sleeves or Steel pipe sleeves.
    - b. Piping NPS 6 and Larger: Cast-iron pipe sleeves or Steel pipe sleeves.
  2. Exterior Concrete Walls below Grade:
    - a. Piping Smaller Than NPS 6: Cast-iron pipe sleeves with sleeve-seal system or Steel pipe sleeves with sleeve-seal system.



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- 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
- b. Piping NPS 6 and Larger: Cast-iron pipe sleeves with sleeve-seal system or Steel pipe sleeves with sleeve-seal system.
  - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
3. Concrete Slabs-on-Grade:
  - a. Piping Smaller Than NPS 6: Cast-iron pipe sleeves with sleeve-seal system or Steel pipe sleeves with sleeve-seal system.
    - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
  - b. Piping NPS 6 and Larger: Cast-iron pipe sleeves with sleeve-seal system or Steel pipe sleeves with sleeve-seal system.
    - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
4. Concrete Slabs above Grade:
  - a. Piping Smaller Than NPS 6 : Steel pipe sleeves or PVC pipe sleeves.
  - b. Piping NPS 6 and Larger: Steel pipe sleeves or PVC pipe sleeves.

END OF SECTION 21 0517

SECTION 21 0518 - ESCUTCHEONS FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Escutcheons.
  2. Floor plates.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

- A. One-Piece, Steel Type: With polished, chrome-plated finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped steel with polished, chrome-plated finish and spring-clip fasteners.
- C. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.
- D. Split-Plate, Stamped-Steel Type: With polished, chrome-plated finish; concealed hinge; and spring-clip fasteners.

2.2 FLOOR PLATES

- A. Split Floor Plates: Steel with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors. Escutcheons shall be polished-chrome unless provided for factory-painted sprinkler heads that shall have color to match sprinkler head.

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- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
  - 1. Escutcheons for New Piping and Relocated Existing Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.
    - b. Chrome-Plated Piping: One-piece steel with polished, chrome-plated finish.
    - c. Insulated Piping: One-piece steel with polished, chrome-plated finish.
    - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece steel with polished, chrome-plated finish.
    - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece stamped steel with polished, chrome-plated finish.
    - f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece steel with polished, chrome-plated finish.
    - g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece stamped steel with polished, chrome-plated finish.
  - 2. Escutcheons for Existing Piping to Remain:
    - a. Chrome-Plated Piping: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
    - b. Insulated Piping: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
    - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
    - d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
- C. Install floor plates for piping penetrations of equipment-room floors.
- D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
  - 1. New Piping and Relocated Existing Piping: Split floor plate.
  - 2. Existing Piping: Split floor plate.

### 3.2 FIELD QUALITY CONTROL

- A. Using new materials, replace broken and damaged escutcheons and floor plates.

END OF SECTION 21 0518

SECTION 210523 - GENERAL-DUTY VALVES FOR WATER-BASED FIRE-SUPPRESSION PIPING

1.1 SUMMARY

- A. Section Includes:
1. Iron butterfly valves with indicators.
  2. Check valves.
  3. Iron OS&Y gate valves.
  4. NRS gate valves.
  5. Indicator posts.
  6. Trim and drain valves.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of valve.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain each type of valve from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. UL Listed: Valves shall be listed in UL's "Online Certifications Directory" under the headings listed below and shall bear UL mark:
1. Fire Main Equipment: HAMV - Main Level.
    - a. Indicator Posts, Gate Valve: HCBZ - Level 1.
    - b. Ball Valves, System Control: HLUG - Level 3.
    - c. Butterfly Valves: HLXS - Level 3.
    - d. Check Valves: HMER - Level 3.
    - e. Gate Valves: HMRZ - Level 3.
  2. Sprinkler System & Water Spray System Devices: VDGT - Main Level.
    - a. Valves, Trim and Drain: VQGU - Level 1.
- B. FM Global Approved: Valves shall be listed in its "Approval Guide," under the headings listed below:
1. Automated Sprinkler Systems:

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- a. Indicator posts.
- b. Valves.
  - 1) Gate valves.
  - 2) Check valves
  - 3) Miscellaneous valves.

C. ASME Compliance:

- 1. ASME B1.20.1 for threads for threaded-end valves.
- 2. ASME B16.1 for flanges on iron valves.
- 3. ASME B31.9 for building services piping valves.

D. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.

E. NFPA Compliance for valves:

- 1. Comply with NFPA 13, NFPA 14, NFPA 20, and NFPA 24.

F. Valve Pressure Ratings: Not less than the minimum pressure rating indicated or higher, as required by system pressures.

G. Valve Sizes: Same as upstream piping unless otherwise indicated.

H. Valve Actuator Types:

- 1. Worm-gear actuator with handwheel for quarter-turn valves, except for trim and drain valves.
- 2. Handwheel: For other than quarter-turn trim and drain valves.
- 3. Hand lever: For quarter-turn trim and drain valves NPS 2 and smaller.

2.3 BUTTERFLY VALVES WITH INDICATORS

A. Description:

- 1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 112.
- 2. Minimum Pressure Rating: 175 psig.
- 3. Body Material: Cast or ductile iron with nylon, EPDM, epoxy, or polyamide coating.
- 4. Seat Material: EPDM.
- 5. Stem: Stainless steel.
- 6. Disc: Neoprene coated Ductile iron or aluminum bronze
- 7. Actuator: Worm gear.
- 8. Supervisory Switch: Internal or external.
- 9. Body Design: Lug or wafer with flanged or Grooved-end connections.

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2.4 CHECK VALVES

A. Description:

1. Standard: UL 312 and FM Global standard for swing check valves, Class Number 1210.
2. Minimum Pressure Rating: 175 psig.
3. Type: Single swing check.
4. Body Material: Cast iron, ductile iron, or bronze.
5. Clapper: Bronze, ductile iron, or stainless steel with elastomeric seal.
6. Clapper Seat: Brass, bronze, or stainless steel.
7. Hinge Shaft: Bronze or stainless steel.
8. Hinge Spring: Stainless steel.
9. End Connections: Flanged, grooved, or threaded.

2.5 INDICATOR POSTS

A. Description:

1. Standard: UL 789 and FM Global standard for indicator posts.
2. Type: Underground, Wall, or Upright per plans.
3. Base Barrel Material: [Cast or ductile iron.
4. Extension Barrel: Cast or ductile iron.
5. Cap: Cast or ductile iron.
6. Operation: Handwheel.
7. Supervised: Per fire alarm documents.

2.6 TRIM AND DRAIN VALVES

A. Ball Valves:

1. Description:
  - a. Pressure Rating: 175 psig
  - b. Body Design: Two piece.
  - c. Body Material: Forged brass or bronze.
  - d. Port size: Full or standard.
  - e. Seats: PTFE.
  - f. Stem: Bronze or stainless steel.
  - g. Ball: Chrome-plated brass.
  - h. Actuator: Hand-lever.
  - i. End Connections for Valves NPS 1 through NPS 2-1/2: Threaded ends.
  - j. End Connections for Valves NPS 1-1/4 and NPS 2-1/2: Grooved ends.

B. Angle Valves:

1. Description:
  - a. Pressure Rating: 175 psig
  - b. Body Material: Brass or bronze.

- c. Ends: Threaded.
- d. Stem: Bronze.
- e. Disc: Bronze.
- f. Packing: Asbestos free.
- g. Handwheel: Malleable iron, bronze, or aluminum.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION, GENERAL

- A. Comply with requirements in the following Sections for specific valve-installation requirements and applications:
  - 1. Section 211100 "Facility Fire-Suppression Water-Service Piping" for application of valves in fire-suppression water-service piping.
  - 2. Section 211200 "Fire-Suppression Standpipes" for application of valves in fire-suppression standpipes.
  - 3. Section 211313 "Wet-Pipe Sprinkler Systems" for application of valves in wet-pipe, fire-suppression sprinkler systems.
- 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.
- C. Install double-check valve assembly in each fire-protection water-supply connection.
- D. Install valves having threaded connections with unions at each piece of equipment arranged to allow easy access, service, maintenance, and equipment removal without system shutdown. Provide separate support where necessary.
- E. Install valves in horizontal piping with stem at or above the pipe center.
- F. Install valves in position to allow full stem movement.
- G. Install valve tags. Comply with requirements in the NFPA standard applying to the piping system in which valves are installed. Install permanent identification signs indicating the portion of system controlled by each valve.

END OF SECTION 210523

SECTION 21 0529 - HANGERS AND SUPPORTS FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal hanger-shield inserts.
4. Fastener systems.
5. Equipment supports.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 210516 "Expansion Fittings and Loops for Fire-Suppression Piping" for pipe guides and anchors.
3. Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment" for vibration isolation devices and seismic restraints.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For all seismic restraints shall be signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations.

C. Delegated-Design Submittal: For seismic trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.4 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.



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- B. Pipe Welding Qualifications: Qualify procedures and operators according to "2015 ASME Boiler and Pressure Vessel Code, Section IX."

### **PART 2 - PRODUCTS**

#### **2.1 PERFORMANCE REQUIREMENTS**

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design trapeze pipe hangers and equipment supports.
- B. Structural Performance: Hangers and supports for fire-suppression piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
  - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
  - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
  - 3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.
- C. NFPA Compliance: Comply with NFPA 13.
- D. UL Compliance: Comply with UL 203.

#### **2.2 METAL PIPE HANGERS AND SUPPORTS**

- A. Carbon-Steel Pipe Hangers and Supports:
  - 1. Description: Factory-fabricated components, NFPA approved, UL listed, or FM approved for fire-suppression piping support.
  - 2. Galvanized Metallic Coatings: Pre-galvanized or hot-dip galvanized.
  - 3. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

#### **2.3 TRAPEZE PIPE HANGERS**

- A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon-steel shapes, with NFPA-approved, UL-listed, or FM-approved carbon-steel hanger rods, nuts, saddles, and U-bolts.

#### **2.4 FASTENER SYSTEMS**

- A. Powder-Actuated Fasteners: NFPA-approved, UL-listed, or FM-approved 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.

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- B. Mechanical-Expansion Anchors: NFPA-approved, UL-listed, or FM-approved, insert-wedge-type anchors, for use in hardened Portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
  - 1. Indoor Applications: Zinc-coated or Stainless steel.
  - 2. Outdoor Applications: Stainless steel.

### **PART 3 - EXECUTION**

#### **3.1 APPLICATION**

- A. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

#### **3.2 HANGER AND SUPPORT INSTALLATION**

- A. Metal Pipe-Hanger Installation: Comply with installation requirements of approvals and listings. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
  - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.
  - 2. Field fabricate from ASTM A36/A36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- 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. Install in accordance with approvals and listings.
  - 2. Install mechanical-expansion anchors in concrete, after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions. Install in accordance with approvals and listings.

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- E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- H. Install lateral bracing with pipe hangers and supports to prevent swaying.
- I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- J. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- K. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- L. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- M. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work.

### 3.3 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches

### 3.4 PAINTING

- A. Touchup: Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately after erecting hangers and supports. Use same materials as those used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded, shop-painted areas on miscellaneous metal are specified in Section 099113 "Exterior Painting.", Section 099123 "Interior Painting." And Section 099600 "High-Performance Coatings."

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- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A780/A780M.

### 3.5 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with NFPA requirements for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finishes.
- D. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.
- E. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
- F. Horizontal-Piping Hangers and Supports: Comply with NFPA requirements. 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 - or insulated, stationary pipes NPS 1/2 to NPS 30.
  - 2. Steel Pipe Clamps (MSS Type 4): For suspension of NPS 1/2 to NPS 24 if little or no insulation is required.
  - 3. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8.
  - 4. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of non-insulated, stationary pipes NPS 3/8 to NPS 8.
  - 5. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of non-insulated, stationary pipes NPS 3/8 to NPS 3.
  - 6. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
  - 7. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
  - 8. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
  - 9. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
- 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.

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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: Comply with NFPA requirements.
- I. Building Attachments: Comply with NFPA requirements. 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. C-Clamps (MSS Type 23): For structural shapes.
  3. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
- J. Saddles and Shields: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
  2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
  3. Thermal Hanger-Shield Inserts: For supporting insulated pipe.
- K. Comply with NFPA requirements for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- L. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction. Verify type and maximum depth of anchors for all post-tensioned and precast concrete slabs with the structural engineer.

END OF SECTION 21 0529

SECTION 211100 - FACILITY FIRE-SUPPRESSION WATER-SERVICE PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes fire-suppression water-service piping and related components outside the building and service entrance piping through floor into the building or through wall into the building and the following:
  - 1. Pipes, fittings, and specialties.
  - 2. Fire-suppression specialty valves.
  - 3. Concrete vaults.
  - 4. Protective enclosures.
  - 5. Alarm devices.
- B. Utility-furnished products include water meters that are furnished to the site, ready for installation.
- C. Related Requirements:
  - 1. Section 211119 "Fire-Department Connections" for yard-type, fire-department connections.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
  - 1. Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.
  - 2. Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.
- B. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements:

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1. Comply with requirements of utility company supplying the water. Include tapping of water mains and backflow prevention.
  2. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.
- B. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with FM Global's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.
- E. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-suppression water-service piping.

### **PART 2 - PRODUCTS**

#### **2.1 DUCTILE-IRON PIPE AND FITTINGS**

- A. Grooved-Joint, Ductile-Iron Pipe: AWWA C151, with cut, rounded-grooved ends.
- B. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end.
- C. Grooved-End, Ductile-Iron Pipe Appurtenances:
1. Grooved-End, Ductile-Iron Fittings: ASTM A47/A47M, malleable-iron castings or ASTM A536, ductile-iron castings with dimensions matching pipe.
  2. Grooved-End, Ductile-Iron-Piping Couplings: AWWA C606, for ductile-iron-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.
- D. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
1. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- E. Flanges: ASME B16.1, Class 125, cast iron.

#### **2.2 PE PIPE AND FITTINGS**

- A. PE, Fire-Service Pipe: FM Global approved, with minimum thickness equivalent to Class 150
- B. Molded PE Fittings: FM Global approved; PE butt-fusion type, made to match PE pipe dimensions and class.

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### 2.3 PVC PIPE AND FITTINGS

- A. PVC Pipe: AWWA C900, Class 150, with bell end with gasket, and with spigot end.
- B. PVC Fittings: AWWA C900, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.

### 2.4 SPECIAL PIPE FITTINGS

- A. Ductile-Iron Flexible Expansion Joints:
  - 1. Description: Compound, ductile-iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include two gasketed ball-joint sections and one or more gasketed sleeve sections. Assemble components for offset and expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
  - 2. Pressure Rating: 250 psig minimum.
- B. Ductile-Iron Deflection Fittings:
  - 1. Description: Compound, ductile-iron coupling fitting with sleeve and one or two flexing sections for up to 15-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
  - 2. Pressure Rating: 250 psig minimum.

### 2.5 JOINING MATERIALS

- A. Gaskets for Ferrous Piping and Copper-Alloy Tubing: ASME B16.21, asbestos free.
- B. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series.

### 2.6 PIPING SPECIALTIES

- A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.
- B. Tubular-Sleeve Pipe Couplings:
  - 1. Description: Metal, bolted, sleeve-type, reducing or transition coupling, with center sleeve, gaskets, end rings, and bolt fasteners, and with ends of same sizes as piping to be joined.
  - 2. Standard: AWWA C219.
  - 3. Center-Sleeve Material: Manufacturer's standard.
  - 4. Gasket Material: Natural or synthetic rubber.
  - 5. Pressure Rating: 150 psig minimum.
  - 6. Metal Component Finish: Corrosion-resistant coating or material.



2.7 CURB VALVES

- A. Curb Valves: Comply with AWWA C800 for high-pressure, service-line valves. Valve has bronze body, ground-key plug or ball, wide tee head, and inlet and outlet matching service piping material.
- B. Service Boxes for Curb Valves: Similar to AWWA M44 requirements for cast-iron valve boxes. Include cast-iron telescoping top section of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over curb valve and with a barrel approximately 3 inches in diameter.
  - 1. Shutoff Rods: Steel; with tee-handle with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve.
- C. Meter Valves: Comply with AWWA C800 for high-pressure, service-line valves. Include angle- or straight-through-pattern bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material.

2.8 DETECTOR CHECK VALVES

- A. Equivalent by Watts, Fabco, Hershey, Ames, Wilkens or Conbraco.
- B. Basis of design: Watts LF709
- C. Description: Galvanized cast-iron body, bolted cover with air-bleed device for access to internal parts, and flanged ends. Include one-piece bronze disc with bronze bushings, pivot, and replaceable seat. Include threaded bypass taps in inlet and outlet for bypass meter connection. Set valve to allow minimal water flow through bypass meter when major water flow is required.
- D. Standards: UL 312 and FM Global's "Approval Guide."
- E. Pressure Rating: 175 psig (1200 kPa).
- F. Water Meter: AWWA C700, disc type, at least one-fourth size of detector check valve. Include meter, bypass piping, gate valves, check valve, and connections to detector check valve.

2.9 PRESSURE-REDUCING VALVES

- A. Water Regulators:
  - 1. Standard: ASSE 1003.
  - 2. Pressure Rating: Initial pressure of 150 psig.
  - 3. Size: Full size of pipe per plans.
  - 4. Design Flow Rate: Per Plans.
  - 5. Design Inlet Pressure: Per Plans.
  - 6. Design Outlet Pressure Setting: Per Plans.

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7. Body Material: Bronze for NPS 2 and smaller; cast iron[ with interior lining complying with AWWA C550 or that is FDA approved] for NPS 2-1/2 and NPS 3.
8. End Connections: Threaded for NPS 2 and smaller; flanged or grooved for NPS 2-1/2 and NPS 3.

### 2.10 BACKFLOW PREVENTERS

#### A. Double-Check, Backflow-Prevention Assemblies:

1. Equivalents by Watts, Fabco, Hershey, Ames, Wilkens or Conbraco.
2. Basis of Design: Watts LF709 with strainer and shut-off valves.
3. Standard: ASSE 1015.
4. Operation: Continuous-pressure applications unless otherwise indicated.
5. Pressure Loss: 5 psig maximum, through middle one-third of flow range.
6. Size: Full size of service pipe per plans.
7. Design Flow Rate: Per Documents.
8. Pressure Loss at Design Flow Rate: 10 psig.
9. Body Material: cast iron with epoxy interior lining and stainless steel seats complying with AWWA C550 or that is FDA approved.
10. End Connections: Flanged or grooved.
11. Configuration: Designed for horizontal or vertical, straight through flow.
12. Accessories:
  - a. OS&Y gate valves with flanged ends on inlet and outlet
  - b. Strainer on inlet.

#### B. Backflow Preventer Test Kits:

1. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions by valve manufacturer.

### 2.11 VALVE BOXES

#### A. Description: Cast-iron body and cover for disc-type water meter, with lettering "WATER VALVE" on cover; and with slotted, open-bottom base section of length to fit over service piping.

1. Option: Base section may be cast-iron, PVC, clay, or another pipe.

#### B. Description: Cast-iron body and double cover for disc-type water meter, with lettering "WATER VALVE" on top cover; and with separate inner cover; air space between covers; and slotted, open-bottom base section of length to fit over service piping.

#### C. Description: Polymer-concrete body and cover for disc-type water meter, with lettering "WATER" on cover; and with slotted, open-bottom base section of length to fit over service piping. Include vertical and lateral design loadings of 15,000 lb. minimum over 10 by 10 inches square.

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### 2.12 CONCRETE VAULTS

- A. Description: Precast, reinforced-concrete vault, designed for A-16 load designation according to ASTM C857, and made according to ASTM C858.
- B. Ladder: ASTM A36/A36M, steel ladder; or PE-encased steel steps.
- C. Manhole: ASTM A536, Grade 60-40-18, ductile-iron traffic frame and cover.
  - 1. Dimension: 24-inch minimum diameter unless otherwise indicated.
- D. Drain: ASME A112.6.3, cast-iron floor drain, with outlet of size indicated. Include body anchor flange, light-duty cast-iron grate, bottom outlet, and integral or field-installed bronze ball or clapper-type backwater valve.

### 2.13 FIRE-DEPARTMENT CONNECTION

- A. Standard: UL 405. Comply with NFPA and local fire department and authority having jurisdiction.
- B. Type: Post-type, 2-2.5" National Standard Thread connection equipped with ball drip valve as indicated on plans. FC shall be max of 48" above finish grade. Provide knock locking cap with chain or cable per City requirements.
- C. Pressure Rating: 175 psig minimum.
- D. Body Material: Corrosion-resistant metal.
- E. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
- F. Escutcheon Plate or label Marking: Similar to "AUTO SPKR & STANDPIPE or STANDPIPE" per system type.
- G. Riser Finish: Galvanized steel.

### 2.14 ALARM DEVICES

- A. General: UL 753 and FM Global's "Approval Guide" listing, of types and sizes to mate and match piping and equipment.
- B. Water-Flow Indicators: Vane-type water-flow detector, rated for 250-psig working pressure; designed for horizontal or vertical installation; with two single-pole, double-throw circuit switches to provide 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 when cover is removed.

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- C. Supervisory Switches: Single pole, double throw; designed to signal valve in other than fully open position.
- D. Pressure Switches: Single pole, double throw; designed to signal increase in pressure.

### **PART 3 - EXECUTION**

#### **3.1 EARTHWORK**

- A. Comply with excavating, trenching, and backfilling requirements in Section 312000 "Earth Moving."

#### **3.2 PIPING INSTALLATION**

- A. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.
- B. Make connections NPS 4 and larger with tapping machine according to the following:
  - 1. Install tapping sleeve and tapping valve according to MSS SP-60.
  - 2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
  - 3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
  - 4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.
- C. Comply with NFPA 24 for fire-service-main piping materials and installation.
- D. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.
  - 1. Install encasement for piping according to ASTM A674 or AWWA C105.
- E. Install PVC, AWWA pipe according to ASTM F645 and AWWA M23.
- F. Bury piping with depth of cover over top at least 30 inches with top below level of maximum frost penetration, and according to the following:
  - 1. Under Driveways: With at least 36 inches of cover over top and below frost line.
- G. Install piping by tunneling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed.
- H. Extend fire-suppression water-service piping and connect to water-supply source and building fire-suppression water-service piping systems at locations and pipe sizes indicated.
  - 1. Terminate fire-suppression water-service piping within the building at the floor slab or wall or wall per plans until building-water-piping systems are installed. Terminate piping

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with caps, plugs, or flanges as required for piping material. Make connections to building's fire-suppression water-service piping systems when those systems are installed.

- I. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.
- J. Comply with requirements in Section 211313 "Wet-Pipe Sprinkler Systems," for fire-suppression-water piping inside the building.
- K. The contractor must consult the City water department and local authorities, provide necessary materials and labor to conform to all local requirements and include the cost of all work and materials in connection with the service.
- L. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."
- M. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

### 3.3 JOINT CONSTRUCTION

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure rating same as or higher than systems pressure rating for aboveground applications unless otherwise indicated.
- B. Install flanges, flange adaptors, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 4 and larger end connections.
- C. Ream ends of tubes and remove burrs.
- D. Remove scale, slag, dirt, and debris from outside and inside of pipes, tubes, and fittings before assembly.
- E. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.
- F. Ductile-Iron Piping, Grooved Joints: Cut-groove pipe. Assemble joints with grooved-end, ductile-iron-piping couplings, gaskets, lubricant, and bolts.
- G. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with bolts according to ASME B31.9.
- H. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure.
- I. Do not use flanges or unions for underground piping.

### 3.4 ANCHORAGE INSTALLATION

- A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:
  - 1. Concrete thrust blocks.
  - 2. Locking mechanical joints.
  - 3. Set-screw mechanical retainer glands.
  - 4. Bolted flanged joints.
  - 5. Heat-fused joints.
  - 6. Pipe clamps and tie rods.
- B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches in fire-suppression water-service piping according to NFPA 24 and the following:
  - 1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
  - 2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
- C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

### 3.5 VALVE INSTALLATION

- A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.
- B. AWWA Valves Other Than Gate Valves: Comply with AWWA C600 and AWWA M44.
- C. UL-Listed or FM Global-Approved Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.
- D. UL-Listed or FM Global-Approved Valves Other Than Gate Valves: Comply with NFPA 24.
- E. MSS Valves: Install as component of connected piping system.
- F. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.
- G. Pressure-Reducing Valves: Install in vault or aboveground between shutoff valves.
- H. Support valves and piping, not direct buried, on concrete piers. Comply with requirements for concrete piers in Section 033000 "Cast-in-Place Concrete."

### 3.6 DETECTOR CHECK VALVE INSTALLATION

- A. Install in vault or aboveground.

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- B. Install for proper direction of flow. Install bypass with water meter, gate valves on each side of meter, and check valve downstream from meter.
- C. Support detector check valves and piping on concrete piers. Comply with requirements for concrete piers in Section 033000 "Cast-in-Place Concrete."

### **3.7 BACKFLOW PREVENTER INSTALLATION**

- A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.
- B. Do not install backflow preventers that have relief drain in vault or in other spaces subject to flooding.
- C. Do not install bypass piping around backflow preventers.
- D. Support NPS 2-1/2 and larger backflow preventers and piping on concrete piers. Comply with requirements for concrete piers in Section 033000 "Cast-in-Place Concrete."

### **3.8 FIRE-DEPARTMENT CONNECTION INSTALLATION**

- A. Install ball drip valves at each check valve for fire-department connection to mains.
- B. Install protective pipe bollards on two sides of each freestanding fire-department connection in or adjacent to drive lines or parking as required.

### **3.9 ALARM DEVICE INSTALLATION**

- A. General: Comply with NFPA 24 for devices and methods of valve supervision. Underground valves with valve box do not require supervision.
- B. Supervisory Switches: Supervise valves in open position.
  - 1. Valves: Grind away portion of exposed valve stem. Bolt switch, with plunger in stem depression, to OS&Y gate-valve yoke.
  - 2. Indicator Posts: Drill and thread hole in upper-barrel section at target plate. Install switch, with toggle against target plate, on barrel of indicator post.
- C. Locking and Sealing: Secure unsupervised valves as follows:
  - 1. Valves: Install chain and padlock on open OS&Y gate valve.
  - 2. Post Indicators: Install padlock on wrench on indicator post.
- D. Pressure Switches: Drill and thread hole in exposed barrel of fire hydrant. Install switch.

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- E. Water-Flow Indicators: Install in water-service piping in vault. Select indicator with saddle and vane matching pipe size. Drill hole in pipe, insert vane, and bolt saddle to pipe.
- F. Connect alarm devices to building's fire-alarm system. Wiring and fire-alarm devices are specified in Section 284621 "Conventional Fire-Alarm Systems. Electric tamper switches are not shown but are required wherever a shutoff valve is installed in the sprinkler system. Electric flow switches are not shown but are required. The sprinkler contractor shall be responsible for providing the flow switch and associated wiring to connect the fire alarm system. The Contractor shall be responsible for providing the tamper switch and flow switches and associated wiring to connect the fire alarm system. All wiring shall be in accordance with Division 26.
- G. The sprinkler contractor shall provide written verification and owner observance of operation of the notification system contacting the owner's monitoring service.
- H. All flow switches, gongs, horns, etc., required by the local code officials or authority with jurisdiction shall be included. All wiring shall be in accordance with Division 26.

### 3.10 CONNECTIONS

- A. Connect fire-suppression water-service piping to utility water main, existing water main or stub-outs as shown on civil plans per documents and utility requirements.
- B. Connect fire-suppression water-service piping to interior fire-suppression piping.

### 3.11 FIELD QUALITY CONTROL

- A. Use test procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described below.
- B. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.
- C. Hydrostatic Tests: Test at not less than specified test pressure for two hours.
  - 1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for one hour; decrease to zero psig. Slowly increase again to test pressure and hold for one more hour. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.
- D. Prepare test and inspection reports.



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3.12 IDENTIFICATION

- A. Install continuous underground, detectable, warning tape during backfilling of trench for underground fire-suppression water-service piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Section 312000 "Earth Moving."
- B. Permanently attach equipment nameplate or marker indicating plastic fire-suppression water-service piping or fire-suppression water-service piping with electrically insulated fittings, on main electrical meter panel.

3.13 PIPING SCHEDULE

- A. Underground fire-suppression water-service piping NPS 4 and larger shall be one of the following and shall match the piping material per the civil engineering plans if applicable:
  - 1. Grooved-end, ductile-iron pipe; grooved-end, ductile-iron pipe appurtenances; and grooved joints.
  - 2. Mechanical-joint, ductile-iron pipe; mechanical-joint, ductile-iron, standard-pattern fittings; glands, gaskets, and bolts; and gasketed joints.
- B. Aboveground and vault fire-suppression water-service piping NPS 4 and larger shall be grooved-end, ductile-iron pipe; grooved-end, ductile-iron pipe appurtenances; and grooved joints.

3.14 VALVE SCHEDULE

- A. Underground fire-suppression water-service shutoff valves NPS 4 and larger shall be the following:
  - 1. 250-psig, UL-listed or FM Global-approved, iron, non-rising-stem gate valves.
- B. Indicator-post underground fire-suppression water-service valves NPS 3 and larger shall be 250-psig, UL-listed or FM Global-approved, iron, non-rising-stem gate valves with indicator-post flange.
- C. Standard-pressure, aboveground and vault fire-suppression water-service shutoff valves NPS 4 and larger shall be the following:
  - 1. 250-psig, UL-listed or FM Global-approved, iron, OS&Y gate valves.

END OF SECTION 211100

SECTION 21 1313 - WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Pipes, fittings, and specialties.
  2. Cover system for sprinkler piping.
  3. Specialty valves.
  4. Sprinklers.

1.2 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.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For wet-pipe sprinkler systems.
1. Include plans, elevations, sections, and attachment details.
  2. Include diagrams for power, signal, and control wiring.
- C. Delegated-Design Submittal: For wet-pipe sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed a professional engineer licensed in the State of Missouri and responsible for their preparation.

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### 1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Sprinkler systems, or BIM model, drawn to scale, on which items of other systems and equipment are shown and coordinated with each other, using input from installers of the items involved.
- B. Qualification Data: For qualified Installer and professional engineer.
- C. Design Data:
  - 1. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.
- D. Field Test Reports: 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."
- E. Field quality-control reports.

### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

### 1.6 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 bid on fire-hydrant flow test but new flow test shall be conducted by contractor for all final project calculations..
    - a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer. Furnish all design, labor, materials, fabrication, equipment, and services necessary to provide a complete and operational automatic fire sprinkler system as specified herein and as required for satisfactory operation of the system
    - b. Fire protection work shall be installed by a firm with at least three (3) years of successful installation experience on projects with fire protection work similar to that required for project by a qualified Contractor (sprinkler fitter or per jurisdictional dictates). The Contractor's design shall be stamped by a Registered Professional Engineer licensed in the state of the project.

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1.7 CAD FILE REQUESTS:

- A. CAD files are the property of the D/E. CAD files are only available upon documented written request which must be forwarded to the D/E office. Prior to receiving any CAD files, the contractor shall sign a Second Party User Agreement and Drawing Request Form (available upon request from our office) which must be forwarded back to the D/E office prior to any CAD files being released. BIM/Revit models will not be made available.

PART 2 - SUMMARY AND SCOPE OF WORK

- 2.1 Furnish all design, labor, materials, fabrication, equipment, and services necessary to provide a complete and operational automatic fire sprinkler system as specified herein and as required for satisfactory operation of the system. System shall be provided for 4-story building (basement, two main levels, and mezzanine) with new wet suppression system with light hazard in main building and ordinary hazard in all mechanical rooms. Contractor shall design system with regard to the fire line size noted on plans. If sizes and requirements on plans need to be adjusted, the fire sprinkler contractor shall include all costs in bid including but not limited to larger fire service line, fire pump, etc along with any other electrical or other costs associated with noted adjustments or changes.
- 2.2 The sprinkler system shall be installed in accordance with the latest edition of NFPA. This requirement does not relieve the Contractor from meeting the requirements set by Owner's insurance company. All flow indicators, valves, gongs, horns, etc., shall be included as part of this contract.

PART 3 - PRODUCTS

3.1 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. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with NFPA 13.
- C. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.
- D. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design wet-pipe sprinkler systems.
  - 1. The contractor shall be responsible for verification of existing system pressures and conditions for modifications as required for new construction areas.
  - 2. Sprinkler system design shall be approved by authorities having jurisdiction.

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- a. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
  - b. Sprinkler Occupancy Hazard Classifications:
    - 1) Public Areas: Light Hazard.
    - 2) Mechanical room, Storage rooms, Elevator equipment rooms: Ordinary Hazard
  3. Unless required otherwise, minimum Density for Automatic-Sprinkler Piping Design:
    - a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. area.
    - b. Ordinary-Hazard Occupancy: 0.15 gpm over 1500-sq ft area
  4. Maximum protection area per sprinkler according to UL listing and NFPA 13. Large ceiling plenum spaces with limited access are not used for storage of combustibles.
- E. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7 and seismic load information shown on structural plans.

### 3.2 STEEL PIPE AND FITTINGS

- A. Standard weight Galvanized and Black Steel Pipe: ASTM A53/A53M, Pipe ends may be factory or field formed to match joining method.
- B. Schedule 40, Galvanized and Black Steel Pipe: ASTM A135/A135M; ASTM A795/A795M, or ASME B36.10M wrought steel, with wall thickness not less than Schedule 40.
- C. Pipe fittings shall be cast iron, malleable iron, or steel. Pipe joints shall be seamless, welded, threaded or mechanically coupled.
- D. Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
- E. Malleable- or Ductile-Iron Unions: UL 860.
- F. Cast-Iron Flanges: ASME 16.1, Class 125.
- G. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.
  1. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick, ASME B16.21, nonmetallic and asbestos free, or EPDM rubber gasket.
    - a. Class 125 and Class 250, Cast-Iron, Flat-Face Flanges: Full-face gaskets.
    - b. Class 150 and Class 300, Ductile-Iron or -Steel, Raised-Face Flanges: Ring-type gaskets.

### 3.3 SPRINKLER PIPING SPECIALTIES

- A. Branch Outlet Fittings:

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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-tee and -cross fittings.
5. Configurations: Snap-on and strapless, 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: Grooved, plain-end pipe, or threaded.

### B. Adjustable Drop Nipples:

1. Standard: UL 1474.
2. Pressure Rating: 250-psig 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.

### C. Flexible Sprinkler Hose Fittings (For rooms with existing ceilings only):

1. Standard: UL 1474.
2. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
3. Pressure Rating: 175-psig minimum
4. Size: Same as connected piping, for sprinkler.
5. Material: 100%, type 304, stainless steel.
6. Maximum length: three feet.
7. Shall attach to lay-in and hard ceilings with a multi-port style, galvanized ceiling bracket having self-securing integrated Snap-on clip ends that attach directly to the ceiling with tamper-resistant screws.
8. Manufacturer shall be Victaulic only.

## 3.4 SPRINKLERS

### A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

### B. Pressure Rating for Automatic Sprinklers: 175-psig minimum.

### C. Automatic Sprinklers with Heat-Responsive Element:

1. Early-Suppression, Fast-Response Applications: UL 1767.
2. Nonresidential Applications: UL 199.
3. 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 (unless noted otherwise):

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1. Exposed areas without ceilings-brass, un-plated sprinklers.
  2. Finished ceiling areas- Recessed type in lay-in ceiling and concealed type for all gyp or colored ceilings. All parts polished chrome.
- E. Sprinkler Guards:
1. Standard: UL 199.
  2. Type: Wire cage with fastening device for attaching to sprinkler.

### **PART 4 - EXECUTION**

#### **4.1 PIPING INSTALLATION**

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.
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.
  2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.
- B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.
- C. Install seismic restraints on piping. Comply with NFPA 13 requirements for seismic-restraint device materials and installation.
- D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- E. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13. Install all drain lines in coordination with owner. Do not discharge any on public sidewalks. Route in mechanical rooms, chases, or other non finished areas of the building. Pipe any air vent lines to janitor's basin or floor drains in mechanical spaces.
- H. Install alarm devices in piping systems if needed.
- I. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13. In seismic-rated areas, refer to Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."
- J. Fill sprinkler system piping with water.

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- K. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."
- L. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 210518 "Escutcheons for Fire-Suppression Piping."
- M. Unless coordinated with other trades, all piping shall be installed within 6 inches of structure. Offset around obstacles as necessary and return piping to within 6 inches of structure as close to offset as possible. Branch piping shall be run between concrete stem and steel joists in rooms without ceilings.

### 4.2 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. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
- G. 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.
- H. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.
- I. Steel-Piping, Pressure-Sealed Joints: Join lightwall and Schedule 5 steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.
- J. 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.



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4.3 VALVE AND SPECIALTIES INSTALLATION

- A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

4.4 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center of 2” of the center of acoustical ceiling panels. All heads shall align in rooms. It shall be the responsibility of the sprinkler design engineer to accommodate this requirement. Failure to comply with this requirement will result in return of submitted design for resubmission.
- B. Install sprinklers into flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid.
- C. All piping shall be installed within 6 inches of structure. Offset around obstacles as necessary and return piping to within 6 inches of structure as close to offset as possible. Branch piping shall be run between concrete stem and steel joists in rooms without ceilings.
- D. All piping shall be concealed with the exception of areas without ceilings and stairwells where structure is exposed.

4.5 IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13. Provide all signage and notification for fire department connections, knox box, PIV valves, etc as required for NFPA, fire code, and per local authorities.
- B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

4.6 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections.
  - 1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
  - 3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
  - 4. Energize circuits to electrical equipment and devices.
  - 5. Coordinate with fire-alarm tests. Operate as required.
- B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

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4.7 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

4.8 PIPING SCHEDULE

- A. Standard-pressure, wet-pipe sprinkler system, NPS 2, shall be one of the following:
  - 1. Schedule 40, galvanized-steel pipe with threaded ends; gray-iron threaded fittings; and threaded joints with bacterial resistant internal coating.
- B. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 or larger shall be one of the following:
  - 1. 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 with bacterial resistant internal coating.

4.9 SPRINKLER SCHEDULE

- A. Use sprinkler types in subparagraphs below for the following applications:
  - 1. Rooms without Ceilings: Upright sprinklers.
  - 2. Wall Mounting: Recessed and sprinklers.
- B. Provide sprinkler types in subparagraphs below with finishes indicated.
  - 1. Upright, Pendent, and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; or wax coated where exposed to acids, chemicals, or other corrosive fumes.

END OF SECTION 21 1313

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## SECTION 22 0000 - GENERAL PLUMBING REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
1. Common plumbing installation requirements.

#### 1.2 SPECIFICATION FORM AND DEFINITIONS

- A. These Specifications are abbreviated form and contain incomplete sentences. Omissions of words or phrases such as “the Contractor shall,” “shall be,” “as noted on the drawings,” “according to the drawings,” “a,” “an,” “the,” and “all” are intentional. Omitted words and phrases shall be supplied by inference.
- B. When a word such as “proper,” “satisfactory,” “equivalent,” and “as directed” is used, it requires Engineer’s review.
- C. “Provide” means furnish and install.
- D. “Working Day” wherever used in these Specifications, shall mean the normal working days Monday through Friday, exclusive of Saturday, Sunday, and federally observed holidays.
- E. Architect/Engineer hereinafter abbreviated A/E shall mean both the Design Architects and the Design Engineers.
- F. Design Engineer hereinafter abbreviated D/E shall mean the engineering firm, RTM Engineering Consultants, 3333 E. Battlefield Suite 1000 Springfield, MO 65804, Telephone (417) 881-0020. Contact Person: Jennifer Luce.
- G. General Contractor hereinafter abbreviated G/C shall mean the person or company and their subcontractors who enter into contract with the Owner to perform the general division work.
- H. Electrical Contractor hereinafter abbreviated E/C shall mean the person or company and their subcontractors who enter into contract with the G/C to perform the division 26 work.
- I. Mechanical Contractor hereinafter abbreviated M/C shall mean the person or company and their subcontractors who enter into contract with the G/C to perform the division 23 work.
- J. Plumbing Contractor hereinafter abbreviated P/C shall mean the person or company and their subcontractors who enter into contract with the G/C to perform the division 22 work.
- K. Fire Protection Contractor hereinafter abbreviated FPC shall mean the person or company and their subcontractors who enter contract with the G/C to perform the division 21 work.
- L. Equipment and/or materials manufacturer hereinafter abbreviated E/M shall mean the manufacturer of equipment or materials specified or referred to.

#### 1.3 GENERAL EXTENT OF WORK

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- A. Provide plumbing systems indicated on drawings, specified or reasonably implied. Provide every device and accessory for proper operation and completion of mechanical systems. In no case will claims for “Extra Work” be allowed for work about which P/C could have informed himself before bids were taken.
- B. P/C shall familiarize himself with equipment provided by other contractors.
- C. Make required plumbing connections to equipment provided under Architectural and mechanical divisions of this project, except where shown or specified otherwise. Make required internal field wiring modifications indicated on wiring diagrams of factory installed control system for control sequence specified. These field modifications shall be limited to jumper connections and connection of internal wiring to alternate terminal block lugs. Cost for field modifications requiring re-wiring of factory installed control systems for equipment provided by G/C or P/C shall be included in base bid of each respective contractor.
- D. All plumbing work as required to provide temporary plumbing for construction shall be the responsibility of the plumbing contractor. Include all costs as required in the base bid. Coordinate and verify all requirements with the general contractor.
- E. Refer to the construction documents for owner-supplied, contractor installed materials, equipment or fixtures. Contractor shall be prepared to receive materials and equipment arriving on the project site and shall be responsible for storing, removing from packaging and assembling on site prior to installation. Coordinate delivery times and all requirements with the owner through the general contractor. Contractor shall provide all necessary additional materials, supports, bracing, mounting brackets, back-boxes, etc. as required for installation of owner-supplied, contractor-installed materials, equipment or fixtures.

### 1.4 LOCAL CONDITIONS

- A. Visit site and determine existing local conditions affecting work in contract.
- B. Failure to determine site conditions or nature of existing or new construction will not be considered a basis for granting additional compensation.

### 1.5 CODES, ORDINANCES, RULES AND REGULATIONS

- A. Provide work in accordance with applicable codes, rules, ordinances, and regulations of Local, State, and Federal Governments and other authorities having lawful jurisdiction.
- B. Drawings and specifications indicate minimum construction standards, but should any work indicated be sub-standard to any ordinances, laws, codes, rules, or regulations bearing on work, P/C shall promptly notify A/E in writing before proceeding with work so that necessary changes can be made. However, if P/C proceeds with work knowing it to be contrary to any ordinances, laws, rules, and regulations, he shall thereby have assumed full responsibility for and shall bear all costs required to correct non-complying work.
- C. Conform to latest editions and supplements of the following codes, standards, or recommended practices.
  - 1. CITY CODES:
    - a. 2021 International Building Codes
    - b. 2021 International Fire Code

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- c. 2021 International Plumbing Code
  - d. 2021 International Energy Code
  - e. 2021 International Existing Building Code
  - 2. SAFETY CODES:
    - a. National Electric Safety Code Handbook H30 – National Bureau of Standards.
    - b. Occupational Safety and Health Standards – Department of Labor.
    - c. Specifications for Making Buildings and Facilities Accessible To, and Usable By, the Physically Handicapped – American Standards Institute ANSI A117.1.
  - 3. NATIONAL FIRE CODES:
    - a. NFPA 54 Gas Appliance and Gas Piping Code.
    - b. NFPA 70 National Electric Code – 2020 Edition.
    - c. NFPA 89M Clearances, Heat Producing Appliances.
    - d. NFPA 90A Air Conditioning and Ventilation Systems.
    - e. NFPA 91 Blower and Exhaust Systems.
    - f. NFPA 101 Life Safety Code – 2012 Edition.
- D. Where following standards are applicable to equipment specified, equipment shall conform to requirements of standard and shall display the appropriate seal or seals:
- 1. AGA – The American Gas Association Laboratories.
  - 2. ASME – American Society of Mechanical Engineers.
  - 3. NSF – National Sanitation Foundation.
  - 4. UL – Underwriters Laboratories Inc.

### 1.6 CONTRACT CHANGE

- A. Changes or deviations from contract; including those for extra or additional work must be submitted in writing for review of A/E. No verbal orders will be recognized.
- B. Changes in the work shall be submitted in accordance with AIA Document A201, General Conditions of the Contract for Construction.
- C. All change proposals shall be itemized indicating separately the costs for materials, labor, restocking charges, freight, bonds, insurance, overhead, and profit. All materials shall be listed separately with quantities and individual unit prices. Labor factors shall be from a nationally recognized source with appropriate adjustments.

### 1.7 LOCATIONS AND INTERFERENCES

- A. Locations of equipment, piping, and other mechanical work are indicated diagrammatically by plumbing drawings. Lay out work from dimensions on Architectural and Structural Drawings. Verify equipment size from manufacturer's shop drawings.
- B. Study and become familiar with contract drawings of other trades and the general construction drawings and details to obtain necessary information for figuring installation. Cooperate with other workmen and install work to avoid interference with their work. Minor deviations not affecting design characteristics, performance, or space limitations may be permitted if reviewed by A/E prior to installation.

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- C. Any conduit, apparatus, appliance, or other plumbing item interfering with proper placement of other work as indicated on drawings, specified, or required shall be removed and if so shown, relocated and reconnected without extra cost. Damage to other work caused by the P/C, his subcontractor, his workmen, or by any cause whatsoever, shall be restored as specified for new work.
- D. Do not scale mechanical and electrical drawings for dimensions. Accurately lay out work from dimensions indicated on architectural drawings unless such is found in error.

### 1.8 SYSTEM PERFORMANCE

- A. Final acceptance of work shall be subject to the condition that all systems, equipment, apparatus, and appliances operate satisfactorily as designed and intended; work shall include required adjustment of systems and control equipment installed under this specification.

### 1.9 WARRANTY

- A. Unless noted otherwise in specifications, P/C warrants to Owner and Architect the quality of materials, equipment, workmanship, and operation of equipment provided under this specification division for a period of one (1) year from and after date of substantial completion of building and acceptance of mechanical systems by Owner.
- B. Where manufacturers' warranties expire before or during the one-year warranty period as specified in item 1, the P/C shall include provisions for extending the manufacturer's warranty as required to match the one-year period from substantial completion and shall include cost for warranty extension in his base bid.
- C. P/C warrants to Owner and Architect that on receipt of written notice from either of them within one (1) year warranty period following date of acceptance, all defects that have appeared in materials and/or workmanship shall be promptly corrected to condition required by contract documents at P/C's expense.
- D. The above warranty shall not supersede any separately stated warranty or other requirements by law or by these specifications.
- E. Keeps an itemized list of all equipment warranties listing equipment by name, mark, and type along with length and expiration date of each warranty. Submit two (2) copies to A/E with request for final inspection.
- F. If the Architect's specification includes a warranty requirement that exceeds the above warranty requirements, the Architect's warranty shall take precedence.

### 1.10 MATERIALS, EQUIPMENT AND SUBSTITUTIONS

- A. The intent of these specifications is to allow ample opportunity for P/C to use his ingenuity and abilities to perform the work to his and the Owner's best advantage, and to permit maximum competition in bidding on standards of materials and equipment required.
- B. Material and equipment installed under this contract shall be first class quality, new, unused, and without damage.

- C. In general, these specifications identify required materials and equipment by naming first the manufacturer whose product was used as the basis for the project design and specifications. The manufacturer's product, series, model, catalog, and/or identification numbers shall set quality requirements for comparing the equivalency of other manufacturer's products in general. Where models are listed or scheduled with information that does not match specified manufacturer's data for size or capacity, the larger, more expensive and/or restrictive requirement between the schedule and the manufacturer's data shall be met and included. Where other manufacturer's names are listed, they are considered an approved manufacturer for the product specified; however, the listing of their names implies no prior approval of any product unless specific model or catalog numbers are listed in these specifications or in subsequent addenda. The naming of a manufacturer, or even a model number, does not alleviate the contractor from being required to provide or submit equipment which meets all of the criteria and items listed in the specifications or shown on the plans even if the specified model and/or manufacturer does not. All requirements on the drawings must be met, not just the specific model number or manufacturer. Where other than first named products are used for P/C's base bid proposal, it shall be his responsibility to determine prior to bid time that his proposed materials and equipment selections are products of approved manufacturers, which meet or exceed the specifications, fit physically in the spaces provided, are compatible with all other systems and are acceptable to the D/E.
- D. Where varying or conflicting information, notes or specifications may be shown in different locations on the drawings, schedules, or specifications, all requirements are required to be met and the worst case or more expensive and/or restrictive option should be included where duplicate information is not the same. Notify A/E for clarification.
- E. Where materials or equipment are described but not named, provide required items of first quality, adequate in every respect for intended use. Such items shall be submitted to A/E for review prior to procurement.
- F. PRIOR TO RECEIPT OF BIDS, IF P/C WISHES TO INCORPORATE PRODUCTS OTHER THAN THOSE NAMED IN SPECIFICATIONS IN HIS BASE BID, HE SHALL SUBMIT A WRITTEN REQUEST FOR REVIEW OF SUBSTITUTIONS TO D/E NOT LESS THAN SEVEN (7) WORKING DAYS PRIOR TO BID TIME OR AS REQUIRED BY FRONT END DOCUMENTS. D/E WILL REVIEW REQUESTS AND ACCEPTABLE ITEMS WILL BE LISTED IN AN ADDENDUM ISSUED TO PRINCIPAL BIDDERS.
- G. Materials and equipment proposed for substitutions shall be equal to or superior to that specified in construction, efficiency, utility, aesthetic design, and color, as determined by A/E, whose decision shall be final and without further recourse. Physical size of substitute brand shall be no larger than space provided including allowances for access for installation and maintenance of installed equipment, as well as other systems shared in the same space. Requests must be accompanied by two (2) copies of complete descriptive and technical data including E/M's name, model, and catalog number, photographs or cuts, physical dimensions, operating characteristics, and any other information needed for comparison.
- H. In proposing a substitution prior to or subsequent to receipt of bids, include in such proposal cost of altering other elements of project, including (but not limited to) adjustments in mechanical, electrical, plumbing, controls, fire alarm and/or any other service requirements necessary to accommodate such substitution; whether such affected elements are under this contract or under separate contracts.



1.11 SHOP DRAWINGS, OPERATION AND MAINTENANCE INSTRUCTION

- A. Unless noted differently in the general requirements of the specifications, P/C shall furnish one of the following options, whichever format is preferred:
  - 1. Electronic PDF submittals as required by Missouri S&T.
- B. Where catalog cuts are submitted for review, conspicuously mark or provide schedule of equipment, capacities, controls, fittings, sizes, etc., that are to be provided. Mark equipment to match equipment labels provided on the drawings, schedules or specifications. Mark each submitted item with applicable section and paragraph numbers of these specifications, or plan sheet number, when item does not appear in specifications. Where equipment submitted does not appear in base specifications or specified equivalent, submittals shall be marked with applicable alternate numbers, change order numbers, or letters of authorization where said equipment was approved. Each submittal shall contain at least two (2) sets of original catalog cuts. Each catalog sheet shall bear E/M's name and address. All shop drawings on materials and equipment listed by UL shall indicate UL approval on submittal.
- C. P/C shall check all shop drawings to verify that they meet specifications and/or drawing requirements before forwarding submittals to the A/E for their review. All shop drawings submitted to A/E shall bear P/C approval stamp which shall indicate that P/C has reviewed submittals and that they meet specification and/or drawing requirements. P/C's submittal review shall specifically check for, but not be limited to, the following: equipment capacities, physical size in relation to space allowed; plumbing characteristics, provisions for supply, return, and drainage connections to building systems. All shop drawings not meeting P/C's approval shall be returned to his supplier for resubmittal.
- D. No shop drawing submittals will be considered for review by the A/E without P/C's approval stamp, or that have extensive changes made on the original submittal as a result of P/C's review.
- E. A/E will not be responsible for the cost of returning shop drawing submittals that are submitted to them without P/C's review and approval stamp. A letter will be sent to P/C by either the Architect or Engineer indicating receipt of an improper submittal. P/C shall acknowledge receipt of letter and indicate his plans for pick-up or resubmitting. A/E will hold improper submittals for pick-up by P/C or supplier for 15 working days after date of receipt. If not picked up by the 16th working day, submittals will be disposed of by A/E.
- F. A/E's review of shop drawings will not relieve P/C of responsibility for deviations from drawings and specifications unless such deviations have been specifically approved in writing by Owner or his representative, nor shall it relieve P/C of responsibility for errors in shop drawings. No work shall be fabricated until A/E's review has been obtained. Any time delay caused by correcting and resubmitting shop drawings will be P/C's responsibility.
- G. A/E shall make every effort to provide shop drawing review in a timely fashion, but in no case shall the A/E be held responsible for delays in project construction or completion without prior notification of scheduling requirements specifically for return of shop drawings at least 8 weeks in advance. In no case shall less than 10 working days after A/E receipt of shop drawings be counted on by the contractor for A/E shop drawing review without prior notification and approval.
- H. Operating and Maintenance Instructions:

1. Submit with shop drawings of equipment: copies of installation, operating, maintenance instructions, and parts list for equipment provided. Instructions shall be prepared by E/M.

1.12 PROPOSED VALUE ENGINEERING/PROJECT SCOPE REVISIONS

- A. Where design revisions are requested/required based on value-engineering or proposed changes in project scope, the contractor shall include in his proposed cost savings or adds the necessary MEP design fees that are required for modifying construction documents and associated meetings. In order to determine that value to be included, the contractor shall submit to the A/E the proposed scope of the work required for the changes at least 7 days prior to required pricing submittal so that the design fees can be accurately determined and included. Design work and drawing changes will only commence once the design fee is established and a signed agreement returned to the A/E for inclusion.
- B. Where the contractor proposes to use different size equipment, feeders, feeder materials, circuit breakers, fuses or significant difference in routing of feeders or branches than shown in the construction documents, the contractor shall include the necessary MEP design fees that are required for modifying or creating construction drawings necessary either for construction or submission to the authority having jurisdiction and required for additional review. Design work and drawing changes will only commence once the design fee is established and a signed agreement returned to the A/E for inclusion.

1.13 CAD FILE REQUESTS

- A. CAD files are the property of the D/E. CAD files are only available upon documented written request which must be forwarded to the D/E office.

1.14 CUTTING AND PATCHING

- A. Contractor shall do cutting, and patching of building materials required for installation of work herein specified. Cut no structural members without Architect's approval and in a manner approved by him.
- B. Patching shall be by mechanics of particular trade involved and shall meet approval of Architect.
- C. Drilling and cutting of openings through building materials requires Architect's review and approval. Make openings in concrete with concrete hole saw or concrete drill. Do not use star drill or air hammer for this work.

1.15 MUTILIATION

- A. Mutilation of building finishes, caused by installation of plumbing equipment, fixtures, outlets, and other plumbing devices shall be repaired at P/C's expense to approval of Architect.

1.16 SETTING, ADJUSTMENT AND EQUIPMENT SUPPORTS:

- A. The following are general specifications. Refer to section 220529 Hangers and Supports for Plumbing Systems for additional requirements.
- B. Work shall include mounting, alignment, and adjustment of all systems and equipment. Set equipment level on adequate foundations and provide proper anchor bolts and isolation. Level, shim, and grout equipment bases as recommended by E/M. Mount motors, align and adjust drive shafts and belts according to E/M's instructions. Equipment failures resulting from improper installation or field alignment shall be repaired or replaced by P/C at no cost to Owner.
- C. Provide each piece of equipment or apparatus suspended from ceiling or mounted above floor level with suitable structural support, platform, or carrier in accordance with best recognized practice and the E/M. P/C shall arrange for attachment to building structure, unless otherwise indicated on drawings or specified. Provide hangers with vibration eliminators. Contractor shall verify with structural engineer that structural members of buildings are adequate to support equipment. Submit details of hangers, platforms, mounting brackets and supports together with total weights of mounted equipment to structural engineer and A/E for review before proceeding with fabrication or installation.

1.17 START-UP, CHANGE-OVER, TRAINING AND OPERATIONAL CHECKS

- A. P/C shall perform initial start-up of systems and equipment. Personnel qualified to start-up and service this equipment, including E/M's technicians, when specified, and Owner's operating personnel shall be present during these operations.
- B. P/C shall be responsible for training Owner's operating personnel to operate and maintain systems and equipment installed. Keep a record of training provided to Owner's personnel listing the date, subject covered, instructor's name, names of Owner's personnel attending, and the total hours given each individual.
- C. After each inspection, P/C shall submit written report to A/E indicating condition of equipment and including any recommended changes in operation of system or other information which will be helpful to Owner.

1.18 MAINTENANCE OF SYSTEMS

- A. P/C shall be responsible for operation, maintenance, and lubrication of equipment installed under his contract. All equipment and systems shall be fully operational when turned over to the owner at project substantial completion.

1.19 PROTECTION AND CLEANING OF SYSTEMS AND EQUIPMENT

- A. It shall be P/C's responsibility to protect and prevent damage to all plumbing materials and equipment stored and/or installed under this contract. All work, materials, and equipment shall be adequately protected by any and all means necessary to prevent damage by weather, flooding, condensation, construction debris, fire, and construction equipment and vehicles.

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- B. Equipment not rated for outdoor use shall be protected from moisture damage before and during construction. Covering equipment with a tarp on site is not considered a means of providing protection from moisture. Any equipment not rated for outdoor use exposed to moisture for any duration shall be replaced with new equipment at the contractor's expense.
- C. Where job conditions, or work of other contractors produce the potential for damage to plumbing systems and equipment, P/C shall immediately notify the G/C so that corrective action can be taken.
- D. P/C shall take extra precautions to protect plumbing equipment containing solid state electronics, open relays, and contacts from damage by water, dust, dirt, construction debris, and the formation of condensate. All equipment so damaged shall be replaced by P/C with new equipment at no cost to Owner.
- E. P/C shall periodically inspect and clean all systems and equipment to ensure all systems and equipment remain in like new condition during construction, free from dust and debris. All cleaning shall be done in accordance with E/M's recommendation where available and applicable.
- F. Before request for final inspection, all systems and equipment shall be properly cleaned, vacuumed, polished, painted, etc., as required to return equipment to like new appearance.
- G. All equipment requiring painting or touch-up shall be properly prepared and painted in accordance with this specification.

### 1.20 PAINTING OF MATERIAL

- A. Equipment and materials exposed to interior dry environment shall have a minimum of one (1) primer and one (1) finish coat. Equipment and materials mounted in exterior location shall have a minimum of one (1) primer and two (2) finish coats with total thickness of at least 5 mils. Finish coat colors in finish areas shall be as selected by A/E.
- B. After installation, damage to painted surfaces shall be properly prepared and primed with primers equal to factory materials. Finish coating shall be same color and type as factory finish.
- C. Where extensive refinishing of factory applied finishes are required, equipment shall be completely repainted. A/E will make final determination of extent of refinishing required.

### 1.21 RECORD DOCUMENTS

- A. Record Drawings: Unless noted otherwise in architectural documents, maintain a reproducible set of contract drawings and shop drawings in clean, undamaged condition, with mark-up of actual installations which vary substantially from the work as originally shown. Mark whichever drawing is most capable of showing "field" condition fully and accurately; however, where shop drawings are used for mark-up, record a cross-reference at corresponding location on working drawings. Mark with red erasable red pencil and, where feasible, use other colors to distinguish between variations in separate categories of work. Mark-up new information, which is recognized to be of importance to Owner, but was for some reason not shown on either contract drawings or shop drawings. Give particular attention to concealed work, which would be difficult to measure and record at a later date. Note related change order numbers where applicable.

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Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates, and other identification on cover of each sheet.

- B. As-built documents shall be submitted for approval prior to final payment. Copies of “in-progress” as-built drawings shall be submitted at each pay request.

END OF SECTION 220000

SECTION 22 0517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Sleeves.
  2. Sleeve-seal systems.
  3. Grout.
  4. Silicone sealants.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral water-stop collar.
- B. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, anticorrosion coated or galvanized, with plain ends and integral welded water-stop collar.
- C. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- D. PVC Pipe Sleeves: ASTM D1785, Schedule 40.
- E. Sleeves passing through floors with waterproof membranes shall be core-drilled and sealed with Thunderline, Link-Seal or Calpico, Sealing Linx.

2.2 SLEEVE-SEAL SYSTEMS

- A. Description: Thunderline, Link-Seal or Calpico, Sealing Linx.
1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
  2. Designed to form a hydrostatic seal of 20 psig minimum.
  3. Sealing Elements: Modular, elastomer, interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  4. Pressure Plates: Stainless steel, Type 316.
  5. Connecting Bolts and Nuts: Stainless steel, Type 316 of length required to secure pressure plates to sealing elements.

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### 2.3 GROUT

- A. Description: Non-shrink, for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

### 2.4 SILICONE SEALANTS

- A. Silicone, S, NS, 25, NT: Single-component, non-sag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant, ASTM C920, Type S, Grade NS, Class 25, Use NT.
- B. Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T and NT. Grade P Pourable (self-leveling) formulation is for opening in floors and other horizontal surfaces that are not fire rated.

## PART 3 - EXECUTION

### 3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level unless noted otherwise.
  - 2. Using grout or silicone sealant, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
  - 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
  - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.

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- E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 078413 "Penetration Firestopping."

### 3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

### 3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.
- B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

### 3.4 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
  - 1. Concrete Slabs-on-Grade:
    - a. Piping Smaller Than NPS 6: Cast-iron pipe sleeves with sleeve-seal system.
      - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
  - 2. Interior Partitions:
    - a. Piping Smaller Than NPS 6: Cast-iron pipe sleeves or Steel pipe sleeves.
    - b. Piping NPS 6 and Larger: Cast-iron pipe sleeves or Steel pipe sleeves.

END OF SECTION 220517



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SECTION 22 0518 - ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Escutcheons.
  - 2. Floor plates.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

- A. One-Piece, Steel Type: With polished, chrome-plated or painted cover to match wall and setscrew fastener.
- B. Split-Plate, Stamped-Steel Type: With polished, chrome-plated finish or painted to match wall; concealed hinge; and spring-clip fasteners.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.
  - 1. Escutcheons for New Piping and Relocated Existing Piping: Verify chrome or white finish with architect for each location.
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.
    - b. Chrome-Plated Piping: One-piece steel with polished, chrome-plated finish.
    - c. Insulated Piping: One-piece steel with [polished, chrome-plated finish.
    - d. Insulated Piping: One-piece stamped steel, split-plate, or stamped steel with concealed hinge with polished, chrome-plated finish.
    - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece steel with polished, chrome-plated finish.
    - f. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece stamped steel, split-plate, or stamped steel with concealed hinge with polished, chrome-plated finish.

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- g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece steel with polished, chrome-plated finish.
- h. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece stamped steel, split-plate, or stamped steel with concealed hinge with polished, chrome-plated finish.

END OF SECTION 220518

SECTION 22 0523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Brass ball valves.
  - 2. Bronze swing check valves.
- B. Related Sections:
  - 1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
  - 2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
  - 3. Division 33 water distribution piping Sections for general-duty and specialty valves for site construction piping.

1.2 SUBMITTALS

- A. Product Data: For each type of valve indicated.

1.3 QUALITY ASSURANCE

- A. ASME Compliance: ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
- B. NSF Compliance: NSF 61 for valve materials for potable-water service.

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. 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.
- E. 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.

2.2 BRONZE BALL VALVES

- A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim 2.5" and smaller:

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1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. American Valve, Inc.
  - b. Conbraco Industries, Inc.; Apollo Valves.
  - c. Crane Co.; Crane Valve Group; Crane Valves.
  - d. Milwaukee Valve Company.
  - e. NIBCO INC.
  - f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
  - a. Basis of design: Apollo Series 77CLF-X40
  - 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: 316 stainless steel
  - i. Ball: 316 stainless steel
  - j. Port: Full.
  - k. Handle Extension as required for insulation of valve body

### 2.3 FLOW CONTROL VALVE

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. IMI Flow Design
2. Description:
  - a. Basis of design: IMI Flow Design ICSS
  - b. NSF Rating: 61-G
  - c. CWP Rating: 400 psig.
  - d. Body Material: 300 stainless steel
  - e. Ends: Threaded.
  - f. Flow cartridge: 300 stainless steel

### 2.4 BRONZE SWING CHECK VALVES

#### A. Class 125, Bronze Swing Check Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Crane Co.; Crane Valve Group; Crane Valves.
  - b. Crane Co.; Crane Valve Group; Jenkins Valves.
  - c. Crane Co.; Crane Valve Group; Stockham Division.
  - d. Milwaukee Valve Company.
  - e. NIBCO INC.
  - f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
  - a. Standard: MSS SP-80, Type 4.

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- b. CWP Rating: 200 psig.
- c. Body Design: Horizontal flow.
- d. Body Material: ASTM B 62, bronze.
- e. Ends: Threaded.
- f. Disc: PTFE or TFE.

### PART 3 - EXECUTION

#### 3.1 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.

#### 3.2 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.

#### 3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
  - 1. Shutoff Service: Ball or butterfly valves.
  - 2. Throttling Service: Globe, ball or butterfly valves.
  - 3. Pump-Discharge Check Valves:
    - a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.
- B. 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.
- 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.

#### 3.4 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

- A. Pipe NPS 2-1/2 and Smaller:
  - 1. Bronze and Brass Valves: Solder-joint or threaded ends
  - 2. Bronze Angle Valves: Class 125, bronze disc.
  - 3. Ball Valves: Two-piece, full port, bronze with stainless steel trim.
  - 4. Bronze Swing Check Valves: Class 125 disc.
  - 5. Flow Control Valve: Stainless steel

END OF SECTION 220523

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SECTION 22 0529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal hanger-shield inserts.
4. Fastener systems.
5. Pipe-positioning systems.
6. Equipment supports.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

2.2 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pre-galvanized, hot-dip galvanized, or electro-galvanized.
3. Nonmetallic Coatings: Plastic coated or epoxy powder coated.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe and Tube Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.



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2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

### 2.3 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-58, 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.

### 2.4 THERMAL HANGER-SHIELD INSERTS

- A. Insulation-Insert Material for Cold Piping with elastomeric insulation: ASTM C591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.
- B. Insulation-Insert Material for Hot Piping with elastomeric insulation: ASTM C591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.
- C. Insulation-Insert Material for Cold Piping with fiberglass insulation: ASTM C552, Type II cellular glass with 100-psig minimum compressive strength and vapor barrier.
- D. Insulation-Insert Material for Hot Piping fiberglass insulation: ASTM C552, Type II cellular glass with 100-psig minimum compressive strength.
- E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- G. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

### 2.5 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.
  1. Equivalent manufacturers of fasteners by Tolco, Anvil, B-Line Systems, Hitli, ITW Ramset/Red Head, Power Fasteners, PHD, Anvil International, Inc., or Fluorcarbon Company.
- B. Mechanical-Expansion Anchors: Insert-wedge-type anchors, for use in hardened Portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
  1. Equivalent manufacturers of fasteners by Tolco, Anvil, B-Line Systems, Hitli, ITW Ramset/Red Head, Power Fasteners, PHD, Anvil International, Inc., or Fluorcarbon Company.
  2. Indoor Applications: Zinc-coated steel.

### 2.6 PIPE-POSITIONING SYSTEMS

- A. Description: IAPMO PS 42 positioning system composed of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

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### 2.7 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural-carbon-steel shapes.

### 2.8 MATERIALS

- A. Aluminum: ASTM B221.
- B. Carbon Steel: ASTM A1011/A1011M.
- C. Structural Steel: ASTM A36/A36M carbon-steel plates, shapes, and bars; black and galvanized.
- D. Stainless Steel: ASTM A240/A240M.
- E. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink and nonmetallic grout; suitable for interior and exterior applications.
  - 1. Properties: Non-staining, noncorrosive, and nongaseous.
  - 2. Design Mix: 5000-psi, 28-day compressive strength.

## PART 3 - EXECUTION

### 3.1 APPLICATION

- A. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lbs.

### 3.2 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
  - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.
  - 2. Field fabricate from ASTM A36/A36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Thermal Hanger-Shield Installation: Install in pipe hanger or shield for insulated piping.
- D. Fastener System Installation:

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1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete, after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
  2. Install mechanical-expansion anchors in concrete, after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- E. Pipe-Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.
- F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- H. 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.
- I. Install lateral bracing with pipe hangers and supports to prevent swaying.
- J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, 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.
- K. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- M. Insulated Piping:
1. Attach clamps and spacers to piping.
    - a. Piping Operating Above Ambient Air Temperature: Clamp may project through insulation.
    - b. Piping Operating Below Ambient Air Temperature: Use thermal hanger-shield insert with clamp sized to match OD of insert.
    - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
  2. Install MSS SP-58, Type 39 protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
    - a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
  3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
    - a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
  4. Shield Dimensions for Pipe: Not less than the following:

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- a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
  - b. NPS 4: 12 inches long and 0.06 inch thick.
  - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
  - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
  - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least if protective shield.
  6. Thermal Hanger Shields: Install with insulation of same thickness as piping insulation.

### 3.3 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

### 3.4 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work.

### 3.5 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

### 3.6 PAINTING

- A. Touchup: Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately after erecting hangers and supports. Use same materials as those used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils unless noted otherwise per architectural divisions.
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded, shop-painted areas on miscellaneous metal are specified in Section 099113 "Exterior Painting.", Section 099123 "Interior Painting.", or Section 099600 "High-Performance Coatings."

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- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A780/A780M.

### 3.7 HANGER AND SUPPORT SCHEDULE

- A. Equivalent manufacturers by Tolco, Anvil, B-Line Systems, Hitli, ITW Ramset/Red Head, Power Fasteners, PHD, Anvil International, Inc., or Fluorcarbon Company.
- B. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- C. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.
- D. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finishes.
- E. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- F. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.
- G. Use stainless-steel pipe hangers and stainless-steel attachments for hostile and corrosive environment applications.
- H. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
- I. Use padded hangers for piping that is subject to scratching.
- J. Use thermal hanger-shield inserts for insulated piping and tubing.
- K. 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 non-insulated or insulated, stationary pipes NPS 1/2 to NPS 30 .
  - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F pipes NPS 4 to NPS 24 , requiring up to 4 inches of insulation.
  - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
  - 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
  - 5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
  - 6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of non-insulated, stationary pipes NPS 3/4 to NPS 8.
  - 7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8 .
  - 8. Adjustable Band Hangers (MSS Type 9): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8 .
  - 9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8 .
  - 10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of non-insulated, stationary pipes NPS 3/8 to NPS 8 .

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11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of non-insulated, stationary pipes NPS 3/8 to NPS 3 .
  12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 .
  13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
  14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 , with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
  15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
  16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
  17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction occurs.
  18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction occurs.
  19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction occurs but vertical adjustment is unnecessary.
  20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction occurs and vertical adjustment is unnecessary.
  21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation, in addition to expansion and contraction, is required.
- L. 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 of 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.
- M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
  2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
  3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.

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5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
  6. C-Clamps (MSS Type 23): For structural shapes.
  7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
  8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
  9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
  10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
  11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
  12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    - a. Light (MSS Type 31): 750 lb.
    - b. Medium (MSS Type 32): 1500 lb.
    - c. Heavy (MSS Type 33): 3000 lb.
  13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
  14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
  15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
  2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
  3. Thermal Hanger-Shield Inserts: For supporting insulated pipe.
- O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
  2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
  3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
  4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
  5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
  6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.

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7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
  8. Constant Supports: For critical piping stress and if necessary, to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
    - a. Horizontal (MSS Type 54): Mounted horizontally.
    - b. Vertical (MSS Type 55): Mounted vertically.
    - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- P. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- Q. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
- R. Use pipe-positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529



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SECTION 22 0553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Equipment labels.
  2. Warning signs and labels.
  3. Pipe labels.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 VALVE LABELS

- A. Valves located in University buildings shall be given identifying tags in accordance with university standards. All tags shall be 1-1/2" diameter brass tags with black lettering and shall be attached using 3/32" diameter galvanized, zinc plated steel wire rope with sealed oval sleeve compression connectors.

2.1 PIPE LABELS

- A. Pipe labels shall comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size and color, filed color, length, and viewing angle. Labeling shall indicate pressure and/or temperature when applicable, domestic cold water (CW), domestic hot water (HW), domestic hot water return (HWR), sanitary waste (SW), etc. Pipe labels shall be color coded, preprinted, gloss vinyl film (minimum 2 mil thickness) with permanent pressure sensitive adhesive. At each end of pipe marker provide appropriately color coded adhesive tape with flow direction arrows indicating the direction of flow. Adhesive tape banding shall be not less than 1-1/2 inch wide and shall lap the end of the pipe label. Tape banding shall wrap the pipe fully and lap itself a minimum of 3 inches. Pre-tensioned Pipe Labels: Pre-coiled, semi-rigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive
- B. Provide pipe labels where piping is exposed or above accessible ceilings in finished spaces; in machine rooms; in accessible maintenance spaces such as shafts, tunnels, and plenums; and at exterior exposed locations. Where piping runs are grouped, install pipe markers on each pipe in the same location to aid in differentiating each pipe in the group. Locate pipe labels as follows:
1. Near each valve and control device.

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2. Near each branch connection, excluding short takeoffs for fixtures and terminal units.
  3. Where flow pattern is not obvious, mark each pipe at branch.
  4. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
  5. At access doors, manholes, and similar access points that permit view of concealed piping.
  6. Near major VALVE items and other points of origination and termination.
  7. Spaced at maximum intervals of 50 feet along each run. Spacing shall be reduced to 25 feet maximum in areas of congested piping and VALVE.
- C. If piping is to be color coded by continuously painting runs of piping, color coding shall be as outlined in the listing below. Note that if piping is to be painted for aesthetic purposes, such as to match adjacent surfaces in finished areas or at building exterior, this color coding is not required to be followed.
1. Drain (HVAC condensate drain, storm water, sump pump discharge, etc.)                      Green
- D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
  2. Lettering Size: At least 1.5 inches high.

### PART 1 - EXECUTION

#### 1.1 PREPARATION

- A. Clean piping and VALVE surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

#### 1.2 VALVE LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical VALVE.
- B. Locate VALVE labels where accessible and visible.

#### 1.3 PIPE LABEL INSTALLATION

- A. Piping Color-Coding: Painting of piping is specified in Division 09 Section "Interior Painting."
- B. 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.

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5. Near major VALVE items and other points of origination and termination.
  6. Spaced at maximum intervals of 100 feet along each run. Reduce intervals to 25 feet in areas of congested piping and VALVE.
  7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- C. Pipe Label Color Schedule:
1. Domestic Cold Water Piping (CW):
    - a. Background Color: Green.
    - b. Letter Color: White.
  2. Domestic Hot Water Piping (HW):
    - a. Background Color: Yellow.
    - b. Letter Color: Black.
  3. Domestic Hot Water Return Piping (HWR):
    - a. Background Color: Yellow.
    - b. Letter Color: Black.

END OF SECTION 220553

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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. Supplies and drains for handicap-accessible lavatories and sinks.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).

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.

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### 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 Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

## PART 2 - PRODUCTS

### 2.1 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. 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 the following:
    - a. Aeroflex USA Inc.; Aerocel.
    - b. Armacell LLC; AP Armaflex.
- G. Mineral fiber (fiberglass) pre-formed Insulation: Type I, 850 Deg F (454 Deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
  - 1. Products: Subject to compliance with requirements, provide the following:
    - a. Owens Corning
    - b. Johns Manville
    - c. Knauf Insulation

## 2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Aeroflex USA Inc.; Aero seal.
    - b. Armacell LCC; 520 Adhesive.
  - 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
  - 1. Products: Subject to compliance with requirements, provide the following:
    - a. Owens Corning
    - b. Johns Manville
    - c. Knauf Insulation
  - 2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
  - 1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- E. PVC Jacket Adhesive: Compatible with PVC jacket.
  - 1. Products: Subject to compliance with requirements, provide the following:
    - a. Owens Corning
    - b. Johns Manville
    - c. Knauf Insulation
  - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.3 SEALANTS

- A. Joint Sealants:
  - 1. Joint Sealants for Cellular-Glass Products: Subject to compliance with requirements, provide one of the following:



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- a. Childers Products, Division of ITW; CP-76.
  - b. Foster Products Corporation, H. B. Fuller Company; 30-45.
  - c. Marathon Industries, Inc.; 405.
  - d. Pittsburgh Corning Corporation; Pittseal 444.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
  3. Permanently flexible, elastomeric sealant.
  4. Service Temperature Range: Minus 100 to plus 300 deg F.
  5. Color: White or gray.
  6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

### B. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Childers Products, Division of ITW; CP-76-8.
  - b. Foster Products Corporation, H. B. Fuller Company; 95-44.
  - c. Marathon Industries, Inc.; 405.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

### C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Childers Products, Division of ITW; CP-76.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.4 FACTORY-APPLIED JACKETS

### A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. PVDC Jacket for Indoor Applications: 4-mil-thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms when tested according to ASTM E 96 and with a

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flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.

- a. Products: Subject to compliance with requirements, provide the following:
  - 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

### 2.5 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
  1. Products: Subject to compliance with requirements, provide one of the following]:
    - a. Johns Manville; Zeston.
    - b. P.I.C. Plastics, Inc.; FG Series.
  2. Adhesive: As recommended by jacket material manufacturer.
  3. Color: White.
  4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
    - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

### 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. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
    - b. Compac Corp.; 104 and 105.
    - c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
    - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
  2. Width: 3 inches.
  3. Thickness: 11.5 mils.
  4. Adhesion: 90 ounces force/inch in width.
  5. Elongation: 2 percent.
  6. Tensile Strength: 40 lbf/inch in width.
  7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
    - b. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.

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- c. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.
  2. Width: 3 inches.
  3. Thickness: 6.5 mils.
  4. Adhesion: 90 ounces force/inch in width.
  5. Elongation: 2 percent.
  6. Tensile Strength: 40 lbf/inch in width.
  7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
    - b. Compac Corp.; 130.
    - c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
    - d. Venture Tape; 1506 CW NS.
  2. Width: 2 inches.
  3. Thickness: 6 mils.
  4. Adhesion: 64 ounces force/inch in width.
  5. Elongation: 500 percent.
  6. Tensile Strength: 18 lbf/inch in width.

### 2.7 SECUREMENTS

- A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 0.75-inch wide with wing or closed seal.
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Products; Bands.
    - b. PABCO Metals Corporation; Bands.
    - c. RPR Products, Inc.; Bands.
- B. Staples: Outward-clinching insulation staples, nominal 0.75-inch-wide, stainless steel or Monel.

### 2.8 CORNER ANGLES

- A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

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- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

### 3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches OC.
  - 3. Overlap jacket longitudinal seams at least 1.5 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 OC.
    - a. For below ambient services, apply vapor-barrier mastic over staples.
  - 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
  - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

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- 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.

### 3.3 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
  - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
  - 1. Comply with requirements in Division 07 Section "Penetration Firestopping"
- D. Insulation Installation at Floor Penetrations:
  - 1. Pipe: Install insulation continuously through floor penetrations.
  - 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

### 3.4 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.

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4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
  5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
  6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
  7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
  8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
  9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.
- C. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
  2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
  3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
  4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
  5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

**3.5 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 MINERAL-FIBER (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.

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2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

### 3.7 FIELD-APPLIED JACKET INSTALLATION

- A. Where FSK jackets are indicated, install as follows:
  1. Draw jacket material smooth and tight.
  2. Install lap or joint strips with same material as jacket.
  3. Secure jacket to insulation with manufacturer's recommended adhesive.
  4. Install jacket with 1.5-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
  5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.
  1. Apply two (2) continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

### 3.8 FINISHES

- A. Equipment and Pipe Insulation with ASJ or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.
  1. Flat Acrylic Finish: Two (2) finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
    - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

### 3.9 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.

### 3.10 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Hot and Recirculated Hot Water: Insulation shall match existing type connecting to:



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1. Flexible Elastomeric: 1-inch thick up to 1.25-inch pipe size. Provide 1.5-inch-thick for all piping 1.5 inches and larger.
2. Mineral fiber (fiberglass), Preformed Pipe Insulation: 1-inch thick up to 1.25-inch pipe size. Provide 1.5-inch-thick for all piping 1.5 inches and larger

B. Domestic Cold Water: Insulation shall be the following:

1. Flexible Elastomeric: 0.5 inch thick.

C. Exposed, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities: Insulation shall be the following:

1. Flexible Elastomeric: 0.5-inch-thick.

**3.11 INDOOR, FIELD-APPLIED JACKET SCHEDULE**

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. None.

D. Piping, Exposed:

1. PVC: 30 mils thick.

END OF SECTION 220719

## SECTION 22 1116 - DOMESTIC WATER PIPING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
1. Copper tube and fittings.
  2. PEX tube and fittings.
  3. Piping joining materials.
  4. Transition fittings.
  5. Dielectric fittings.

### PART 2 - PRODUCTS

#### 2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372.

#### 2.2 COPPER TUBE AND FITTINGS

- A. Drawn-Temper Copper Tube: ASTM B88, Type K, ASTM B88, Type L and ASTM B88, Type M per the Piping Material Schedule.
- B. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
- C. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, pressure fittings.
- D. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- E. Cast Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.
- F. Wrought Copper Unions: ASME B16.22.
- G. Copper Tube, Pressure-Seal-Joint Fittings:
1. Equivalents by Mueller, Elkhart Products, and Viega
  2. Fittings: Cast-brass, cast-bronze, or wrought-copper with EPDM O-ring seal in each end.
  3. Minimum 200-psig working-pressure rating at 250 deg F.

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### **2.3 PEX TUBE AND FITTINGS**

- A. Equivalents by Wirsbo, Watts, Uponor, Zurn, and Viega.
- B. Tube Material: PEX plastic according to ASTM F876 and ASTM F877.
- C. Fittings: ASTM F1807, metal insert and copper crimp rings.
- D. Manifold: Multiple-outlet, plastic or corrosion-resistant-metal assembly complying with ASTM F876; with plastic or corrosion-resistant-metal valve for each outlet.

### **2.4 PIPING JOINING MATERIALS**

- A. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- B. Solder Filler Metals: ASTM B32, lead-free alloys.
- C. Flux: ASTM B813, water flushable.
- D. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.
- E. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

### **2.5 TRANSITION FITTINGS**

- A. General Requirements:
  - 1. Same size as pipes to be joined.
  - 2. Pressure rating at least equal to pipes to be joined.
  - 3. End connections compatible with pipes to be joined.
- B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

### **2.6 DIELECTRIC FITTINGS**

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
  - 1. Standard: ASSE 1079.
  - 2. Pressure Rating: 125 psig minimum at 180 deg F
  - 3. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Nipples:
  - 1. Standard: IAPMO PS 66.
  - 2. Electroplated steel nipple complying with ASTM F1545.
  - 3. Pressure Rating and Temperature: 300 psig at 225 deg F.
  - 4. End Connections: Male threaded or grooved.
  - 5. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- D. Refer to the "Piping Material Schedule" on plans for piping applications.

3.2 INSTALLATION OF PIPING

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install valves according to the following:
  - 1. Section 220523 "Valves for Plumbing Piping."
- D. Install domestic water piping level without pitch and plumb.
- E. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- F. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- G. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- H. 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.
- I. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- J. Install piping to permit valve servicing.
- K. 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.
- L. Install piping free of sags and bends.
- M. Install fittings for changes in direction and branch connections.
- N. Install PEX tubing with loop at each change of direction of more than 90 degrees.
- O. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- P. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

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- Q. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- R. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

### 3.3 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.
- E. Soldered Joints for Copper Tubing: Apply ASTM B813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B828 or CDA's "Copper Tube Handbook."
- F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.
- G. Joints for PEX Tubing, ASTM: Join according to ASTM F1807 for metal insert and copper crimp ring fittings and ASTM F1960 for cold expansion fittings and reinforcing rings.
- H. Joints for PEX Tubing, ASSE: Join according to ASSE 1061 for push-fit fittings.
- I. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

### 3.4 INSTALLATION OF TRANSITION FITTINGS

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

### 3.5 INSTALLATION OF DIELECTRIC FITTINGS

- 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, nipples, or unions.

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### **3.6 INSTALLATION OF HANGERS AND SUPPORTS**

- A. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for hangers, supports, and anchor devices in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
- C. Install hangers for copper, ductile iron, and galvanized steel; tubing and piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- D. Install vinyl-coated hangers for CPVC and PVC piping, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- E. Install vinyl-coated hangers for PEX tubing, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent. Piping shall not be allowed to run unsupported across joists or on ceiling.
- F. Support horizontal piping within 12 inches of each fitting.
- G. Support vertical runs of copper, ductile iron, galvanized steel, and stainless steel; tubing and piping to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- H. Support vertical runs of PEX tubing to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

### **3.7 CONNECTIONS**

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
  - 1. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.

### **3.8 IDENTIFICATION**

- A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."

### **3.9 ADJUSTING**

- A. Perform the following adjustments before operation:
  - 1. Close drain valves, hydrants, and hose bibbs.

2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.

### 3.10 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.

##### 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 per Piping Material Schedule requirements 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.

### 3.11 CLEANING

#### A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
  - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
  - b. Fill and isolate system according to either of the following:

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- 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
  - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
- c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
  - d. Repeat procedures if biological examination shows contamination.
  - e. Submit water samples in sterile bottles to authorities having jurisdiction.
- B. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION 221116



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SECTION 22 1316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Hubless cast-iron soil and pipe fittings
  - 2. PVC pipe and fittings.
  - 3. Specialty pipe fittings.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 WARRANTY

- A. Listed manufacturers to provide labeling and warranty of their respective products.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
  - 1. Soil, Waste, and Vent Piping: 10-foot head of water.

2.2 PIPING MATERIALS

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with requirements in "Piping Material Schedule" on plans.

2.3 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A888 or CISPI 301.
- B. CISPI-Trademark, Shielded Couplings:

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1. Description: ASTM C1277 and CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C564, rubber sleeve with integral, center pipe-stop.

### 2.4 PVC PIPE AND FITTINGS

- A. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-DWV" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.
- B. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
- C. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- D. Adhesive Primer: ASTM F 656.
- E. Solvent Cement: ASTM D 2564.

### 2.5 SPECIALTY PIPE FITTINGS

- A. Transition Couplings:
  1. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
  2. Unshielded, Non-pressure Transition Couplings:
    - a. Standard: ASTM C 1173.
    - b. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
    - c. End Connections: Same size as and compatible with pipes to be joined.
    - 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.
  3. Shielded, Non-pressure Transition Couplings:
    - a. Standard: ASTM C 1460.
    - b. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
    - c. End Connections: Same size as and compatible with pipes to be joined.

PART 3 - EXECUTION

3.1 EARTH MOVING

- A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.
  - 1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
  - 2. 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 enough 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 and vent piping using appropriate branches, bends, and long-sweep bends.
  - 1. 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.
  - 2. 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.
    - a. Straight tees, elbows, and crosses may be used on vent lines.
  - 3. Do not change direction of flow more than 90 degrees.
  - 4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.
    - a. Reducing size of waste piping in direction of flow is prohibited.
- K. Lay buried building waste piping beginning at low point of each system.

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1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
  2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
  3. Maintain swab in piping and pull past each joint as completed.
- L. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:
1. Building Sanitary Waste and Drain: 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.
- 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. Install aboveground PVC piping according to ASTM D 2665.
- O. Install underground **PVC** piping according to ASTM D 2321.
- P. Plumbing Specialties:
1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.
    - a. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."
  2. Install drains in sanitary waste gravity-flow piping.
    - a. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."
- Q. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- R. Install sleeves for piping penetrations of walls, ceilings, and floors.
1. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- S. Install sleeve seals for piping penetrations of concrete walls and slabs.
1. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- T. Install escutcheons for piping penetrations of walls, ceilings, and floors.
1. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

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### 3.3 JOINT CONSTRUCTION

- A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.
- C. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.
- D. Plastic, Non-Pressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
  - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
  - 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 appendixes.
  - 3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 appendixes.

### 3.4 SPECIALTY PIPE FITTING INSTALLATION

- A. Transition Couplings:
  - 1. Install transition couplings at joints of piping with small differences in ODs.
  - 2. In Waste Drainage Piping: **Shielded**, non-pressure transition couplings.

### 3.5 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
  - 1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
  - 2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
  - 3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
  - 4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
  - 5. Vertical Piping: MSS Type 8 or Type 42, clamps.
  - 6. Install individual, straight, horizontal piping runs:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
  - 7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  - 8. Base of Vertical Piping: MSS Type 52, spring hangers.

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- C. Install hangers for cast-iron soil piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- D. Install hangers for PVC piping, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- E. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.
- F. Support vertical runs of cast iron soil piping to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- G. Support vertical runs of PVC piping to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

### 3.6 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 waste and vent piping to the following:
  - 1. Plumbing Fixtures: Connect waste 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 waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
  - 4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
  - 5. Comply with requirements for backwater valves, cleanouts, and drains specified in Section 221319 "Sanitary Waste Piping Specialties."
  - 6. Equipment: Connect waste piping as indicated.
    - a. Provide shutoff valve if indicated and union for each connection.
    - b. 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.

### 3.7 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping.

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- B. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

### 3.8 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.

### 3.9 CLEANING AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.
- D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.
- E. Repair damage to adjacent materials caused by waste and vent piping installation.

### 3.10 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Refer to the "Piping Material Schedule" on plans.

END OF SECTION 221316



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## SECTION 22 1319 - SANITARY WASTE PIPING SPECIALTIES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Cleanouts.
  - 2. Miscellaneous sanitary drainage piping specialties.
  
- B. Related Requirements:
  - 1. Section 076200 "Sheet Metal Flashing and Trim" for metal roof flashing assemblies.
  - 2. Section 077200 "Roof Accessories" for preformed flashings.
  - 3. Section 078413 "Penetration Firestopping" for through-penetration firestop assemblies.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

### PART 2 - PRODUCTS

#### 2.1 ASSEMBLY DESCRIPTIONS

- A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14 for plastic sanitary waste piping specialty components.

#### 2.2 CLEANOUTS

- A. Cast-Iron Exposed Cleanouts:
  - 1. Equivalents by Wade, Watts, Josam, Zurn or Jonespec.
  - 2. Standard: ASME A112.36.2M.
  - 3. Size: Same as connected drainage piping.
  - 4. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch or hubless, cast-iron soil pipe test tee as required to match connected piping.
  - 5. Closure: Countersunk, brass plug. Provide plastic plug on PVC piping.
  - 6. Closure Plug Size: Same as cleanout size.
  
- B. Cast-Iron Exposed Floor Cleanouts:
  - 1. Equivalents by Wade, Watts, Josam, Zurn or Jonespec.

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2. Standard: ASME A112.36.2M for cast-iron soil pipe with cast-iron ferrule, heavy-duty, adjustable housing, or threaded, adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Cast-iron soil pipe with cast-iron ferrule, Heavy-duty, adjustable housing, or Threaded, adjustable housing.
5. Body or Ferrule: Cast iron.
6. Clamping Device: Not required.
7. Outlet Connection: Threaded.
8. Closure: Brass plug.
9. Adjustable Housing Material: Cast iron with threads.
10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
11. Frame and Cover Shape: Round.
12. Top-Loading Classification: Heavy Duty. Provide heavy duty in vehicle traffic areas.
13. Riser: ASTM A74, Service Class, cast-iron drainage pipe fitting and riser to cleanout. Provide extra heavy in vehicle traffic areas.

### C. Cast-Iron Wall Cleanouts:

1. Equivalents by Wade, Watts, Josam, Zurn or Jonespec.
2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hub-and-spigot, cast-iron soil pipe T-branch or Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure Plug:
  - a. Brass.
  - b. Countersunk head.
  - c. Drilled and threaded for cover attachment screw.
  - d. Size: Same as cleanout size.
6. Wall Access, Cover Plate: Round, flat, chrome-plated brass or stainless steel cover plate with screw.
7. Wall Access, Frame and Cover: Round, nickel-bronze, copper-alloy, or stainless steel wall-installation frame and cover.

## 2.3 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

### A. Open Drains:

1. Description: Shop or field fabricate from ASTM A74, Service Class, hub-and-spigot, cast-iron soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C564 rubber gaskets.
2. Size: Same as connected waste piping with increaser fitting of two pipe sizes or of size indicated.

### B. Trap Seal Primers – Insert Type:

1. MIFAB MI-GARD Series inline floor drain trap seal with UV resistant ABS plastic frame, silicon rubber sealing flapper and four flexible sealing ribs. Tested and certified to the

ASSE 1072 Standard and listed with IAPMO and I.P.C. Connection the full size of drain per plans. Equal by Sioux Chief and ProSet.

C. Vent Caps:

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. 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.
- B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- D. Assemble open drain fittings and install with top of hub 2 inches minimum or as noted on plans above floor.
- E. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- F. Install sleeve and sleeve seals with each riser and stack passing through floors with waterproof membrane.
- G. Install vent caps on each vent pipe passing through roof.
- H. Install wood-blocking reinforcement for wall-mounting-type specialties.
- I. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

**3.2 PIPING CONNECTIONS**

- A. Comply with requirements in Section 221316 "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.

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3.3 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

SECTION 22 1319.13 - SANITARY DRAINS

1.1 SUMMARY

A. Section Includes:

1. Floor drains.

1.2 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene styrene.
- B. PVC: Polyvinyl chloride.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 DRAIN ASSEMBLIES

- A. Sanitary drains shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14 for plastic sanitary piping specialty components.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Equivalents by J.R. Smith, Wade, Watts, Zurn, Josam or Jonespec.
2. Standard: ASME A112.6.3 with backwater valve where noted on plan.
3. Pattern: Floor drain.
4. Body Material: Gray iron.
5. Seepage Flange: Required.
6. Anchor Flange: Required above grade or in structural slabs on grade.
7. Clamping Device: Required above grade or in structural slabs on grade.
8. Outlet: Bottom.
9. Coating on Interior and Exposed Exterior Surfaces: Not required unless installed in kitchens or noted otherwise.
10. Sediment Bucket: Not required unless noted otherwise.
11. Top or Strainer Material: Nickel bronze unless noted otherwise. Provide polished chrome in showers.
12. Top of Body and Strainer Finish: Nickel bronze unless noted otherwise.
13. Top Shape: Round.
14. Top Loading Classification: Medium Duty. Provide heavy duty in traffic areas.

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15. Funnel: Provide where noted on plan.
16. Inlet Fitting: Trap-seal primer valve connection where noted on plan.
17. Trap Material: Cast iron.
18. Trap Pattern: Standard P-trap. Provide each fixture with an integral P-trap.
19. Trap Features: Trap-seal primer valve drain connection or trap guard insert as noted on plans.
20. Refer to architectural plans for elevations and any exact locations.
21. Floor Drain Schedule:
  - a. Type "A" floor drain shall be J.R. Smith Model 2010-A.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
  1. Position floor drains for easy access and maintenance.
  2. Set floor drains below elevation of surrounding finished floor to allow floor drainage.
  3. Install floor-drain flashing collar or flange, so no leakage occurs between drain and adjoining flooring.
    - a. Maintain integrity of waterproof membranes where penetrated.
  4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

#### **3.2 CONNECTIONS**

- A. Comply with requirements in Section 221316 "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 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 221319.13

SECTION 22 4000 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
  - 1. Faucets for lavatories, bathtubs, bathtub/showers, showers and sinks.
  - 2. Flushometers.
  - 3. Toilet seats.
  - 4. Fixture supports.
  - 5. Water closets.
  - 6. Urinals.
  - 7. Lavatories.
- B. Related Sections include the following:
  - 1. Division 221119 Section "Domestic Water Piping Specialties."

1.2 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- C. PVC: Polyvinyl chloride plastic.
- D. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- A. Fixture Standards: ASME A112.19.1, A112.19.2, A112.19.3 and A112.19.5 and ANSI Z124.1.2.
- B. Fitting and Faucet Standards: ASME A112.18.1 and A112.18.2.
- C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities" Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.
- D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- E. NSF Standard: Comply with NSF 61 Annex G, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- F. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.



**PART 2 - PRODUCTS**

**2.1 PLUMBING FIXTURES**

- A. Refer to the Plumbing Fixture Schedule on plans for exact fixture types.
  - 1. Provide plumbing fixtures as shown on drawings as specified complete including piping and connections. China fixtures shall be of best grade vitreous ware, without pit holes or blemishes, and outlines shall be generally true. Architect reserves right to reject any piece which, in his opinion, is faulty. Fixtures fitting against walls shall have ground backs. Exposed piping and fitting shall be chrome plated.

**2.2 LAVATORY FAUCETS**

- A. Lavatory Faucets:
  - 1. Basis-of-Design Product: Subject to compliance with requirements in the Plumbing Fixture Schedule on plans, provide the product indicated on Drawings or a comparable product by one of the following:
    - a. Sloan
    - b. Zurn Plumbing Products Group; Commercial Brass Operation.

**2.3 FLUSHOMETERS**

- A. Flushometers:
  - 1. Basis-of-Design Product: Subject to compliance with requirements in the Plumbing Fixture Schedule on plans, provide the product indicated on Drawings or a comparable product by one of the following:
    - a. ATMC
    - b. Zurn Plumbing Products Group; Commercial Brass Operation.

**2.4 TOILET SEATS**

- A. Toilet Seats:
  - 1. Basis-of-Design Product: Subject to compliance with requirements in the Plumbing Fixture Schedule on plans, provide the product indicated on Drawings or a comparable product by one of the following:
    - a. American Standard Companies, Inc.
    - b. Bemis Manufacturing Company.
    - c. Church Seats.
    - d. Eljer.
    - e. Kohler Co.
    - f. Olsonite Corp.

**2.5 FIXTURE SUPPORTS**

- A. Basis-of-Design Product: Subject to compliance with requirements in the Plumbing Fixture Schedule on plans, provide the product indicated on Drawings or a comparable product by one of the following:

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- B. Manufacturers: Subject to compliance with requirements in the Plumbing Fixture Schedule on plans, 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.

### 2.6 WATER CLOSETS

- A. Water Closets:
  - 1. Available Manufacturers: Subject to compliance with requirements in the Plumbing Fixture Schedule on plans, and equivalent performance to model specified manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:
  - 2. Manufacturers: Subject to compliance with requirements in the Plumbing Fixture Schedule on plans, provide products by one of the following:
    - a. American Standard Companies, Inc.
    - b. Kohler Co.

### 2.7 URINALS

- A. Urinals:
  - 1. Basis-of-Design Product: Subject to compliance with requirements in the Plumbing Fixture Schedule on plans, provide the product indicated on Drawings or a comparable product by one of the following:
    - a. American Standard Companies, Inc.
    - b. Kohler Co.
    - c. Zurn Plumbing Products Group

### 2.8 LAVATORIES

- A. Lavatories:
  - 1. Basis-of-Design Product: Subject to compliance with requirements in the Plumbing Fixture Schedule on plans, provide the product indicated on Drawings or a comparable product by one of the following:
    - a. American Standard Companies, Inc.
    - b. Kohler Co.
    - c. Bradley

## PART 3 - EXECUTION

### 3.1 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.

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1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
  2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
  3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
- C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.
- D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
- E. Install wall-mounting fixtures with tubular waste piping attached to supports.
- F. Install fixtures level and plumb according to roughing-in drawings. For fixtures dedicated for children, install at height required by authorities having jurisdiction.
- 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. Provide shut-off valve above accessible ceiling to each fixture group or as otherwise indicated.
- I. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- J. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
- K. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.
- L. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.
- M. Install toilet seats on water closets.
- N. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- O. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.
- P. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- Q. Install traps on fixture outlets.
1. Exception: Omit trap on fixtures with integral traps.
  2. Exception: Omit trap on indirect wastes, unless otherwise indicated.
- R. Install escutcheons at piping wall and ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."
- S. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."
- T. Provide hot water tempering valves per section 221119 for all public lavatories and where shown on plans. Set temperature to a maximum of 105°F.

### 3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

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- 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. Traps, Supplies, and Stops: Dearborn, Sanitary Dash, BrassCraft, or as specified under plumbing fixtures:
  - A. Lavatory Supplies and Stops: McGuire LF170, 0.5-inch compression inlet with angle compression stop and 0.375-inch OD risers in length required. Provide deep chrome plated brass escutcheons.
  - B. Water Closet Supplies and Stops: McGuire LF187, 0.5-inch compression inlet with angle compression stop and 0.5-inch OD risers in length required. Provide deep chrome plated brass escutcheons.
  - C. Traps: McGuire 8912C (1.5-inch) and/or 8872C (1.25-inch) cast brass body with cleanout "P" trap. Provide deep chrome plated brass escutcheon with set screw. Provide offset tailpieces as required for ADA compliance.
- D. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- E. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

### 3.3 FIELD QUALITY CONTROL

- A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.
- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.
- E. Install fresh batteries in sensor-operated mechanisms.
- F. Adjust all temperature settings as required.
- G. Adjust fixture flow regulators for proper flow as required.
- H. Refer to architectural plans for exact locations and elevations of all plumbing fixtures. Trip levers on all ADA water closets shall be opposite the grab bar installed beside the water closet.

### 3.4 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Maintain protective coverings in tubs and showers. Any damage to the slip-resistant coating shall be repaired by the contractor.
- C. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224000

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SECTION 23 0000 - GENERAL MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Common mechanical installation requirements.

1.2 SPECIFICATION FORM AND DEFINITIONS

- A. These Specifications are abbreviated form and contain incomplete sentences. Omissions of words or phrases such as “the Contractor shall,” “shall be,” “as noted on the drawings,” “according to the drawings,” “a,” “an,” “the,” and “all” are intentional. Omitted words and phrases shall be supplied by inference.
- B. When a word such as “proper,” “satisfactory,” “equivalent,” and “as directed” is used, it requires Engineer’s review.
- C. “Provide” means furnish and install.
- D. “Working Day” wherever used in these Specifications, shall mean the normal working days Monday through Friday, exclusive of Saturday, Sunday, and federally observed holidays.
- E. Architect/Engineer hereinafter abbreviated A/E shall mean both the Design Architects and the Design Engineers.
- F. Design Engineer hereinafter abbreviated D/E shall mean the engineering firm, RTM Engineering Consultants, 3333 E. Battlefield Suite 1000 Springfield, MO 65804, Telephone (417) 881-0020. Contact Person: Jennifer Luce.
- G. General Contractor hereinafter abbreviated G/C shall mean the person or company and their subcontractors who enter into contract with the Owner to perform the general division work.
- H. Electrical Contractor hereinafter abbreviated E/C shall mean the person or company and their subcontractors who enter into contract with the G/C to perform the division 26 work.
- I. Mechanical Contractor hereinafter abbreviated M/C shall mean the person or company and their subcontractors who enter into contract with the G/C to perform the division 23 work.
- J. Equipment and/or materials manufacturer hereinafter abbreviated E/M shall mean the manufacturer of equipment or materials specified or referred to.

1.3 GENERAL EXTENT OF WORK

- A. Provide mechanical systems indicated on drawings, specified or reasonably implied. Provide every device and accessory for proper operation and completion of mechanical systems. In no

case will claims for “Extra Work” be allowed for work about which M/C could have informed himself before bids were taken.

- B. M/C shall familiarize himself with equipment provided by other contractors.
- C. All mechanical work as required to provide temporary HVAC for construction shall be the responsibility of the HVAC contractor. Include all costs as required in the base bid. Coordinate and verify all requirements with the general contractor. New HVAC systems shall not be used during construction without written approval from the engineer and owner.
- D. Refer to the construction documents for owner-supplied, contractor installed materials, equipment or fixtures. Contractor shall be prepared to receive materials and equipment arriving on the project site and shall be responsible for storing, removing from packaging and assembling on site prior to installation. Coordinate delivery times and all requirements with the owner through the general contractor. Contractor shall provide any and all necessary additional materials, supports, bracing, mounting brackets, back-boxes, etc. as required for installation of owner-supplied, contractor-installed materials, equipment or fixtures.

#### 1.4 LOCAL CONDITIONS

- A. Visit site and determine existing local conditions affecting work in contract.
- B. Failure to determine site conditions or nature of existing or new construction will not be considered a basis for granting additional compensation.

#### 1.5 CODES, ORDINANCES, RULES AND REGULATIONS

- A. Provide work in accordance with applicable codes, rules, ordinances, and regulations of Local, State, and Federal Governments and other authorities having lawful jurisdiction.
- B. Drawings and specifications indicate minimum construction standards, but should any work indicated be sub-standard to any ordinances, laws, codes, rules, or regulations bearing on work, M/C shall promptly notify A/E in writing before proceeding with work so that necessary changes can be made. However, if M/C proceeds with work knowing it to be contrary to any ordinances, laws, rules, and regulations, he shall thereby have assumed full responsibility for and shall bear all costs required to correct non-complying work.
- C. Conform to latest editions and supplements of the following codes, standards, or recommended practices.
  - 1. CITY CODES:
    - a. 2021 International Building Codes
    - b. 2021 International Fire Code
    - c. 2021 International Mechanical Code
    - d. 2021 International Energy Code
    - e. 2021 International Existing Building Code
  - 2. SAFETY CODES:
    - a. National Electric Safety Code Handbook H30 – National Bureau of Standards.
    - b. Occupational Safety and Health Standards – Department of Labor.

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- c. Specifications for Making Buildings and Facilities Accessible To, and Usable By, the Physically Handicapped – American Standards Institute ANSI A117.1.
    3. NATIONAL FIRE CODES:
      - a. NFPA 54 Gas Appliance and Gas Piping Code.
      - b. NFPA 70 National Electric Code – 2020 Edition.
      - c. NFPA 89M Clearances, Heat Producing Appliances.
      - d. NFPA 90A Air Conditioning and Ventilation Systems.
      - e. NFPA 91 Blower and Exhaust Systems.
      - f. NFPA 101 Life Safety Code – 2012 Edition.
  - D. Where following standards are applicable to equipment specified, equipment shall conform to requirements of standard and shall display the appropriate seal or seals:
    1. AGA – The American Gas Association Laboratories.
    2. ASME – American Society of Mechanical Engineers.
    3. NSF – National Sanitation Foundation.
    4. UL – Underwriters Laboratories Inc.
- 1.6 CONTRACT CHANGE
- A. Changes or deviations from contract; including those for extra or additional work must be submitted in writing for review of A/E. No verbal orders will be recognized.
  - B. Changes in the work shall be submitted in accordance with front end sections and General Conditions of the Contract for Construction.
  - C. All change proposals shall be itemized indicating separately the costs for materials, labor, restocking charges, freight, bonds, insurance, overhead, and profit. All materials shall be listed separately with quantities and individual unit prices. Labor factors shall be from a nationally recognized source with appropriate adjustments.
- 1.7 LOCATIONS AND INTERFERENCES
- A. Locations of equipment, piping, and other mechanical work are indicated diagrammatically by mechanical drawings. Lay out work from dimensions on Architectural and Structural Drawings. Verify equipment size from manufacturer’s shop drawings.
  - B. Study and become familiar with contract drawings of other trades and in particular the general construction drawings and details to obtain necessary information for figuring installation. Cooperate with other workmen and install work to avoid interference with their work. Minor deviations not affecting design characteristics, performance, or space limitations may be permitted if reviewed by A/E prior to installation.
  - C. Do not scale mechanical drawings for dimensions. Accurately lay out work from dimensions indicated on architectural drawings unless such is found in error.
- 1.8 SYSTEM PERFORMANCE



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- A. Final acceptance of work shall be subject to the condition that all systems, equipment, apparatus, and appliances operate satisfactorily as designed and intended; work shall include required adjustment of systems and control equipment installed under this specification.

### 1.9 WARRANTY

- A. Unless noted otherwise in specifications, M/C warrants to Owner and Architect the quality of materials, equipment, workmanship, and operation of equipment provided under this specification division for a period of one (1) year from and after date of substantial completion of building and acceptance of mechanical systems by Owner.
- B. Where manufacturers' warranties expire before or during the one-year warranty period as specified in item 1, the M/C shall include provisions for extending the manufacturer's warranty as required to match the one-year period from substantial completion and shall include cost for warranty extension in his base bid.
- C. M/C warrants to Owner and Architect that on receipt of written notice from either of them within one (1) year warranty period following date of acceptance, all defects that have appeared in materials and/or workmanship shall be promptly corrected to condition required by contract documents at M/C's expense.
- D. The above warranty shall not supersede any separately stated warranty or other requirements by law or by these specifications.
- E. Keeps an itemized list of all equipment warranties listing equipment by name, mark, and type along with length and expiration date of each warranty. Submit two (2) copies to A/E with request for final inspection.
- F. If the Architect's specification includes a warranty requirement that exceeds the above warranty requirements, the Architect's warranty shall take precedence.

### 1.10 MATERIALS, EQUIPMENT AND SUBSTITUTIONS

- A. The intent of these specifications is to allow ample opportunity for M/C to use his ingenuity and abilities to perform the work to his and the Owner's best advantage, and to permit maximum competition in bidding on standards of materials and equipment required.
- B. Material and equipment installed under this contract shall be first class quality, new, unused, and without damage.
- C. In general, these specifications identify required materials and equipment by naming first the manufacturer whose product was used as the basis for the project design and specifications. The manufacturer's product, series, model, catalog, and/or identification numbers shall set quality requirements for comparing the equivalency of other manufacturer's products in general. Where models are listed or scheduled with information that does not match specified manufacturer's data for size or capacity, the larger, more expensive and/or restrictive requirement between the schedule and the manufacturer's data shall be met and included. Where other manufacturer's names are listed, they are considered an approved manufacturer

for the product specified; however, the listing of their names implies no prior approval of any product unless specific model or catalog numbers are listed in these specifications or in subsequent addenda. The naming of a manufacturer, or even a model number, does not alleviate the contractor from being required to provide or submit equipment which meets all of the criteria and items listed in the specifications or shown on the plans even if the specified model and/or manufacturer does not. All requirements on the drawings must be met, not just the specific model number or manufacturer. Where other than first named products are used for M/C's base bid proposal, it shall be his responsibility to determine prior to bid time that his proposed materials and equipment selections are products of approved manufacturers, which meet or exceed the specifications, fit physically in the spaces provided, are compatible with all other systems and are acceptable to the D/E.

- D. Where varying or conflicting information, notes or specifications may be shown in different locations on the drawings, schedules, or specifications, all requirements are required to be met and the worst case or more expensive and/or restrictive option should be included where duplicate information is not the same. Notify A/E for clarification.
- E. Where materials or equipment are described but not named, provide required items of first quality, adequate in every respect for intended use. Such items shall be submitted to A/E for review prior to procurement.
- F. PRIOR TO RECEIPT OF BIDS, IF M/C WISHES TO INCORPORATE PRODUCTS OTHER THAN THOSE NAMED IN SPECIFICATIONS IN HIS BASE BID, HE SHALL SUBMIT A WRITTEN REQUEST FOR REVIEW OF SUBSTITUTIONS TO D/E NOT LESS THAN SEVEN (7) WORKING DAYS PRIOR TO BID TIME OR AS OTHERWISE REQUIRED BY FRONT END DOCUMENTS. D/E WILL REVIEW REQUESTS AND ACCEPTABLE ITEMS WILL BE LISTED IN AN ADDENDUM ISSUED TO PRINCIPAL BIDDERS
- G. Materials and equipment proposed for substitutions shall be equal to or superior to that specified in construction, efficiency, utility, aesthetic design, and color, as determined by A/E, whose decision shall be final and without further recourse. Physical size of substitute brand shall be no larger than space provided including allowances for access for installation and maintenance of installed equipment, as well as other systems shared in the same space. Requests must be accompanied by complete descriptive and technical data including E/M's name, model, and catalog number, photographs or cuts, physical dimensions, operating characteristics, and any other information needed for comparison.
- H. In proposing a substitution prior to or subsequent to receipt of bids, include in such proposal cost of altering other elements of project, including (but not limited to) adjustments in mechanical, mechanical, plumbing, controls, fire alarm and/or any other service requirements necessary to accommodate such substitution; whether such affected elements are under this contract or under separate contracts.

1.11 SHOP DRAWINGS, OPERATION AND MAINTENANCE INSTRUCTION

- A. Unless noted differently in the general requirements of the specifications, M/C shall furnish one of the following options, whichever format is preferred:
  - 1. Electronic PDF submittals as required by Missouri S&T.

- B. Where catalog cuts are submitted for review, conspicuously mark or provide schedule of equipment, capacities, controls, fittings, sizes, etc., that are to be provided. Mark equipment to match equipment labels provided on the drawings, schedules or specifications. Mark each submitted item with applicable section and paragraph numbers of these specifications, or plan sheet number, when item does not appear in specifications. Where equipment submitted does not appear in base specifications or specified equivalent, submittals shall be marked with applicable alternate numbers, change order numbers, or letters of authorization where said equipment was approved. Each submittal shall contain at least two (2) sets of original catalog cuts. Each catalog sheet shall bear E/M's name and address. All shop drawings on materials and equipment listed by UL shall indicate UL approval on submittal.
- C. M/C shall check all shop drawings to verify that they meet specifications and/or drawing requirements before forwarding submittals to the A/E for their review. All shop drawings submitted to A/E shall bear M/C approval stamp which shall indicate that M/C has reviewed submittals and that they meet specification and/or drawing requirements. M/C's submittal review shall specifically check for, but not be limited to, the following: equipment capacities, physical size in relation to space allowed; mechanical characteristics, provisions for supply, return, and drainage connections to building systems. All shop drawings not meeting M/C's approval shall be returned to his supplier for resubmittal.
- D. No shop drawing submittals will be considered for review by the A/E without M/C's approval stamp, or that have extensive changes made on the original submittal as a result of M/C's review.
- E. A/E's review of shop drawings will not relieve M/C of responsibility for deviations from drawings and specifications unless such deviations have been specifically approved in writing by Owner or his representative, nor shall it relieve M/C of responsibility for errors in shop drawings. No work shall be fabricated until A/E's review has been obtained. Any time delay caused by correcting and resubmitting shop drawings will be M/C's responsibility.
- F. A/E shall make every effort to provide shop drawing review in a timely fashion, but in no case shall the A/E be held responsible for delays in project construction or completion without prior notification of scheduling requirements specifically for return of shop drawings at least 8 weeks in advance. In no case shall less than 10 working days after A/E receipt of shop drawings be counted on by the contractor for A/E shop drawing review without prior notification and approval.
- G. Operating and Maintenance Instructions:
  - 1. Submit with shop drawings of equipment: copies of installation, operating, maintenance instructions, and parts list for equipment provided. Instructions shall be prepared by E/M in accordance with Missouri S&T procedures.

#### 1.12 PROPOSED VALUE ENGINEERING/PROJECT SCOPE REVISIONS

- A. Where design revisions are requested/required based on value-engineering or proposed changes in project scope, the contractor shall include in his proposed cost savings or adds the necessary MEP design fees that are required for modifying construction documents and associated meetings. In order to determine that value to be included, the contractor shall submit to the A/E the proposed scope of the work required for the changes at least 7 days

prior to required pricing submittal so that the design fees can be accurately determined and included. Design work and drawing changes will only commence once the design fee is established and a signed agreement returned to the A/E for inclusion.

- B. Where the contractor proposes to use different size equipment, feeders, feeder materials, circuit breakers, fuses or significant difference in routing of feeders or branches than shown in the construction documents, the contractor shall include the necessary MEP design fees that are required for modifying or creating construction drawings necessary either for construction or submission to the authority having jurisdiction and required for additional review. Design work and drawing changes will only commence once the design fee is established and a signed agreement returned to the A/E for inclusion.

**1.13 CAD FILE REQUESTS**

- A. CAD files are the property of the D/E. CAD files are only available upon documented written request which must be forwarded to the D/E office.

**1.14 CUTTING AND PATCHING**

- A. Contractor shall do cutting and patching of building materials required for installation of work herein specified. Cut no structural members without Architect's approval and in a manner approved by him.
- B. Patching shall be by mechanics of particular trade involved and shall meet approval of Architect.
- C. Drilling and cutting of openings through building materials requires Architect's review and approval. Make openings in concrete with concrete hole saw or concrete drill. Do not use star drill or air hammer for this work.

**1.15 MUTILIATION**

- A. Mutilation of building finishes, caused by installation of mechanical equipment, fixtures, outlets, and other mechanical devices shall be repaired at M/C's expense to approval of Architect.

**1.16 SETTING, ADJUSTMENT AND EQUIPMENT SUPPORTS:**

- A. The following are general specifications. Refer to section 250529 Hangers and Supports for Mechanical Systems for additional requirements.
- B. Work shall include mounting, alignment, and adjustment of all systems and equipment. Set equipment level on adequate foundations and provide proper anchor bolts and isolation. Level, shim, and grout equipment bases as recommended by E/M. Equipment failures resulting from improper installation or field alignment shall be repaired or replaced by M/C at no cost to Owner.

- C. Provide each piece of equipment or apparatus suspended from ceiling or mounted above floor level with suitable structural support, platform, or carrier in accordance with best recognized practice and the E/M. M/C shall arrange for attachment to building structure, unless otherwise indicated on drawings or specified. Provide hangers with vibration eliminators. Contractor shall verify with structural engineer that structural members of buildings are adequate to support equipment. Submit details of hangers, platforms, mounting brackets and supports together with total weights of mounted equipment to structural engineer and A/E for review before proceeding with fabrication or installation.

**1.17 START-UP, CHANGE-OVER, TRAINING AND OPERATIONAL CHECKS**

- A. M/C shall perform initial start-up of systems and equipment. Personnel qualified to start-up and service this equipment, including E/M's technicians, when specified, and Owner's operating personnel shall be present during these operations.
- B. M/C shall be responsible for training Owner's operating personnel to operate and maintain systems and equipment installed. Keep a record of training provided to Owner's personnel listing the date, subject covered, instructor's name, names of Owner's personnel attending, and the total hours given each individual.
- C. After each inspection, M/C shall submit written report to A/E indicating condition of equipment and including any recommended changes in operation of system or other information which will be helpful to Owner.

**1.18 MAINTENANCE OF SYSTEMS**

- A. M/C shall be responsible for operation, maintenance, and lubrication of equipment installed under his contract. All equipment and systems shall be fully operational when turned over to the owner at project substantial completion.

**1.19 PROTECTION AND CLEANING OF SYSTEMS AND EQUIPMENT**

- A. It shall be M/C's responsibility to protect and prevent damage to all mechanical materials and equipment stored and/or installed under this contract. All work, materials, and equipment shall be adequately protected by any and all means necessary to prevent damage by weather, flooding, condensation, construction debris, fire, and construction equipment and vehicles.
- B. Equipment not rated for outdoor use shall be protected from moisture damage before and during construction. Covering equipment with a tarp on site is not considered a means of providing protection from moisture. Any equipment not rated for outdoor use exposed to moisture for any duration shall be replaced with new equipment at the contractor's expense.
- C. Where job conditions or work of other contractors produce the potential for damage to mechanical systems and equipment, M/C shall immediately notify the G/C so that corrective action can be taken.

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- D. M/C shall take extra precautions to protect mechanical equipment containing solid state electronics, open relays, and contacts from damage by water, dust, dirt, construction debris, and the formation of condensate. All equipment so damaged shall be replaced by M/C with new equipment at no cost to Owner.
- E. M/C shall periodically inspect and clean all systems and equipment to ensure all systems and equipment remain in like new condition during construction, free from dust and debris. All cleaning shall be done in accordance with E/M's recommendation where available and applicable.
- F. Before request for final inspection, all systems and equipment shall be properly cleaned, vacuumed, polished, painted, etc., as required to return equipment to like new appearance.
- G. All equipment requiring painting or touch-up shall be properly prepared and painted in accordance with this specification.

### 1.20 PAINTING OF MATERIAL

- A. Equipment and materials exposed to interior dry environment shall have a minimum of one (1) primer and one (1) finish coat. Equipment and materials mounted in exterior location shall have a minimum of one (1) primer and two (2) finish coats with total thickness of at least 5 mils. Finish coat colors in finish areas shall be as selected by A/E.
- B. After installation, damage to painted surfaces shall be properly prepared and primed with primers equal to factory materials. Finish coating shall be same color and type as factory finish.
- C. Where extensive refinishing of factory applied finishes are required, equipment shall be completely repainted. A/E will make final determination of extent of refinishing required.

### 1.21 CLEANING OF HVAC SYSTEMS AND EQUIPMENT:

- A. After pressure testing of systems and equipment and before operational test, thoroughly clean interiors of ductwork and equipment.
- B. Clean equipment as recommended by manufacturers. Where specific instructions are not provided by equipment manufacturer, clean equipment systems as follows:
  - 1. Air Handling System: Before starting any air system, clean all debris, foreign matter, and construction dirt from air system and fan. Provide equipment requiring filters, such as air handling units, fan coil units, blowers, etc. with throwaway filters specified under this Specification. After cleaning air system, install temporary filters and run continuously for eight (8) hours at full volume. Replace temporary filters with final filters immediately prior to testing and balancing for any equipment operational when located in area of construction or as directed by owner.

### 1.22 RECORD DOCUMENTS

- A. Record Drawings: Unless noted otherwise in architectural documents, maintain a reproducible set of contract drawings and shop drawings in clean, undamaged condition, with mark-up of

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actual installations which vary substantially from the work as originally shown. Mark whichever drawing is most capable of showing “field” condition fully and accurately; however, where shop drawings are used for mark-up, record a cross-reference at corresponding location on working drawings. Mark with red erasable red pencil and, where feasible, use other colors to distinguish between variations in separate categories of work. Mark-up new information, which is recognized to be of importance to Owner, but was for some reason not shown on either contract drawings or shop drawings. Give particular attention to concealed work, which would be difficult to measure and record at a later date. Note related change order numbers where applicable. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates, and other identification on cover of each sheet.

- B. As-built documents shall be submitted for approval prior to final payment. Copies of “in-progress” as-built drawings shall be submitted at each pay request.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION 23 0000

SECTION 23 0500 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
1. Piping materials and installation instructions common to most piping systems.
  2. Dielectric fittings.
  3. Mechanical sleeve seals.
  4. Sleeves.
  5. Escutcheons.
  6. Grout.
  7. HVAC demolition.
  8. Equipment installation requirements common to equipment sections.
  9. Concrete bases.
  10. Supports and anchorages.

1.2 DEFINITIONS

- A. Design Engineer, hereinafter abbreviated D/E shall mean the Engineering firm, RTM Consulting Engineers., 3333 E. Battlefield, Suite 1000, Springfield, MO 65804, Telephone (417) 881-0020. Contact person: Jennifer Luce.
- B. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- C. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- D. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- E. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
- F. 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.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.



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- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
  - 1. Underdeck Clamp: Clamping ring with set screws.
- E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.
- F. PVC Pipe: ASTM D 1785, Schedule 40.

### 2.2 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, duct and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
  - 1. Finish: Polished chrome plated.
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
  - 1. Finish: Polished chrome plated.

### 2.3 GROUT

- A. Description: ASTM C 1107, Grade B, non-shrink and nonmetallic, dry hydraulic-cement grout.
  - 1. Characteristics: Post-hardening, volume-adjusting, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
  - 2. Design Mix: 5000-psi, 28-day compressive strength.
  - 3. Packaging: Premixed and factory packaged.

## PART 3 - EXECUTION

### 3.1 HVAC 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 HVAC systems, equipment, and components indicated to be removed.
  - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
  - 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
  - 3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
  - 4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
  - 5. Equipment to Be Removed: Disconnect and cap services and remove equipment.

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6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
  7. 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.
1. Piping installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to piping layout.
  2. Suspend ceiling components.
  3. Structural members to which piping will be attached.
  4. Size and location of initial access modules for acoustical tile.
  5. Penetrations of smoke barriers and fire-rated construction.
  6. Coordination between other trades.

### 3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes and required per industry standards.
- 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 and approved hanger/supports per Division 22.
- 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 where visible.
- M. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

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- N. Plastic piping where allowed in other sections within the building shall not be permissible to be exposed to air flow in return air plenum.
- O. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
  - 1. Install steel pipe for sleeves smaller than 6 inches in diameter.
  - 2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
  - 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- P. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire stop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
- Q. Verify final equipment locations for roughing-in.
- R. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

### 3.3 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

### 3.4 GENERAL REQUIREMENTS

- A. Provide every device and accessory necessary for proper operation and completion of mechanical system. Visit site and determine existing local conditions affecting work in contract. Failure to determine site conditions or nature of existing or new construction will not be considered a basis for granting additional compensation.
- B. Provide work in accordance with applicable codes, rules, ordinances, and regulations of Local, State and Federal Government and other authorities having lawful jurisdiction. Conform to latest editions and supplements of following codes, standards or recommended practices as adopted by the authority having jurisdiction. Drawings and specifications indicate minimum construction standards, but should any work indicated be sub-standard to any ordinances, laws or codes, rules or regulations bearing on work, Contractor shall execute work in accordance with such without increased cost to owner, but not until he has referred such variances to A/E for approval.

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- C. M/C shall perform initial start-up of systems and equipment and shall provide necessary supervision and labor to make first seasonal changeover of systems. Personnel qualified to start-up and service this equipment, including E/M's technicians when specified, and Owner's operating personnel shall be present during these operations.

### **3.5 PRE-FINAL AND FINAL CONSTRUCTION REVIEW**

- A. At M/C's request, A/E will make pre-final construction review to determine if to the best of their knowledge project is completed in accordance with plans and specifications. Items found by A/E as not complete or not in accordance with requirements of contract will be outlined in report to M/C. After completion and/or correction of these items' M/C shall notify A/E he is ready for final review. All necessary system adjustments including air and water systems balancing shall be completed and all specified records and reports submitted in sufficient time to be received by A/E at least ten working days prior to date of final construction review.

### **3.6 ELECTRICAL REQUIREMENTS**

- A. Consult Division 26 of electrical specifications for work to be provided by E/C in conjunction with installation of mechanical equipment. Electrical work required to operate and/or control mechanical equipment which is not shown on plans or specified under Division 26 shall be included in M/C's base bid proposal.
- B. M/C shall be responsible for providing supervision to E/C to insure that required connections, interlocking and interconnection of mechanical and electrical equipment are made to attain intended control sequences and system operation. Control devices and field wiring to be provided by E/C shall be clearly indicated by notation and drawing symbols on wiring diagrams.
- C. Safety disconnect switches and manual magnetic motor starters shall be provided by E/C. Exceptions will be allowed where mechanical equipment is specified with these devices installed as part of factory-built control systems.

END OF SECTION 23 0500

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SECTION 23 0529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. Equipment supports.
6. Pre-Insulated pipe clamps.

B. Related Requirements:

1. See Division 05 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. See Division 21 Section "Water-Based Fire-Suppression Systems" for pipe hangers for fire-protection piping.
3. See Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment" for vibration isolation devices.
4. See Division 23 Section "Metal Ducts" for duct hangers and supports.

1.2 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- C. Design seismic-restraint hangers and supports for piping and equipment as per local authority.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Steel pipe hangers and supports.
2. Thermal-hanger shield inserts.
3. Powder-actuated fastener systems.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design trapeze pipe hangers and equipment supports.
- B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
  - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
  - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
  - 3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

### 2.2 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
  - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
  - 2. Galvanized Metallic Coatings: Pre-galvanized, hot dip galvanized, or electro-galvanized.
  - 3. Nonmetallic Coatings: Plastic coated, or epoxy powder coated.
  - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
  - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- B. Stainless Steel Pipe Hangers and Supports:
  - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
  - 2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
  - 3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

### 2.3 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-58, 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.

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### 2.4 PRE-INSULATED PIPE CLAMPS

- A. Clamps on all hydronic piping shall be fully insulated equal to an Anvil Cush-A-Therm. Cushioned or bare clamps that are not fully insulated are not allowed. Insulation material and thickness shall match specified material.

### 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.
  - 1. Available Manufacturers:
    - a. Hilti, Inc.
    - b. ITW Ramset/Red Head.
    - c. Masterset Fastening Systems, Inc.
    - d. Powers Fasteners.
- B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened Portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
  - 1. Available Manufacturers:
    - a. B-Line Systems, Inc.; a division of Cooper Industries.
    - b. Hilti, Inc.
    - c. ITW Ramset/Red Head.
    - d. Powers Fasteners.

### 2.6 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

### 2.7 MATERIALS

- A. Aluminum: ASTM B221.
- B. Carbon Steel: ASTM A1011/A1011M.
- C. Structural Steel: ASTM A36/A36M, carbon-steel plates, shapes, and bars; black and galvanized.
- D. Stainless Steel: ASTM A240/A240M.
- E. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink and nonmetallic grout; suitable for interior and exterior applications.
  - 1. Properties: Non-staining, noncorrosive, and nongaseous.
  - 2. Design Mix: 5000-psi, 28-day compressive strength.



PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lbs.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
  - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
  - 2. Field fabricate from ASTM A36/A36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Fastener System Installation:
  - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
  - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- D. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- E. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- F. Install hangers and supports to allow controlled thermal 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.

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- 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.

### 3.3 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

### 3.4 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

### 3.5 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to **1-1/2 inches**.

3.6 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Touchup: Comply with requirements in Section 099113 "Exterior Painting" Section 099123 "Interior Painting" and Section 099600 "High-Performance Coatings" for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780/A780M.

3.7 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers, and metal framing systems and attachments for general service applications.
- F. Use stainless steel pipe hangers and fiberglass pipe hangers and fiberglass strut systems and stainless steel or corrosion-resistant attachments for hostile environment applications.
- G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
- H. Use padded hangers for piping that is subject to scratching.
- I. Use thermal-hanger shield inserts for insulated piping and tubing.
- J. 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 non-insulated or insulated, stationary pipes NPS 1/2 to NPS 30.

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2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
  3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
  4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
  5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
  6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
  7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
  8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
  9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
  10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
  11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
  12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
  13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
  14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
  15. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
  16. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
  17. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
  18. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is unnecessary.
  19. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is unnecessary.
  20. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- K. 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.

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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.
- L. 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. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
  6. C-Clamps (MSS Type 23): For structural shapes.
  7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
  8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
  9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
  10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
  11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
  12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    - a. Light (MSS Type 31): 750 lb.
    - b. Medium (MSS Type 32): 1500 lb.
    - c. Heavy (MSS Type 33): 3000 lb.
  13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
  14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
  15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
  2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
  3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

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- N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
  2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
  3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
  4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
  5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
  6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
  7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
  8. Constant Supports: For critical piping stress and if necessary, to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
    - a. Horizontal (MSS Type 54): Mounted horizontally.
    - b. Vertical (MSS Type 55): Mounted vertically.
    - c. Trapeze (MSS Type 56): Two vertical type supports and one trapeze member.
- O. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- P. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 23 0529

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SECTION 23 0553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Equipment labels.
  2. Warning signs and labels.
  3. Pipe labels.

1.2 SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
1. Material and Thickness: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
  2. Letter Color: White.
  3. Background Color: Black.
  4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
  5. Minimum Letter Size: 1/2 inch . Include secondary lettering two-thirds to three-quarters the size of principal lettering.
  6. Fasteners: Stainless-steel rivets or self-tapping screws.
  7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Plastic Labels for Equipment:
1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8-inch-thick, and having predrilled holes for attachment hardware.
  2. Letter Color: White.
  3. Background Color: Black.
  4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
  5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
  6. Minimum Letter Size: 1/2 inch. Include secondary lettering two-thirds to three-quarters the size of principal lettering.



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- 7. Fasteners: Stainless-steel rivets or self-tapping screws.
- 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

- C. Label Content: Include equipment's Drawing designation or unique equipment number, drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.
- D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

### 2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: Black.
- C. Background Color: Yellow.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information plus emergency notification instructions.

## 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.

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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.
- C. Provide sticker on ceiling tile below equipment in accordance with owner guidance.

END OF SECTION 23 0553

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SECTION 23 0593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Testing, Adjusting, and Balancing of Air Systems shall be direct by owner.
2. Contractor responsibilities for Owner Supplied test and balance.

1.2 DEFINITIONS

- A. TAB: Testing, adjusting, and balancing.

1.3 FIELD CONDITIONS

- A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect installed systems for balancing devices, isolation valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.
- B. Inspect system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- C. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.
- D. Examine operating safety interlocks and controls on HVAC equipment.
- E. Examine control dampers for proper installation for their intended function of isolating, throttling, diverting, or mixing air flows.
- F. Correct any deficiencies discovered before and during performance of TAB procedures.

**3.2 PREPARATION**

- A. Contractor shall perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:
1. Airside:
    - a. Duct systems are complete with terminals installed.
    - b. Volume, smoke, and fire dampers are open and functional.
    - c. Clean filters are installed.
    - d. Fans are operating, free of vibration, and rotating in correct direction.
    - e. Suitable access to balancing devices and equipment is provided.
    - f. Clean and seal all new ductwork and existing where modifications are done.
    - g. Service and tag all equipment
    - h. Set and align all motors and drives
    - i. Start up and prove all equipment and systems.
    - j. Operate all systems for twenty-four (24) hours minimum.
    - k. Patch insulation, ductwork, and housing using materials identical to those removed.

**3.3 GENERAL PROCEDURES AND REQUIREMENTS PRIOR TO TEST AND BALANCE.**

- 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.
- B. Contractor Responsibilities:
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. Attend a coordination meeting prior to the balancing of the system and a coordination meeting following the balancing of the system.
  5. Provide a complete set of as-built drawings prior to the TAB effort.
  6. Provide craftsmen of the proper trade to work with the TAB firm to make adjustments and installation changes as required.
  7. Change out fan sheaves when and if required by the TAB firm.
  8. Dedicate the resources to accommodate all changes identified by the test and balance firm in a timely manner.
  9. 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.

END OF SECTION 23 0593

SECTION 23 0700 - HVAC INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Insulation Materials:
    - a. Flexible elastomeric.
    - b. Mineral fiber.
  - 2. Insulating cements.
  - 3. Adhesives.
  - 4. Mastics.
  - 5. Sealants.
  - 6. Factory-applied jackets.
  - 7. Field-applied fabric-reinforcing mesh.
  - 8. Field-applied jackets.
  - 9. Tapes.
  - 10. Securements.
  - 11. Corner angles.
- B. Related Sections:
  - 1. Division 23 Section "Metal Ducts" for duct liners.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.

1.3 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that meet stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

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- 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. Duct liner will not be allowed unless use for patching existing ductwork or for return transfer boots for acoustic purposes. Duct liner shall match existing on site.
- G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article. Fiberglass wrap insulation shall be minimum density of 1 lb/CF.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. CertainTeed Corp.; Duct Wrap.
    - b. Johns Manville; Microlite.
    - c. Knauf Insulation; Duct Wrap.
    - d. Owens Corning; All-Service Duct Wrap.

### 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.

### 2.3 MASTICS AND COATINGS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-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 and outdoor use on below ambient services.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Products, Division of ITW; CP-35.
    - b. Foster Products Corporation, H. B. Fuller Company; 30-90.

### 2.4 SEALANTS

- A. FSK and Metal Jacket Flashing Sealants:
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Products, Division of ITW; CP-76-8.
    - b. Foster Products Corporation, H. B. Fuller Company; 95-44.
  - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
  - 3. Fire- and water-resistant, flexible, elastomeric sealant.
  - 4. Service Temperature Range: Minus 40 to plus 250 deg F.
  - 5. Color: Aluminum.
  - 6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

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### 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. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

### 2.6 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. Field-applied jackets shall comply with ASTM C1136, Type I, unless otherwise indicated.
- C. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

### 2.7 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.
  - 1. Width: 3 inches.
  - 2. Thickness: 11.5 mils.
  - 3. Adhesion: 90 ounces force/inch in width.
  - 4. Elongation: 2 percent.
  - 5. Tensile Strength: 40 lbf/inch in width.
  - 6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C1136.
  - 1. Width: 3 inches.
  - 2. Thickness: 6.5 mils.
  - 3. Adhesion: 90 ounces force/inch in width.
  - 4. Elongation: 2 percent.
  - 5. Tensile Strength: 40 lbf/inch in width.
  - 6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

### 2.8 SECUREMENTS

- A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 0.5-inch wide with closed seal.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Products; Bands.
    - b. PABCO Metals Corporation; Bands.
- B. Insulation Pins and Hangers:
  - 1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that can hold insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:



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- a. Products: Subject to compliance with requirements, provide one of the following:
    - 1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series T.
    - 2) GEMCO; Perforated Base.
    - 3) Midwest Fasteners, Inc.; Spindle.
  - b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
  - c. Spindle Aluminum, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
  - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
2. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that can hold insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
- a. Products: Subject to compliance with requirements, provide one of the following:
    - 1) GEMCO; Nylon Hangers.
    - 2) Midwest Fasteners, Inc.; Nylon Insulation Hangers.

**PART 3 - EXECUTION**

**3.1 PREPARATION**

- A. Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

**3.2 GENERAL INSTALLATION REQUIREMENTS**

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item 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.
- E. Contractor shall be responsible for re-insulating existing equipment, ductwork, and piping where insulation has been removed for new connections or where old insulation has been abated. Repair existing insulation when damaged during construction. Match existing insulation and install new jacket lapping and sealed over existing.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.

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- 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 and per manufacturer recommendations.
- J. Duct wrap on horizontal ducts shall be pinned on the bottom and side of the duct at 18" intervals to prevent sagging. Duct wrap shall be pinned on vertical ducts to keep from sagging.
- K. Duct wrap insulation shall be installed after duct leakage tests are complete and acceptable.
- L. 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.
- M. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- N. 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 1.5 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 as recommended by insulation material manufacturer to maintain vapor seal.
  - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.
- O. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- P. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- Q. 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 like butt joints.
- R. At connections to VAV boxes, collars, reheat coils, ducts shall be insulated as the adjacent duct. All components in contact with 55 degrees supply air shall be insulated and vapor barrier installed.
- S. For above ambient services, do not install insulation to the following:

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1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

### 3.3 PENETRATIONS

- A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls, floors, and partitions.
- B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
  1. Comply with requirements in Division 07 Section "Penetration Firestopping" firestopping and fire-resistive joint sealers.

### 3.4 FINISHES

- A. Duct, Equipment, and Pipe Insulation with ASJ or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.
  1. Flat Acrylic Finish: Two (2) finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
    - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- C. Do not field paint aluminum or stainless-steel jackets.

### 3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
  1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited two (2) location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

### 3.6 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
  1. Indoor, concealed supply and outdoor air.
  2. Indoor, exposed supply and outdoor air.

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- B. Items Not Insulated:
  - 1. Factory-insulated flexible ducts.
  - 2. Factory-insulated plenums and casings.
  - 3. Flexible connectors.
  - 4. Vibration-control devices.
  - 5. Factory-insulated access panels and doors.

**3.7 INDOOR DUCT AND PLENUM INSULATION SCHEDULE**

- A. Concealed, Supply-Air Duct and Plenum Insulation: Mineral-fiber blanket with FSK jacket, 1.5 inches thick and 1.5-lb/cu. ft. nominal density (R-4.2/inch). Double this thickness on attics or other unconditioned places.
- B. Concealed, Return-Air Duct and Plenum Insulation (Only in unconditioned spaces): Mineral-fiber blanket with FSK jacket, 1.5 inches thick and 1.5-lb/cu. ft. nominal density (R-4.2/inch).
- C. Exposed, Supply-Air Duct and Plenum Insulation: Mineral-fiber blanket with FSK jacket, 1.5 inches thick and 1.5-lb/cu. ft. nominal density (R-4.2/inch).
- D. Exposed, Return-Air Duct and Plenum Insulation (only in unconditioned spaces): Mineral-fiber blanket with FSK jacket, 1.5 inches thick and 1.5-lb/cu. ft. nominal density (R-4.2/inch).

**3.8 PIPING INSULATION SCHEDULE, GENERAL**

- A. Insulation conductivity and thickness per pipe size shall comply with schedules in this Section or with requirements of authorities having jurisdiction, whichever is more stringent.
- B. INDOOR PIPING INSULATION SCHEDULE
  - 1. Condensate and Equipment Drain Water below 60 Deg F:
    - a. All Pipe Sizes: Insulation shall be:
      - 1) Flexible Elastomeric: 0.75 inches thick.
  - 2. Chilled Water, Above 40 Deg F:
    - a. Insulation shall be:
      - 1) Flexible Elastomeric: 1 inches thick.

END OF SECTION 23 0700

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SECTION 232113 - HYDRONIC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes pipe and fitting materials and joining methods for the following:

1. Copper Tube and Fittings.
2. Steel pipe and fittings.
3. Joining materials.
4. Transition fittings.
5. Dielectric fittings.
6. Valves.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:

1. Chilled-Water Piping: 175 psig at 200 deg F
2. Condensate-Drain Piping: 150 deg F.

2.2 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B88, Type L.

B. Annealed-Temper Copper Tubing: ASTM B88, Type K.

C. DWV Copper Tubing: ASTM B306, Type DWV.

D. Wrought-Copper Fittings: ASME B16.22.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Anvil International, Inc.
- b. S. P. Fittings; a division of Star Pipe Products.
- c. Victaulic Company of America.

E. Wrought-Copper Unions: ASME B16.22.

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**2.3 STEEL PIPE AND FITTINGS**

- A. Steel Pipe: ASTM A53/A53M, black steel with plain ends; welded and seamless, Grade B, and wall thickness as indicated in "Piping Applications" Article.
- B. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300 as indicated in "Piping Applications" Article.
- C. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in "Piping Applications" Article.
- D. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
  - 1. Material Group: 1.1.
  - 2. End Connections: Butt welding.
  - 3. Facings: Raised face.
- E. Grooved Mechanical-Joint Fittings and Couplings:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Anvil International, Inc.
    - b. Central Sprinkler Company; a division of Tyco Fire & Building Products.
    - c. National Fittings, Inc.
    - d. S. P. Fittings; a division of Star Pipe Products.
    - e. Victaulic Company of America.
  - 2. Joint Fittings: ASTM A536, Grade 65-45-12 ductile iron; ASTM A47/A47M, Grade 32510 malleable iron; ASTM A53/A53M, Type F, E, or S, Grade B fabricated steel; or ASTM A106/A106M, Grade B steel fittings with grooves or shoulders constructed to accept grooved-end couplings; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
  - 3. Couplings: Ductile- or malleable-iron housing and EPDM or nitrile gasket of central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.

**2.4 JOINING MATERIALS**

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  - 1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless otherwise indicated.
    - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

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- C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.
- D. Solder Filler Metals: ASTM B32, lead-free alloys. Include water-flushable flux according to ASTM B813.
- E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.
- F. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- G. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

2.5 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Capitol Manufacturing Company.
    - b. Central Plastics Company.
    - c. Hart Industries International, Inc.
    - d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    - e. Zurn Plumbing Products Group; AquaSpec Commercial Products Division.
  - 2. Description:
    - a. Standard: ASSE 1079.
    - b. Pressure Rating: 250 psig at 180 deg F.
    - c. End Connections: Solder-joint copper alloy and threaded ferrous.
- D. Dielectric Couplings:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Calpico, Inc.
    - b. Lochinvar Corporation.
  - 2. Galvanized-steel coupling with inert and noncorrosive thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.



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2.6 VALVES

2.7 GENERAL REQUIREMENTS FOR VALVES

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
  - 1. ASME B16.1 for flanges on iron valves.
  - 2. ASME B1.20.1 for threads for threaded-end valves.
  - 3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
  - 4. ASME B16.18 for solder-joint connections.
  - 5. ASME B31.1 for power piping valves.
  - 6. ASME B31.9 for building services piping valves.
- C. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- D. Valve Bypass and Drain Connections: MSS SP-45.
- E. Refer to HVAC valve schedule articles for applications of valves.
- F. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- G. Valve Sizes: Same as upstream piping unless otherwise indicated.
- H. Valve Actuator Types:
  - 1. Gear Actuator: For quarter-turn valves NPS 8 and larger.
  - 2. Handwheel: For valves other than quarter-turn types.
  - 3. Handlever: For quarter-turn valves NPS 6 and smaller.
  - 4. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.
- I. 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.
- J. 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.
- K. Two-Piece, Full-Port, Bronze Ball Valves with Stainless Steel Trim:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Conbraco Industries, Inc.; Apollo Valves.
    - b. Crane Co.; Crane Valve Group; Crane Valves.

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- c. Hammond Valve.
  - d. Lance Valves; a division of Advanced Thermal Systems, Inc.
  - e. Milwaukee Valve Company.
  - f. NIBCO INC.
  - g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
- a. Standard: MSS SP-110.
  - b. SWP Rating: 150 psig.
  - c. CWP Rating: 600 psig.
  - d. Body Design: Two piece.
  - e. Body Material: Bronze.
  - f. Ends: Threaded.
  - g. Seats: PTFE or TFE.
  - h. Stem: Stainless steel.
  - i. Ball: Stainless steel, vented.
  - j. Port: Full.
- L. Class 125, Bronze Swing Check Valves with Bronze Disc:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- a. American Valve, Inc.
  - b. Crane Co.; Crane Valve Group; Crane Valves.
  - c. Crane Co.; Crane Valve Group; Jenkins Valves.
  - d. Crane Co.; Crane Valve Group; Stockham Division.
  - e. Hammond Valve.
  - f. Kitz Corporation.
  - g. Milwaukee Valve Company.
  - h. NIBCO INC.
  - i. Powell Valves.
  - j. Red-White Valve Corporation.
  - k. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  - l. Zy-Tech Global Industries, Inc.
2. Description:
- a. Standard: MSS SP-80, Type 3.
  - b. CWP Rating: 200 psig.
  - c. Body Design: Horizontal flow.
  - d. Body Material: ASTM B 62, bronze.
  - e. Ends: Threaded.
  - f. Disc: Bronze.
- M. Bronze, Calibrated-Orifice, Balancing Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- a. Bell & Gossett Domestic Pump; a division of ITT Industries.

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- b. Flow Design Inc.
  - c. Griswold Controls.
  - d. Taco.
2. Body: Bronze, ball or plug type with calibrated orifice or venturi.
  3. Ball: Brass or stainless steel.
  4. Plug: Resin.
  5. Seat: PTFE.
  6. End Connections: Threaded or socket.
  7. Pressure Gage Connections: Integral seals for portable differential pressure meter.
  8. Handle Style: Lever, with memory stop to retain set position.
  9. CWP Rating: Minimum 125 psig.
  10. Maximum Operating Temperature: 250 deg F.

## 2.8 AIR CONTROL DEVICES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manual Air Vents:
  1. Body: Bronze.
  2. Internal Parts: Nonferrous.
  3. Operator: Screwdriver or thumbscrew.
  4. Inlet Connection: NPS 1/2.
  5. Discharge Connection: NPS 1/8.
  6. CWP Rating: 150 psig.
  7. Maximum Operating Temperature: 225 deg F.

## 2.9 HYDRONIC PIPING SPECIALTIES

- A. Y-Pattern Strainers:
  1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
  2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
  3. Strainer Screen: 60-mesh startup strainer and perforated stainless-steel basket with 50 percent free area.
  4. CWP Rating: 125 psig.

## PART 3 - EXECUTION

### 3.1 PIPING APPLICATIONS

- A. Chilled-water piping, aboveground, NPS 2 and smaller shall be either of the following:
  1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
  2. Schedule 40 steel pipe; Class 125, cast-iron or Class 150, malleable-iron fittings; cast-iron flanges and flange fittings; and threaded joints.

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- A. Condensate-Drain Piping: Type M DWV, drawn-temper copper tubing, wrought-copper fittings, and soldered joints or Schedule 40 PVC plastic pipe and fittings and solvent-welded joints.

3.2 VALVE APPLICATIONS

- A. Install shut off-duty valves at each branch connection to supply mains, and at supply connection to each piece of equipment.
- B. Install balancing valves at each branch connection to return main.
- C. Install balancing valves in the return pipe of each heating or cooling terminal.
- D. Install check valves at each pump discharge and elsewhere as required to control flow direction.

3.3 INSTALLATION OF PIPING

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- 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. Select system components with pressure rating equal to or greater than system operating pressure.
- K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- L. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

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- M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.
- N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- O. Install branch connections to mains using pre-manufactured tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.
- P. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
- Q. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.
- R. Install shutoff valve immediately upstream of each dielectric fitting.
- S. Install strainers on inlet side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS 3/4 nipple and ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.
- T. Install expansion loops, expansion joints, anchors, and pipe alignment guides as specified in Division 23 Section "Expansion Fittings and Loops for HVAC Piping."
- U. Identify piping as specified in Division 23 Section "Identification for HVAC Piping and Equipment."
- V. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- W. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- X. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

**3.4 JOINT CONSTRUCTION**

- A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM 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.

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- 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/A5.8M.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- H. Grooved Joints: Assemble joints with coupling and gasket, lubricant, and bolts. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. Use grooved-end fittings and rigid, grooved-end-pipe couplings.
- I. Plain-End Mechanical-Coupled Joints: Prepare, assemble, and test joints in accordance with manufacturer's written installation instructions.
- J. Mechanically Formed, Copper-Tube-Outlet Joints: Use manufacturer-recommended tools and procedure, and brazed joints.

**3.5 INSTALLATION OF DIELECTRIC FITTINGS**

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric nipples or unions.

**3.6 INSTALLATION OF HANGERS AND SUPPORTS**

- A. Hanger, support, and anchor devices are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment." Comply with the following requirements for maximum spacing of supports.
- B. Seismic restraints are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."
- C. Install the following pipe attachments:
  - 1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
  - 2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
  - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
  - 4. Spring hangers to support vertical runs.

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5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
  6. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.
- D. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
1. NPS 3/4: Maximum span, 7 feet; minimum rod size, 0.375-inch.
  2. NPS 1: Maximum span, 7 feet; minimum rod size, 0.375-inch.
  3. NPS 1-1/4: Maximum span, 7 feet; minimum rod size, 0.375-inch.
  4. NPS 1-1/2: Maximum span, 9 feet; minimum rod size, 0.375-inch.
  5. NPS 2: Maximum span, 10 feet; minimum rod size, 0.375-inch.
  6. NPS 2-1/2: Maximum span, 11 feet; minimum rod size, 0.5-inch.
  7. NPS 3: Maximum span, 12 feet; minimum rod size, 0.5-inch.
  8. NPS 3-1/2: Maximum span, 13 feet; minimum rod size, 0.5-inch.
  9. NPS 4: Maximum span, 14 feet; minimum rod size, 0.625-inch.
- E. Install hangers for drawn-temper copper tubing with the following maximum spacing and minimum rod sizes:
1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 0.375-inch.
  2. NPS 1: Maximum span, 6 feet; minimum rod size, 0.375-inch.
  3. NPS 1-1/4: Maximum span, 7 feet ; minimum rod size, 0.375-inch.
  4. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 0.375-inch.
  5. NPS 2: Maximum span, 8 feet ; minimum rod size, 0.375-inch.
  6. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 0.5-inch.
  7. NPS 3: Maximum span, 10 feet; minimum rod size, 0.5-inch.
- F. Plastic Piping Hanger Spacing: Space hangers according to pipe manufacturer's written instructions for service conditions. Avoid point loading. Space and install hangers with the fewest practical rigid anchor points.
- G. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

### 3.7 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.

### 3.8 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.
- C. Install bypass piping with valve around control valve. If parallel control valves are installed, only one bypass is required.
- D. Install ports for pressure gages and thermometers at coil inlet and outlet connections.

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3.9 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification materials and installation in Section 230553 "Identification for HVAC Piping and Equipment."

3.10 FIELD QUALITY CONTROL

- A. Prepare hydronic piping according to ASME B31.9 and as follows:
1. Leave joints, including welds, uninsulated and exposed for examination during test.
  2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
  3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
  4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
  5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.
- B. Perform the following tests on hydronic piping:
1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
  2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
  3. Isolate expansion tanks and determine that hydronic system is full of water.
  4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times the "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
  5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
  6. Prepare written report of testing.
- C. Perform the following before operating the system:
1. Open manual valves fully.
  2. Inspect pumps for proper rotation.
  3. Set makeup pressure-reducing valves for required system pressure.
  4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).



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5. Set temperature controls so all coils are calling for full flow.
6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
7. Verify lubrication of motors and bearings.

END OF SECTION 232113

SECTION 23 3113 - METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Sheet metal materials.
4. Sealants and gaskets.
5. Hangers and supports.

B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and with performance requirements and design criteria indicated in "Duct Schedule" Article.
- B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".
- C. Airstream Surfaces: Surfaces in contact with airstream shall comply with requirements in ASHRAE 62.1.
- D. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment," and Section 7 - "Construction and System Startup."

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- E. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."
- F. Duct Dimensions: Unless otherwise indicated, all duct dimensions indicated on Drawings are inside clear dimensions and do not include insulation or duct wall thickness.

### **2.2 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS**

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
  - 1. Construct ducts of G90 galvanized sheet steel unless otherwise indicated.
- B. Transverse Joints: Fabricate joints in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - 1. For ducts with longest side less than 36 inches, select joint types in accordance with Figure 2-1.
  - 2. For ducts with longest side 36 inches or greater, use flange joint connector Type T-22, T-24, T-24A, T-25a, or T-25b. Factory-fabricated flanged duct connection system may be used if submitted and approved by engineer of record.
- C. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." All longitudinal seams shall be Pittsburgh lock seams unless otherwise specified for specific application.
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

### **2.3 SINGLE-WALL ROUND DUCTS AND FITTINGS**

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
  - 1. Construct ducts of galvanized sheet steel unless otherwise indicated.

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- B. Transverse Joints: Select joint types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - 1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
- C. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Tees and Laterals: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

### 2.4 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A653/A653M.
  - 1. Galvanized Coating Designation: G90.
  - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.

### 2.5 DUCT LINER (ALLOWED ONLY FOR PATCHING ON EXTENSION OF EXISTING DUCTS)

- A. Fibrous-Glass Duct Liner: Comply with ASTM C1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
  - 1. Equivalents by Owens-Corning, John Manville, CertainTeed, and Knauf.
  - 2. Internal acoustical and thermal duct insulation for low velocity ductwork shall be CertainTeed 2-pound density Toughgard R duct liner with 0.24 BTUH thermal conductivity at 75 deg F mean temperature. Facing shall have a maximum water vapor sorption rate of 3 percent by weight. Approved for use in return air plenums, conforms to ASTM E84 requirements and withstands temperatures of 250°.
- B. Insulation Pins and Washers:

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1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch-diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
  2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick; galvanized steel; with beveled edge sized as required to hold insulation securely in place, but not less than 1-1/2 inches in diameter.
- C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."
1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
  2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
  3. Butt transverse joints without gaps, and coat joint with adhesive.
  4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
  5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
  6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2000 fpm or greater.
  7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
  8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
    - a. Fan discharges.
    - b. Intervals of lined duct preceding unlined duct.
    - c. Upstream edges of transverse joints in ducts where air velocities are higher than 2000 fpm or where indicated.
  9. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.
- 2.6 SEALANT AND GASKETS
- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.
  - B. Water-Based Joint and Seam Sealant:

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1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
10. Sealant shall have a VOC content of 420 g/L or less.
11. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
12. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
13. Service: Indoor or outdoor.
14. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

### 2.7 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Galvanized-steel rods and nuts.
- B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- C. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A603.
- D. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A492.
- E. Steel Cable End Connections: Galvanized-steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- F. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

## PART 3 - EXECUTION

### 3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design

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considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and coordination drawings.

- B. Install ducts in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install ducts in maximum practical lengths with fewest possible joints.
- D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- G. Install ducts with a clearance of 1 inch plus allowance for insulation thickness.
- H. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- I. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
- J. Install fire, smoke, and combination fire/smoke dampers where indicated on Drawings and as required by code, and by local authorities having jurisdiction. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers and specific installation requirements of the damper UL listing.
- K. Install heating coils, cooling coils, air filters, dampers, and all other duct-mounted accessories in air ducts where indicated on Drawings.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials both before and after installation. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."
- M. Elbows: Use long-radius elbows with a centerline radius of 1.5 x duct width unless noted otherwise.
- N. Branch Connections: Use bellmouth or high-efficiency, rectangular to round branch duct fittings. Conical fittings are not allowed.
- O. Construct and install ductwork to be completely free from vibration under all conditions of operation. Support and securely anchor ductwork and equipment from structural framing of building. Provide suitable intermediate metal framing where required between building

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structural framing. Each duct system shall be constructed for the specific duct pressure classifications shown on the contract documents or in equipment fan schedule listed as external total static pressure.

- P. All metal ductwork scheduled for interior thermal and acoustical liner is not sized on plans to include the proper thickness of insulation. Add 1 inch or 2 inches in height and width of ductwork to accommodate insulation thickness. Mount duct specialties such as turning vanes, damper, etc., to ductwork with the section insulated "Build Outs" to maintain continuity of thermal barrier.
- Q. Construct ductwork system to conform to SMACNA Manual 23d H C Air Duct Leakage Test Manual.
- R. Where dimensions, sizes, and arrangements of elements of duct assembly and support systems are not provided herein, the Contractor shall select such to be suitable for the service. All methods and devices shall be subject to the review and approval from Engineer.
- S. Make ductwork transitions with sides sloped not to exceed a maximum of 20 degrees, 40 degrees included angle for diverging air flow and 30 degrees, 60 degrees included angle for converging air flow. Factory fabricated reduced fittings of ASME short flow nozzle design will be acceptable for round ductwork.
- T. Provide turning vanes in all elbows over 20 degrees unless otherwise noted.
- U. The Contractor shall follow the applications recommendations of the manufacturer of all hardware and accessory items and make selections of such consistent with the duct classification and services.
- V. Elbows for round ductwork shall be die formed though 8-inch diameter and 5 sections elbow 9 inches and above in diameter. Adjustable elbows are not allowed.
- W. Ducts shall be sealed in accordance with Table 1-2 of SMACNA Manual 1 5d. The allowable air leakage shall be in compliance with SMACNA standards for each respective duct pressure class and duct seal class.

### 3.2 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Seal ducts at a minimum to the following seal classes in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
  - 1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - 2. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
  - 3. Conditioned Space, Return-Air Ducts: Seal Class C.



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### **3.3 HANGER AND SUPPORT INSTALLATION**

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
  - 1. Where practical, install concrete inserts before placing concrete.
  - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
  - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
  - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
  - 5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at maximum intervals of 16 feet.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

### **3.4 CONNECTIONS**

- A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

### **3.5 PAINTING**

- A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

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3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Leakage Tests:
  - 1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
- C. Duct System Cleanliness Tests:
  - 1. Visually inspect duct system to ensure that no visible contaminants are present.

3.7 DUCT CLEANING

- A. Clean new duct system(s) before testing, adjusting, and balancing.
- B. Clean the following components by removing surface contaminants and deposits:
  - 1. Air outlets and inlets (registers, grilles, and diffusers).
  - 2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
  - 3. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
  - 4. Supply-air ducts, dampers, actuators, and turning vanes.

3.8 STARTUP

- A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.9 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:
  - 1. Fabricate all ducts to achieve SMACNA pressure class, seal class, and leakage class as indicated below.
  - 2. All duct pressure classes shall be same as the external static pressure (ESP) of the equipment supplying the duct. The equipment ESP shall be the pressure class for the entire supply duct system.
- B. Liner (Refer to section 230713 for external insulation):
  - 1. Supply-Air Rectangular Ducts: Fibrous glass, Type I, 1/2-inch thick. (ONLY WHERE TO MATCH EXISTING INSTALLATION)
  - 2. Return-Air Rectangular Ducts Fibrous glass, Type I, 1/2-inch thick. (ONLY WHERE TO MATCH EXISTING INSTALLATION)

C. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
  - a. Velocity 1000 fpm or Lower:
    - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
    - 2) Mitered Type RE 4 with single width vanes.
2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
  - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
  - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
  - c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
  - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
    - 1) Velocity 1000 fpm or Lower: 1.5 radius-to-diameter ratio, die formed through 8" and three segments for 90-degree elbow.
  - b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.

D. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
  - a. Rectangular Main to Rectangular Branch: 45-degree entry.
  - b. Rectangular Main to Round Branch: Bellmouth tap or high efficiency, rectangular to round. Conical spin in is not allowed.
2. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
  - a. Velocity 1000 fpm: Conical tap.

END OF SECTION 23 3113

SECTION 23 3300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Backdraft and pressure relief dampers.
2. Manual volume dampers.
3. Control dampers.
4. Flange connectors.
5. Turning vanes.
6. Duct-mounted access doors.
7. Flexible connectors.
8. Duct accessory hardware.

B. Related Requirements:

1. Section 233346 "Flexible Ducts" for insulated and non-insulated flexible ducts.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with NFPA 90A and NFPA 90B.
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

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### 2.2 SHEET METAL SPECIALTIES

- A. Turning Vanes: Aero-Dyne or equal 26-gauge HEP high efficiency profile air foil vanes mounted 2.125 inches OC on 24-gauge runners. Equals by DuctMate and Duro Dyne.
- B. Control Dampers (Round – Velocities 4000 FPM and less): Provide Ruskin Model CDRS25 dampers suitable for use in temperatures from minus 50 deg F to 200 deg F. Damper shall be butterfly type consisting of circular blade mounted to axle. Frames shall be 20-gauge steel for dampers up to 24-inch diameter. Damper blades shall be two (2) layers, 14-gauge galvanized steel, and include a full-circumference neoprene seal. Leakage through damper in closed position shall not exceed 0.15 cfm per inch of blade circumference at a pressure differential of 4.0" W.G. Axle shall be 0.5-inch diameter plated steel with sleeve bearing pressed into frame.
- C. Control Dampers (Rectangular – Velocities 1000 FPM and less): Provide Ruskin Model CD36 standard dampers suitable for use in temperatures from minus -25 deg F to 180 deg F. Frames shall be 5-inch by 1-inch x 16-gauge galvanized steel hat channel. Blades shall be roll formed, triple-V-groove 16-gauge galvanized steel, maximum of 6-inch wide. Axles shall be 0.5-inch plated steel hex. Bearings shall be molded synthetic and linkage concealed in frame. Maximum single section size shall be 48 inches wide and 72 inches high. Provide extended shaft with bracket and locking hand quadrant. When applications require more than one (1) damper section to fill opening, sections shall be interconnected by appropriate jack shafting. Blade edge seals shall be extruded dual durometer vinyl. Jamb seals shall be flexible metal, compression type. Leakage through damper in closed position shall not exceed 10 cfm per square foot of damper area at a pressure differential of 4.0" W.G.
- D. Manual Volume Dampers (Round – Velocities 1000 FPM and less): Provide Ruskin Model MDRS25 dampers suitable for use in temperatures from minus 50 deg F to 250 deg F. Damper shall be butterfly type consisting of circular blade mounted to axle. Frames shall be 20-gauge steel. Damper blades shall be 20-gauge galvanized steel. Leakage through damper in closed position shall not exceed ratings published by Ruskin. Axle shall be 0.5-inch diameter plated steel with sleeve bearing pressed into frame. All parts not protected shall be given one coat of aluminum paint. Provide 2" extended stand-off bracket and locking hand quadrant.
- E. Manual Volume Dampers (Rectangular – Velocities 1000 FPM and less): Provide Ruskin Model MD-35 standard dampers suitable for use in temperatures from minus 0 deg F to 240 deg F. Frames shall be 3-inch wide x 22-gauge or 5-inch by 1-inch x 18-gauge galvanized steel channel. Single blades shall be 22-gauge. Multiple blades shall be roll formed, triple-V-groove 18-gauge galvanized steel, maximum of 8-inch wide. Axles shall be 0.5-inch plated steel hex. Bearings shall be molded synthetic and linkage concealed in frame. Maximum single section size shall be 48 inches wide and 48 inches high. Provide 2" extended stand-off bracket and locking hand quadrant. When applications require more than one (1) damper section to fill opening, sections shall be interconnected by appropriate jack shafting.
- F. Dampers shall be Carnes, CESCO, Greenheck, Nailor, Prefco, Titus, United McGill, Louvers & Dampers Co., Pottorff or equal.
- G. Round take-off fittings without dampers from medium, high, and low-pressure rectangular ductwork shall be made with Buckley BMD or equal bell mouth fittings. HET (High Efficiency

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Takeoffs), Buckley Model 3300 or equal will be allowed, where rectangular duct depth noted on drawings is not 4 inches or greater than the round branch duct size. Round take-off fittings with dampers from medium, high, and low-pressure rectangular ductwork shall be made with Buckley HD-BMD or equal bell mouth fittings. HET (High Efficiency Takeoffs), Buckley Model 3300-D-HD or equal will be allowed, where rectangular duct depth noted on drawings is not 4 inches or greater than the round branch duct size. All dampers shall be provided with extended stand-off bracket, locking handle, square damper bar, and a minimum of two U-bolts. Equivalent by Barrington, SEMCO, McGill and SMC.

### 2.3 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.

### 2.4 MATERIALS

- A. Galvanized Sheet Steel: Comply with ASTM A653/A653M.
  - 1. Galvanized Coating Designation: G90.
  - 2. Exposed-Surface Finish: Mill phosphatized.
- B. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- C. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install duct accessories in accordance with applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116 for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless steel accessories in stainless steel ducts, and aluminum accessories in aluminum ducts.
- C. Unless noted otherwise, install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

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- D. Where multiple damper sections are necessary to achieve required dimensions, provide reinforcement to fully support damper assembly when fully closed at full system design static pressure.
- E. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
  - 1. Install steel volume dampers in steel ducts.
- F. Set dampers to fully open position before testing, adjusting, and balancing.
- G. Install test holes at fan inlets and outlets and elsewhere as indicated and as needed for testing and balancing.
- H. Install flexible connectors to connect ducts to equipment.
- I. Install duct test holes where required for testing and balancing purposes.
- J. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

### 3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
  - 1. Operate dampers to verify full range of movement.
  - 2. Inspect locations of access doors and verify that size and location of access doors are adequate to perform required operation.
  - 3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and that proper heat-response device is installed.
  - 4. Inspect turning vanes for proper and secure installation and verify that vanes do not move or rattle.
  - 5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 23 3300

SECTION 23 3346 - FLEXIBLE DUCTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Insulated flexible ducts.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For flexible ducts.
  - 1. Include plans showing locations and mounting and attachment details.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- C. Comply with the Air Diffusion Council's "ADC Flexible Air Duct Test Code FD 72-R1."
- D. Comply with ASTM E96/E96M, "Test Methods for Water Vapor Transmission of Materials."

2.2 INSULATED FLEXIBLE DUCTS

- A. Equivalent by Flex Master, McGill, ATCO, Johns Manville, Hart & Cooley, and Ward Industrial.
- B. Low-pressure, flexible duct for connection to diffusers shall be Flex Master Type 1M flexible duct in accordance with NFPA, BOA, NFPA 90B, and UL 181, Class I Air Duct. Duct shall be factory insulated with flexible fiberglass insulation with a minimum R-value of 4.2 at a mean temperature of 75 deg F. The insulation shall be covered with a reinforced aluminum metalized vapor barrier jacket having a permeance of not greater than 0.05 perms when



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tested in accordance with ASTM E 96, Procedure A. Flexible duct shall be rated for a velocity of at least 4000 feet per minute and suitable for operating temperatures of at least 250 deg F. Internal working pressure rating shall be at least 10 inches W.C. positive and 5 inches W.C. negative. Maximum flexible duct length of run shall be 5 feet unless shown otherwise. Connections shall be either stainless steel bands or nylon straps. Provide vertical flexible ductwork elbows at diffusers with external support: Thermaflex Flexflow Elbow or approved equivalent. Contractor shall submit acoustic performance factors for flexible duct. Performance factors shall be equivalent to the flexible duct specified.

### 2.3 FLEXIBLE DUCT CONNECTORS

- A. Clamps: Nylon strap in sizes 3 through 12 inches in accessible locations. Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inch in accessible and concealed locations.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install flexible ducts according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install in indoor applications only. Flexible ductwork should not be exposed to UV lighting.
- C. Connect terminal units to supply ducts directly or with maximum 3-inch lengths of flexible duct. Do not use flexible ducts to change directions.
- D. Connect diffusers or light troffer boots to ducts directly or with maximum 60-inch lengths of flexible duct clamped or strapped in place.
- E. Install duct test holes where required for testing and balancing purposes.
- F. Installation:
  - 1. Install ducts fully extended.
  - 2. Do not bend ducts across sharp corners.
  - 3. Bends of flexible ducting shall not exceed a minimum of one duct diameter.
  - 4. Avoid contact with metal fixtures, water lines, pipes, or conduits.
  - 5. Install flexible ducts in a direct line, without sags, twists, or turns.
- G. Supporting Flexible Ducts:
  - 1. Suspend flexible ducts with bands 1-1/2 inches wide or wider and spaced a maximum of 48 inches apart. Maximum centerline sag between supports shall not exceed 1/2 inch per 12 inches.

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2. Install extra supports at bends placed approximately one duct diameter from center line of the bend.
3. Ducts may rest on ceiling joists or truss supports. Spacing between supports shall not exceed the maximum spacing per manufacturer's written installation instructions.
4. Vertically installed ducts shall be stabilized by support straps at a maximum of 72 inches o.c.
5. Changes in direction (angle down to diffuser connection) shall be supported with a Flexflow support adapter or equal.

END OF SECTION 23 3346

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SECTION 23 3713 – GRILLES, REGISTERS, AND DIFFUSERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ceiling diffusers.
2. Adjustable bar registers.
3. Fixed face registers and grilles.

B. Related Sections:

1. Specification Section "Louvers and Vents" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
2. Division 23 Section "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static pressure drop, and noise ratings.

B. Samples: For each exposed product and for each color and texture specified.

PART 2 - PRODUCTS

2.1 CEILING DIFFUSERS

A. Ceiling Diffuser:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Anemostat Products; a Mestek company.
  - b. Carnes.
  - c. Hart & Cooley Inc.
  - d. METALAIRE, Inc.
  - e. Nailor Industries Inc.
  - f. Price Industries.
  - g. Titus.
  - h. Tuttle & Bailey.
  - i. Thermal Core.
2. Devices shall be specifically designed for variable-air-volume flows.
3. Material: Steel or Aluminum, as specified.
4. Finish: Baked enamel, white or as specified as color selected by Architect.
5. Face Size: As specified.
6. Mounting: Duct connection.
7. Pattern: Fully adjustable.

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8. Dampers: Radial opposed blade where scheduled.
9. Diffusers shall have uniform face appearance for all square diffusers.
10. Accessories:
  - a. Equalizing grid.
  - b. Plaster ring.
  - c. Safety chain.
  - d. Wire guard.
  - e. Sectorizing baffles.
  - f. Operating rod extension.

### 2.2 REGISTERS AND GRILLES

#### A. Adjustable Bar Register:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Anemostat Products; a Mestek company.
  - b. Carnes.
  - c. Hart & Cooley Inc.
  - d. Krueger.
  - e. METALAIRE, Inc.
  - f. Nailor Industries Inc.
  - g. Price Industries.
  - h. Titus.
  - i. Tuttle & Bailey.
2. Material: Steel.
3. Finish: Baked enamel, color selected by Architect.
4. Face Blade Arrangement: Horizontal spaced 0.75-inch.
5. Core Construction: Integral.
6. Rear-Blade Arrangement: Vertical 0.75-inch.
7. Frame: 1 inch wide.
8. Mounting Frame: Filter.
9. Mounting: Countersunk screw.
10. Damper Type: Adjustable opposed.
11. Accessories:
  - a. Rear-blade gang operator.
  - b. Filter.

#### B. Fixed Face Register and grille:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Anemostat Products; a Mestek company.
  - b. Carnes.
  - c. Hart & Cooley Inc.
  - d. Krueger.
  - e. Nailor Industries Inc.

- f. Price Industries.
  - g. Titus.
  - h. Tuttle & Bailey.
- 2. Material: Steel.
  - 3. Finish: Baked enamel, color selected by Architect.
  - 4. Face Arrangement: 0.5-inch by 0.5-inch by 0.5-inch grid core.
  - 5. Core Construction: Integral.
  - 6. Frame: 1 inch wide.
  - 7. Mounting Frame: Filter.
  - 8. Mounting: Countersunk screw.
  - 9. Damper Type: Adjustable opposed blade.
  - 10. Accessory: As noted.

### 2.3 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

### 3.2 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 23 3713

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SECTION 26 0000 - GENERAL ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Common electrical installation requirements.

1.2 SPECIFICATION FORM AND DEFINITIONS

- A. These Specifications are abbreviated form and contain incomplete sentences. Omissions of words or phrases such as “the Contractor shall,” “shall be,” “as noted on the drawings,” “according to the drawings,” “a,” “an,” “the,” and “all” are intentional. Omitted words and phrases shall be supplied by inference.
- B. When a word such as “proper,” “satisfactory,” “equivalent,” and “as directed” is used, it requires Engineer’s review.
- C. “Provide” means furnish and install.
- D. “Working Day” wherever used in these Specifications, shall mean the normal working days Monday through Friday, exclusive of Saturday, Sunday, and federally observed holidays.
- E. Architect/Engineer hereinafter abbreviated A/E shall mean both the Design Architects and the Design Engineers.
- F. Design Engineer hereinafter abbreviated D/E shall mean the engineering firm, RTM Engineering Consultants, 3333 E. Battlefield Suite 1000 Springfield, MO65804, Telephone (417) 881-0020. Contact Person: Jennifer Luce.
- G. General Contractor hereinafter abbreviated G/C shall mean the person or company and their subcontractors who enter into contract with the Owner to perform the general division work.
- H. Electrical Contractor hereinafter abbreviated E/C shall mean the person or company and their subcontractors who enter into contract with the G/C to perform the division 26 work.
- I. Mechanical Contractor hereinafter abbreviated M/C shall mean the person or company and their subcontractors who enter into contract with the G/C to perform the division 23 work.
- J. Equipment and/or materials manufacturer hereinafter abbreviated E/M shall mean the manufacturer of equipment or materials specified or referred to.

1.3 GENERAL EXTENT OF WORK



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- A. Provide electrical systems indicated on drawings, specified or reasonably implied. Provide every device and accessory for proper operation and completion of mechanical systems. In no case will claims for “Extra Work” be allowed for work about which E/C could have informed himself before bids were taken.
- B. E/C shall familiarize himself with existing conditions and equipment provided by other contractors and owner, which require electrical connections and controls.
- C. Make required electrical connections to equipment provided under Architectural and mechanical divisions of this project, except where shown or specified otherwise. Make required internal field wiring modifications indicated on wiring diagrams of factory installed control system for control sequence specified. These field modifications shall be limited to jumper connections and connection of internal wiring to alternate terminal block lugs. Cost for field modifications requiring re-wiring of factory installed control systems for equipment provided by G/C or M/C shall be included in base bid of each respective contractor.
- D. E/C shall check electrical data and wiring diagrams received from owner for compliance with project voltages, wiring, controls, and protective devices on electrical drawings. Promptly bring discrepancies found to attention of A/E for a decision.
- E. Provide safety disconnect switches, contactors, etc for all electrical equipment requiring such devices, whether specifically scheduled or shown on the drawings or not – no adds shall be paid for this equipment required for proper operation of the equipment after the bid. Coordinate with the owner and omit these devices only where they are included as part of the equipment, unless scheduled otherwise on the drawings, and only where approved by the A/E. Where approval has not been obtained from the A/E prior, include all costs for this equipment in the base bid. With exception of factory installed devices, provide safety disconnect switches, contactors, and motor starters by one manufacturer to allow maximum interchangeability of repair parts and accessories for these devices.
- F. Coordinate closely with equipment electrical connection requirements. Disconnecting means as indicated on the drawings is shown schematically. E/C shall verify mounting location and equipment connection points with all other contractors and connect all equipment per the supplied equipment manufacturer’s requirements. E/C shall verify mounting location of all disconnecting means with the E/M and install per those requirements and so as not to impact equipment performance, access, operation and/or warranty. Disconnecting means shall be installed in an accessible location with working clearances as required by the National Electric Code. Provide structural supports securely attached to the building structure separate from mechanical equipment and/or supports for mounting of disconnecting means as required and include costs for all such supports and associated equipment in the base bid. Maintain all conduit and conductor feeds to equipment concealed inside the building or below grade and stub up at the equipment inside the curb or at equipment supports. Unistrut shall not be allowed for any roof penetrations.
- G. Refer to the construction documents for owner-supplied, contractor installed materials, equipment or fixtures. Contractor shall be prepared to receive materials and equipment arriving on the project site and shall be responsible for storing, removing from packaging and assembling on site prior to installation. Coordinate delivery times and all requirements with

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the owner through the general contractor. Contractor shall provide any and all necessary additional materials, supports, bracing, mounting brackets, back-boxes, etc. as required for installation of owner-supplied, contractor-installed materials, equipment or fixtures.

### 1.4 LOCAL CONDITIONS

- A. Visit site and determine existing local conditions affecting work in contract.
- B. Failure to determine site conditions or nature of existing or new construction will not be considered a basis for granting additional compensation.

### 1.5 CODES, ORDINANCES, RULES AND REGULATIONS

- A. Provide work in accordance with applicable codes, rules, ordinances, and regulations of Local, State, and Federal Governments and other authorities having lawful jurisdiction.
- B. Drawings and specifications indicate minimum construction standards, but should any work indicated be sub-standard to any ordinances, laws, codes, rules, or regulations bearing on work, E/C shall promptly notify A/E in writing before proceeding with work so that necessary changes can be made. However, if E/C proceeds with work knowing it to be contrary to any ordinances, laws, rules, and regulations, he shall thereby have assumed full responsibility for and shall bear all costs required to correct non-complying work.
- C. Conform to latest editions and supplements of the following codes, standards, or recommended practices.
  - 1. CITY CODES:
    - a. 2021 International Building Codes
    - b. 2021 International Fire Code
    - c. 2021 International Energy Code
    - d. 2021 International Existing Building Code
  - 2. SAFETY CODES:
    - a. National Electric Safety Code Handbook H30 – National Bureau of Standards.
    - b. Occupational Safety and Health Standards – Department of Labor.
    - c. Specifications for Making Buildings and Facilities Accessible To, and Usable By, the Physically Handicapped – American Standards Institute ANSI A117.1.
  - 3. NATIONAL FIRE CODES:
    - a. NFPA No. 70 – National Electric Code – 2020 Edition.
    - b. NFPA No. 101 – Life Safety Code – 2012 Edition.
  - 4. UNDERWRITERS LABORATORIES, INC.:
    - a. UL 508 – Standards for Industrial Control Equipment.
    - b. UL 1008 – Standard for Automatic Transfer Switches.
    - c. All materials, equipment and component parts of equipment shall bear UL labels whenever such devices are listed by UL.

### 1.6 CONTRACT CHANGE

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- A. Changes or deviations from contract; including those for extra or additional work must be submitted in writing for review of A/E. No verbal orders will be recognized.
- B. Changes in the work shall be submitted in accordance with front end sections and General Conditions of the Contract for Construction.
- C. All change proposals shall be itemized indicating separately the costs for materials, labor, restocking charges, freight, bonds, insurance, overhead, and profit. All materials shall be listed separately with quantities and individual unit prices. Labor factors shall be from a nationally recognized source with appropriate adjustments.

### 1.7 LOCATIONS AND INTERFERENCES

- A. Locations of equipment, piping, and other mechanical work are indicated diagrammatically by electrical drawings. Lay out work from dimensions on Architectural and Structural Drawings. Verify equipment size from manufacturer's shop drawings.
- B. Study and become familiar with contract drawings of other trades and in particular the general construction drawings and details to obtain necessary information for figuring installation. Cooperate with other workmen and install work to avoid interference with their work. Minor deviations not affecting design characteristics, performance, or space limitations may be permitted if reviewed by A/E prior to installation.
- C. Any conduit, apparatus, appliance, or other electrical item interfering with proper placement of other work as indicated on drawings, specified, or required shall be removed and if so shown, relocated and reconnected without extra cost. Damage to other work caused by the E/C, his subcontractor, his workmen, or by any cause whatsoever, shall be restored as specified for new work.
- D. Do not scale mechanical and electrical drawings for dimensions. Accurately lay out work from dimensions indicated on architectural drawings unless such is found in error.

### 1.8 SYSTEM PERFORMANCE

- A. Final acceptance of work shall be subject to the condition that all systems, equipment, apparatus, and appliances operate satisfactorily as designed and intended; work shall include required adjustment of systems and control equipment installed under this specification.

### 1.9 WARRANTY

- A. Unless noted otherwise in specifications, E/C warrants to Owner and Architect the quality of materials, equipment, workmanship, and operation of equipment provided under this specification division for a period of one (1) year from and after date of substantial completion of building and acceptance of systems by Owner unless otherwise required in other sections of the specification.

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- B. E/C warrants to Owner and Architect that on receipt of written notice from either of them within one (1) year warranty period following date of acceptance, all defects that have appeared in materials and/or workmanship shall be promptly corrected to condition required by contract documents at E/C's expense.
- C. The above warranty shall not supersede any separately stated warranty or other requirements by law or by these specifications.

### 1.10 MATERIALS, EQUIPMENT AND SUBSTITUTIONS

- A. The intent of these specifications is to allow ample opportunity for E/C to use his ingenuity and abilities to perform the work to his and the Owner's best advantage, and to permit maximum competition in bidding on standards of materials and equipment required.
- B. Material and equipment installed under this contract shall be first class quality, new, unused, and without damage.
- C. In general, these specifications identify required materials and equipment by naming first the manufacturer whose product was used as the basis for the project design and specifications. The manufacturer's product, series, model, catalog, and/or identification numbers shall set quality requirements for comparing the equivalency of other manufacturer's products in general. Where models are listed or scheduled with information that does not match specified manufacturer's data for size or capacity, the larger, more expensive and/or restrictive requirement between the schedule and the manufacturer's data shall be met and included. Where other manufacturer's names are listed, they are considered an approved manufacturer for the product specified; however, the listing of their names implies no prior approval of any product unless specific model or catalog numbers are listed in these specifications or in subsequent addenda. The naming of a manufacturer, or even a model number, does not alleviate the contractor from being required to provide or submit equipment which meets all of the criteria and items listed in the specifications or shown on the plans even if the specified model and/or manufacturer does not. All requirements on the drawings must be met, not just the specific model number or manufacturer. Where other than first named products are used for E/C's base bid proposal, it shall be his responsibility to determine prior to bid time that his proposed materials and equipment selections are products of approved manufacturers, which meet or exceed the specifications, fit physically in the spaces provided, are compatible with all other systems and are acceptable to the D/E.
- D. Where varying or conflicting information, notes or specifications may be shown in different locations on the drawings, schedules, or specifications, all requirements are required to be met and the worst case or more expensive and/or restrictive option should be included where duplicate information is not the same. Notify A/E for clarification.
- E. Where materials or equipment are described but not named, provide required items of first quality, adequate in every respect for intended use. Such items shall be submitted to A/E for review prior to procurement.
- F. Materials and equipment proposed for substitutions shall be equal to or superior to that specified in construction, efficiency, utility, aesthetic design, and color, as determined by A/E,

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whose decision shall be final and without further recourse. Physical size of substitute brand shall be no larger than space provided including allowances for access for installation and maintenance of installed equipment, as well as other systems shared in the same space. Requests must be accompanied by two (2) copies of complete descriptive and technical data including E/M's name, model, and catalog number, photographs or cuts, physical dimensions, operating characteristics, and any other information needed for comparison.

### 1.11 SHOP DRAWINGS, OPERATION AND MAINTENANCE INSTRUCTION

- A. Unless noted differently in the general requirements of the specifications, E/C shall furnish the following:
  - 1. Electronic PDF submittals as required by Missouri S&T.
- B. Where catalog cuts are submitted for review, conspicuously mark or provide schedule of equipment, capacities, controls, fittings, sizes, etc., that are to be provided. Mark equipment to match equipment labels provided on the drawings, schedules or specifications. Mark each submitted item with applicable section and paragraph numbers of these specifications, or plan sheet number, when item does not appear in specifications. Where equipment submitted does not appear in base specifications or specified equivalent, submittals shall be marked with applicable alternate numbers, change order numbers, or letters of authorization where said equipment was approved. Each submittal shall contain at least two (2) sets of original catalog cuts. Each catalog sheet shall bear E/M's name and address. All shop drawings on materials and equipment listed by UL shall indicate UL approval on submittal.
- C. E/C shall check all shop drawings to verify that they meet specifications and/or drawing requirements before forwarding submittals to the A/E for their review. All shop drawings submitted to A/E shall bear E/C approval stamp which shall indicate that E/C has reviewed submittals and that they meet specification and/or drawing requirements. E/C's submittal review shall specifically check for, but not be limited to, the following: equipment capacities, physical size in relation to space allowed; electrical characteristics, provisions for supply, return, and drainage connections to building systems. All shop drawings not meeting E/C's approval shall be returned to his supplier for resubmittal.
- D. A/E's review of shop drawings will not relieve E/C of responsibility for deviations from drawings and specifications unless such deviations have been specifically approved in writing by Owner or his representative, nor shall it relieve E/C of responsibility for errors in shop drawings. No work shall be fabricated until A/E's review has been obtained. Any time delay caused by correcting and resubmitting shop drawings will be E/C's responsibility.
- E. A/E shall make every effort to provide shop drawing review in a timely fashion, but in no case shall the A/E be held responsible for delays in project construction or completion without prior notification of scheduling requirements specifically for return of shop drawings at least 8 weeks in advance. In no case shall less than 10 working days after A/E receipt of shop drawings be counted on by the contractor for A/E shop drawing review without prior notification and approval.
- F. Operating and Maintenance Instructions:

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1. Submit with shop drawings of equipment: copies of installation, operating, maintenance instructions, and parts list for equipment provided. Instructions shall be prepared by E/M.
2. Keep in safe place keys and wrenches furnished with equipment under this contract. Present to Owner and obtain a receipt for same upon completion of project.
3. Contractor shall provide all final documents including drawings, shop drawings, etc., in PDF format on a single disk to Owner or as required by the owner. Videotaping, as specified in other parts of this specification, will also be required at closeout.

### **1.12 CUTTING AND PATCHING**

- A. Contractor shall do cutting and patching of building materials required for installation of work herein specified. Cut no structural members without Architect's approval and in a manner approved by him.
- B. Patching shall be by mechanics of particular trade involved and shall meet approval of Architect.
- C. Drilling and cutting of openings through building materials requires Architect's review and approval. Make openings in concrete with concrete hole saw or concrete drill. Do not use star drill or air hammer for this work. All opening shall be sized for only as required, extra large opening will not be acceptable. Close opening and provide escutcheons as needed for clean and professional installation.

### **1.13 MUTILATION**

- A. Mutilation of building finishes, caused by installation of electrical equipment, fixtures, outlets, and other electrical devices shall be repaired at E/C's expense to approval of Architect.

### **1.14 SETTING, ADJUSTMENT AND EQUIPMENT SUPPORTS:**

- A. The following are general specifications. Refer to section 260529 Hangers and Supports for Electrical Systems for additional requirements.
- B. Work shall include mounting, alignment, and adjustment of all systems and equipment. Set equipment level on adequate foundations and provide proper anchor bolts and isolation. Level, shim, and grout equipment bases as recommended by E/M. Mount motors, align and adjust drive shafts and belts according to E/M's instructions. Equipment failures resulting from improper installation or field alignment shall be repaired or replaced by E/C at no cost to Owner.
- C. Provide concrete bases for all floor and slab mounted equipment, regardless of whether specifically noted on the drawings or not.
- D. Provide each piece of equipment or apparatus suspended from ceiling or mounted above floor level with suitable structural support, platform, or carrier in accordance with best recognized

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practice and the E/M. E/C shall arrange for attachment to building structure, unless otherwise indicated on drawings or specified. Provide hangers with vibration eliminators. Contractor shall verify with structural engineer that structural members of buildings are adequate to support equipment. Submit details of hangers, platforms, mounting brackets and supports together with total weights of mounted equipment to structural engineer and A/E for review before proceeding with fabrication or installation.

- E. Supports and/or support wires for electrical equipment, raceways, light fixtures, etc. shall be designated (painting is acceptable) separately from supports and/or support wires for other building systems. All supports and/or support wires shall be designated the same throughout the project.

### 1.15 START-UP, CHANGE-OVER, TRAINING AND OPERATIONAL CHECKS

- A. E/C shall perform initial start-up of systems and equipment. Personnel qualified to start-up and service this equipment, including E/M's technicians, when specified, and Owner's operating personnel shall be present during these operations.

### 1.16 PROTECTION AND CLEANING OF SYSTEMS AND EQUIPMENT

- A. It shall be E/C's responsibility to protect and prevent damage to all electrical materials and equipment stored and/or installed under this contract. All work, materials, and equipment shall be adequately protected by any and all means necessary to prevent damage by weather, flooding, condensation, construction debris, fire, and construction equipment and vehicles.
- B. Equipment not rated for outdoor use shall be protected from moisture damage before and during construction. Covering equipment with a tarp on site is not considered a means of providing protection from moisture. Any equipment not rated for outdoor use exposed to moisture for any duration shall be replaced with new equipment at the contractor's expense.
- C. Where job conditions or work of other contractors produce the potential for damage to electrical systems and equipment, E/C shall immediately notify the G/C so that corrective action can be taken.
- D. E/C shall take extra precautions to protect electrical equipment containing solid state electronics, open relays, and contacts from damage by water, dust, dirt, construction debris, and the formation of condensate. All equipment so damaged shall be replaced by E/C with new equipment at no cost to Owner.
- E. E/C shall periodically inspect and clean all systems and equipment to ensure all systems and equipment remain in like new condition during construction, free from dust and debris. All cleaning shall be done in accordance with E/M's recommendation where available and applicable.
- F. Before request for final inspection, all systems and equipment shall be properly cleaned, vacuumed, polished, painted, etc., as required to return equipment to like new appearance.

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- G. All equipment requiring painting or touch-up shall be properly prepared and painted in accordance with this specification.

1.17 RECORD DOCUMENTS

- A. Record Drawings: Maintain a reproducible set of contract drawings and shop drawings in clean, undamaged condition, with mark-up of actual installations which vary substantially from the work as originally shown. Mark whichever drawing is most capable of showing “field” condition fully and accurately; however, where shop drawings are used for mark-up, record a cross-reference at corresponding location on working drawings. Mark with red erasable red pencil and, where feasible, use other colors to distinguish between variations in separate categories of work. Mark-up new information, which is recognized to be of importance to Owner, but was for some reason not shown on either contract drawings or shop drawings. Give particular attention to concealed work, which would be difficult to measure and record at a later date. Note related change order numbers where applicable.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION 26 0000



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SECTION 26 0519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Copper building wire rated 600 V or less.
  - 2. Metal-clad cable, Type MC, rated 600 V or less.
  - 3. Fire-alarm wire and cable.
  - 4. Low-voltage control cable
  - 5. Control-circuit conductors
  - 6. Connectors, splices, and terminations rated 600 V and less.
- B. Related Requirements:
  - 1. Section 260000 "General Electrical Requirements".

1.2 DEFINITIONS

- A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

- A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.
- B. Provide conductors by Encore Wire and Cable, Southwire, Senator Wire and Cable, and Cerro Wire or equivalent.
- C. Standards:
  - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
  - 2. RoHS compliant.
  - 3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

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- D. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors. Unless noted otherwise conductors referred to are wires and cable. Provide code grade soft annealed copper conductors with specified insulation type in proper colors to conform to color coding specified. Provide conductors No. 8 gauge and larger stranded and conductors No. 10 gauge and smaller shall be solid. Minimum conductor size is #12. All neutral conductors shall be minimum of full size.
- E. Conductor Insulation all rated for 90 deg C with thermoplastic insulation:
  - 1. Type THHN and Type THWN-2: Comply with UL 83.

### 2.2 METAL-CLAD CABLE, TYPE MC

- A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.
- B. Provide conductors by Encore Wire and Cable, Southwire, Senator Wire and Cable, and Cerro Wire or equivalent.
- C. Standards:
  - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
  - 2. Comply with UL 1569.
  - 3. RoHS compliant.
  - 4. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Circuits:
  - 1. Single circuit with color-coded conductors.
- E. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.
- F. Ground Conductor: Insulated.
- G. Conductor Insulation:
  - 1. Type TFN/THHN/THWN-2: Comply with UL 83.
  - 2. Type XHHW-2: Comply with UL 44.
- H. Armor: Steel, interlocked.
- I. Jacket: PVC applied over armor.

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### 2.3 FIRE-ALARM WIRE AND CABLE

- A. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.
- B. All fire-alarm wiring shall be installed in conduit per NEC and NFPA, where exposed and where required in other sections of the specification and drawings.
- C. Signaling Line Circuits: Twisted, shielded pair, size as recommended by system manufacturer.
- D. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation, and complying with requirements in UL 2196 for a two-hour rating.
  - 1. Low-Voltage Circuits: No. 16 AWG, minimum, in pathway.
  - 2. Line-Voltage Circuits: No. 12 AWG, minimum, in pathway.

### 2.4 LOW-VOLTAGE CONTROL CABLE

- A. Plenum-Rated, Paired Cable: NFPA 70, Type CMP. All shall be plenum rated unless noted otherwise.
  - 1. Multi-pair, twisted, No. 18 AWG, stranded (19x30) tinned-copper conductors.
  - 2. PVC insulation.
  - 3. Unshielded.
  - 4. PVC jacket.
  - 5. Flame Resistance: Comply with NFPA 262.

### 2.5 CONTROL-CIRCUIT CONDUCTORS

- A. Class 1 Control Circuits: Stranded copper, Type THHN/THWN-2, complying with UL 83 in raceway.
- B. Class 2 Control Circuits: Stranded copper, Type THHN/THWN-2, complying with UL 83 in raceway.
- C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type THHN/THWN-2, complying with UL 83 in raceway.
- D. Class 2 Control Circuits and Class 3 Remote-Control and Signal Circuits That Supply Critical Circuits: Circuit Integrity (CI) cable.

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2.6 Smoke control signaling and control circuits.

### 2.7 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- B. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.
- C. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.
  - 1. Material: Copper.
  - 2. Type: One hole with standard barrels.
  - 3. Termination: Compression or set screw.

## PART 3 - EXECUTION

### 3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Branch Circuits:
  - 1. Copper, Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Power-Limited Fire Alarm and Control: Solid for No. 12 AWG and smaller.

### 3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Lighting and Receptacle Circuits: Type THHN, 600 volt, 90 deg C (194 deg F) thermoplastic insulated building conductor.
- B. Power Circuits and Feeders: Type THHN, 600 volt, 90 deg C (194 deg F) thermoplastic insulated building conductor.
- C. Low Voltage and Line Voltage Conductors Sizes No. 16 and No. 18 AWG: Type TFFN, 600 volt, 90 deg C (194 deg F) thermoplastic insulated building conductor.
- D. Aluminum conductors will not be allowed.

### 3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

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- B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.
- F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."
- G. Run conductors in conduit continuous between outlets and junction boxes with no splices or taps pulled into conduits.
- H. Neatly route, tie, and support conductors terminating at switchboards, motor control centers, panelboards, sound equipment, etc., with Thomas & Betts Ty-Rap cable ties and clamps or equivalent by Electrovert or Panduit.
- I. Make circuit conductor splices with Buchanan B- Cap nylon insulated connectors or equivalent by Ideal or 3M.
- J. Make fixture and device taps with Scotchlock self-stripping electrical tap connectors.
- K. Terminate solid conductors at equipment terminal strips and other similar terminal points with insulated solderless terminal connectors. Terminate all stranded conductor terminal points with insulated solderless terminal connectors. Provide Thomas & Betts Sa-Kon insulated terminals and connectors or equivalent by API/AMP Blackburn, Buchanan, or Scotchlock.
- L. Where a total of six (6) or more control and feeder conductors terminate in a multiple device panel or enclosure that has no built-in terminal blocks, provide mounting channel and see-through covers. Equivalent terminal blocks by General Electric, Square D, or approved equal.
- M. Wrap conductor taps and connections requiring additional insulation with a minimum of three (3) overlapped layers of 3M Scotch vinyl plastic electrical tape No. 88 or equivalent.

### 3.4 ELECTRICAL CIRCUITING

- A. In general, comply with designated circuiting as shown on the electrical drawings where possible. Where circuiting is changed in the field, the contractor shall document actual circuiting and homerun numbers, and panelboard labels shall accurately indicate field-installed circuiting.

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- B. All devices indicated as isolated ground ('IG' adjacent to receptacles or by note) shall be provided with a dedicated, separate isolated ground from the panelboard, whether specifically indicated on the plans or not.
- C. Dedicated neutral conductors shall be used for all single phase loads unless approved in writing by the project manager. All neutral conductors shall be minimum of full size.
- D. Provide continuous color coding for feeder, branch, and control circuits. Insulation or identification tape color shall be same color for like circuits throughout. Where specified insulation colors are not available in larger wire sizes, color code conductor at all accessible locations with Scotch 35 all-weather color code tape.
- E. Identify the same phase conductor with same color throughout.
- F. Minimum conductor size shall be #12.

### 3.5 CONDUIT APPLICATION

- A. All circuiting on the project shall be in steel conduit unless noted otherwise in this section, or elsewhere within these specifications or construction documents.
- B. Provide EMT conduit for the following applications:
  - 1. All branch circuits below 7' where exposed
  - 2. All homeruns
- C. MC Cable shall be allowed for the following applications only:
  - 1. 20A Branch circuits fed above grade (dry locations) inside walls and above suspended ceilings with prior approval by Missouri S&T.
  - 2. Light fixture whips
  - 3. Installation shall be per NFPA.
  - 4. Lengths shall be limited to 50'
- D. All conduit and MC cable shall be installed concealed where possible in framed walls. In areas with exposed structure for walls and/or ceilings or new devices on existing CMU/brick walls, provide EMT conduit routed tight to structural members. All turns shall be made with 90-degree bends or LB's where visible. MC cable is not allowed where exposed to view.
- E. Minimum conduit size shall be 0.75", unless noted otherwise.
- F. Provide EMT conduit where required by NEC or exposed below 7'. Exposed conduit will not be allowed below 7' AFF in areas where raceway may receive physical abuse, such as hallways, mechanical room, storage rooms, and janitor's closet unless the conduit is 2" or larger in diameter.
- G. All conduit and MC cable shall be installed concealed. In areas with exposed structure for walls and/or ceilings, provide EMT conduit routed tight to structural members and concealed in the framing. All turns shall be made with 90-degree bends. MC cable is not allowed where exposed to view.

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- H. Use no conductors smaller than No. 12 gauge unless specifically called for or approved by D/E. Size wire for 120-volt branch circuits for 3 percent maximum voltage drop. Size feeder circuits for 2 percent maximum voltage drop. Combined voltage drop of feeders and branch circuits shall not exceed 5 percent maximum.
- I. Unless noted otherwise in other specification sections or on the drawings, all low voltage wiring systems (including, but not limited to security, access control, telephone, data, television, audio/video, fire alarm, lighting control, intercom, clock system, nurse call, etc.) shall be provided with junction boxes in walls and conduit extended up to above the nearest accessible lay-in ceiling where open, plenum-rated wiring is allowed only above lay-in and/or sheetrock ceilings where wiring will be concealed from view (unless noted otherwise or shown by details on the drawings as different, minimum junction box for telephone, data and/or television outlets shall be 4"Wx4"Tx3.5"D with 1" conduit in new walls. Back-boxes and conduit for other systems shall be as required by the applicable E/M). Where there is no ceiling (exposed structure), conduits shall be provided to conceal all wiring and all conduits shall be concealed in the building construction – exposed conduits are not allowed anywhere on the project. Security, access control, telephone, data, television, audio/video, fire alarm, lighting control, intercom, clock system, nurse call, etc. wiring shall be bundled together by system and supported from the structure at regular intervals with J-hooks and additionally as required by code and the manufacturer where routed as open wiring above ceilings. Wiring shall not be routed unsupported and shall not be strapped to structural members or walls. Fire alarm wiring shall be in conduit.
- J. Temperature control wiring (including, but not limited to thermostat wiring, sensor wiring, control wiring, communication wiring, wiring between control panels and wiring to controllers or control devices) shall be installed in conduit in new walls.

### 3.6 INSTALLATION OF FIRE-ALARM WIRE AND CABLE

- A. Comply with NECA 1 and NFPA 72.
- B. Wiring Method: **Install all fire alarm wiring in conduit per NFPA, NEC, other sections of these specifications and in walls and where exposed unless noted otherwise on drawing.**
- C. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with fire-alarm system to terminal blocks. Mark each terminal according to system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- D. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.
- E. Color-Coding: Color-code fire-alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different



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colors for visible alarm-indicating devices. Paint fire-alarm system junction boxes and covers red.

### **3.7 CONNECTIONS**

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.
- D. Comply with requirements in Section 284621.11 "Addressable Fire-Alarm Systems" for connecting, terminating, and identifying wires and cables.

### **3.8 IDENTIFICATION**

- A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor and identify as spare conductor.

### **3.9 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS**

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

### **3.10 FIRESTOPPING**

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

END OF SECTION 26 0519

## SECTION 26 0526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 SUMMARY

Section includes grounding and bonding systems and equipment.

A. Related Requirements:

1. Section 260000 "General Electrical Requirements".

### PART 2 - PRODUCTS

#### 2.1 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

#### 2.2 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
  1. Solid Conductors: ASTM B3.
  2. Stranded Conductors: ASTM B8.
  3. Tinned Conductors: ASTM B33.
  4. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.

#### 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. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- C. Cable-to-Cable Connectors: Compression type, copper or copper alloy.

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- D. Cable Tray Ground Clamp: Mechanical type, zinc-plated malleable iron.
- E. Conduit Hubs: Mechanical type, terminal with threaded hub.
- F. Lay-in Lug Connector: Mechanical type, copper rated for direct burial terminal with set screw.

### PART 3 - EXECUTION

#### 3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Grounding electrode conductors shall be insulated stranded conductors. Concealed terminations and terminations to the ground electrode shall be made using exothermic welds.

#### 3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
  - 1. Feeder.
  - 2. Receptacle circuits.
  - 3. Single-phase motor and appliance branch circuits.
  - 4. Three-phase motor and appliance branch circuits.
  - 5. Flexible raceway runs.
  - 6. Armored and metal-clad cable runs.

#### 3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
  - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
  - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
- C. A separate grounding conductor will be installed. Use of the conduit or raceway is not acceptable grounding method, however all metallic raceway shall be electrical continuous and bonded to the grounding conductor.

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- D. All work shall meet or exceed requirements in the National Electrical Code.

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.

- B. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements per NEC.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

END OF SECTION 26 0526

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SECTION 26 0529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel slotted support systems.
2. Conduit and cable support devices.
3. Support for conductors in vertical conduit.
4. Structural steel for fabricated supports and restraints.
5. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
6. Fabricated metal equipment support assemblies.

B. Related Requirements:

1. Section 260000 "General Electrical Requirements".

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch- (10-mm-) diameter holes at a maximum of 8 inches (200 mm) o.c. in at least one surface.
1. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
  2. Material for Channel, Fittings, and Accessories: Steel.
  3. Channel Width: Selected for applicable load criteria.
  4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
  5. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as

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required to suit individual conductors or cables supported. Body shall be made of malleable iron.

- D. Structural Steel for Fabricated Supports and Restraints: ASTM A36/A36M steel plates, shapes, and bars; black and galvanized.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
  - 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
  - 2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
  - 3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
  - 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
  - 5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM F3125/F3125M, Grade A325 (Grade A325M).
  - 6. Toggle Bolts: Steel springhead type.
  - 7. Hanger Rods: Threaded steel.

### **PART 3 - EXECUTION**

#### **3.1 APPLICATION**

- A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:
  - 1. NECA 1.
  - 2. NECA 101
  - 3. NECA 102.
  - 4. NECA 105.
- B. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- C. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."

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- D. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.
- E. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
  - 1. Secure raceways and cables to these supports with conduit clamps.
- F. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings, and for fastening raceways to trapeze supports.

### 3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).
- C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
  - 1. To Wood: Fasten with lag screws or through bolts.
  - 2. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  - 3. To Existing Concrete: Expansion anchor fasteners.
  - 4. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
  - 5. To Light Steel: Sheet metal screws.
  - 6. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.
- D. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

### 3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.



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- B. Field Welding: Comply with AWS D1.1/D1.1M.

END OF SECTION 26 0529

SECTION 26 0533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal conduits and fittings.
2. Surface raceways.
3. Boxes, enclosures, and cabinets.

B. Related Requirements:

1. Section 260000 "General Electrical Requirements" and 260519 "Electrical Power Conductors and Cables"
2. Section 078413 "Penetration Firestopping" for firestopping at conduit and box entrances.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

A. Metal Conduit:

1. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. EMT (Electric Metallic Tubing): Comply with ANSI C80.3 and UL 797.
3. FMC (Flexible Metal Conduit): Comply with UL 1; zinc-coated steel or aluminum.
4. LFMC (Liquid-Tight Flexible Metal Conduit): Flexible steel conduit with PVC jacket and complying with UL 360.
5. All conduit and boxes for fire alarm systems shall be colored red unless exposed in finished space.

B. Metal Fittings: Comply with NEMA FB 1 and UL 514B.

1. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Fittings, General: Listed and labeled for type of conduit, location, and use.
3. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
4. Fittings for EMT:
  - a. Material: Steel or die cast.
  - b. Type: Compression.

2.2 BOXES, ENCLOSURES, AND CABINETS

- A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- C. Provide electrical service outlets, including plug receptacles, lamp receptacles, lighting fixtures, and switches with Steel City, Raco, or equivalent 4-inch code gauge steel knockout boxes galvanized or sheradized of required depth for service or device. Sectional boxes shall not be allowed.
- D. Floor Boxes:
  - 1. Refer to the drawings for specific floor box specifications and fire rating requirements. Provide all floor boxes with accessories and covers for a complete installation, compatible with the floor finish and type in which they are installed. Provide finish plates for all wiring devices indicated. Provide cast iron boxes, or boxes with epoxy coating for any boxes shown installed in slab-on-grade installations – boxes shall be UL listed for slab-on-grade installation. All floor boxes shall be UL listed for scrub water penetration. Include any required dividers as required to isolate power and communication compartments when devices are indicated side by side on plans.
  - 2. Where floor boxes are shown but not specifically noted on the drawings, provide concealed service floor boxes with tamper resistant duplex receptacles and communication and data communication brackets as indicated on drawings. Provide gangs as necessary to accommodate the devices and quantity of devices indicated on the plans. Provide all inserts as necessary for the devices indicated and for a complete installation without leaving any unused openings. Where there are spare unused spaces in floor boxes provide blanks for all unused sections.
  - 3. Plastic or PVC floor boxes are not approved.
  - 4. Boxes shall be Legrand Evolution or Hubbell System One for recessed service box with flush universal cover. Covers shall be aluminum finish unless indicated otherwise.
  - 5. Equivalent floor boxes by Wiremold, Steel City and Hubbell.
  - 6. For installation location of floor boxes, Contractor shall refer to Architectural plans for associated furniture locations and floor system type.
- E. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.
- F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

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- G. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, with gasketed cover.
- H. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- I. Device Box Dimensions: 4 inches square by 2-1/8 inches deep or as required for installation.
- J. Gangable boxes are allowed.

### PART 3 - EXECUTION

#### 3.1 RACEWAY APPLICATION

- A. Underground: Apply raceway products as specified below unless otherwise indicated:
  - 1. Underground Conduit: RNC, Type EPC-40-PVC.
  - 2. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
  - 3. Provide all with tracer wire above.
  - 4. Sch 80 conduit shall be utilized where underground conduit emerges from concrete.
- B. General application:
  - 1. All circuiting on the project shall be in steel conduit unless noted otherwise in this section, or elsewhere within these specifications or construction documents.
  - 2. Provide EMT conduit for the following applications:
    - a. All branch circuits above grade where exposed below 7'.
  - 3. Provide a separate grounding conductor for all branch circuits. Use of conduit and grounding method shall not be allowed, however conduit shall be electronically continuous and bonded to the grounding conductor.
  - 4. Non-metallic or rigid conduit (flexible ENT is not allowed for any systems) shall be allowed for the following applications (transition to steel conduit shall be made for all applications prior to conduit coming up from below grade – non-metallic conduit is not allowed above grade for any purpose):
    - a. Branch circuits fed below grade at minimum of 12" below the concrete slab.
- C. Minimum Raceway Size: 3/4-inch trade size unless noted otherwise. 1/2" conduit shall be acceptable for switch legs, lighting whips, and control wiring.
- D. All conduit and MC cable shall be installed concealed. In areas with exposed structure for walls and/or ceilings, provide EMT conduit routed tight to structural members and concealed in the framing. All turns shall be made with 90-degree bends. MC cable is not allowed where exposed.
- E. MC cable and flexible conduit is acceptable where allowed by NEC and installed in walls or above ceilings as applicable and allowed per NEC per other sections of the specifications. Reference Section 26 0519 for additional limitation.

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- F. Make conduit connections to motors and equipment mounted on resilient mounts or vibration isolators with Type U.A. liquid-tight flexible conduit manufactured by Anaconda, or “Liquatite” by Electric-Flex Company.
- G. Raceway Fittings: Compatible with raceways and suitable for use and location.
- H. A separate grounding conductor will be installed. Use of the conduit or raceway is not acceptable grounding method, however all metallic raceway shall be electrical continuous and bonded to the grounding conductor.
- I. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F (49 deg C).
- J. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- K. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- L. Do not install raceways or electrical items on any "explosion-relief" walls or rotating equipment.
- M. Do not fasten conduits onto the bottom side of a metal deck roof.
- N. 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.
- O. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- P. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- Q. Install no more than the equivalent of four 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.
- R. Make bends in raceway using large-radius preformed ells. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and size involved.
- S. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- T. Support conduit within 12 inches (300 mm) of enclosures to which attached.
- U. Raceways Embedded in Slabs are not allowed unless written approval is provided:

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1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot (3-m) intervals.
  2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
  3. Do not embed threadless fittings in concrete.
  4. Change from ENT to GRC or IMC before rising above floor.
- V. Stub-ups to Above Recessed Ceilings:
1. Use EMT, IMC, or RMC for raceways.
  2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- W. 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.
- X. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- Y. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35-mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- Z. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- AA. Unless noted otherwise in other specification sections or on the drawings, all low voltage wiring systems (including, but not limited to security, access control, telephone, data, television, audio/video, fire alarm, lighting control, intercom, clock system, nurse call, etc.) shall be provided with junction boxes in new walls and conduit extended up to above the nearest accessible lay-in ceiling where open, plenum-rated wiring is allowed only above lay-in and/or sheetrock ceilings where wiring will be concealed from view (unless noted otherwise or shown by details on the drawings as different, minimum junction box for telephone, data and/or television outlets shall be 4"Wx4"Tx3.5"D with 1" conduit. Back-boxes and conduit for other systems shall be as required by the applicable E/M).
- BB. Temperature control wiring (including, but not limited to thermostat wiring, sensor wiring, control wiring, communication wiring, wiring between control panels and wiring to controllers or control devices) shall be installed in conduit.
- CC. Surface Raceways:
1. Install surface raceway with a minimum 2-inch radius control at bend points.

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2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
  3. Raceways shall be steel and sized for required power and communication cable as noted on drawings. Provide in color to match other devices in room or to match background as directed by architect.
- DD. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces.
- EE. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
1. Install light switch or lighting control junction boxes at 48 inches above floor to the top of the box unless otherwise called for or required by Wainscot, counter, moulding, etc – coordinate with millwork contractor and G/C prior to any rough-in. All electrical light switches shall be located as close to door frame as possible. Under no circumstances should switches be located more than 12 inches from the edge of door frames.
  2. Install centerline of receptacle outlet boxes 18 inches above floor unless otherwise called for on drawings.
  3. All thermostats, temperature sensors and HVAC controls shall be installed at 48" above finish floor to the top of the thermostat or sensor, on the room side of light switches where shown in the same location. None of the controls shall be higher than 48" above finish floor to the operating or visible parts.
  4. Locate associated data, telephone and television outlets at the same height as adjacent, associated receptacles, within 6 inches of the associated receptacles, where shown side-by-side on the plans and not noted otherwise.
  5. Where wall-mounted telephone outlets are shown on the drawings in the same location as light switches, the telephone outlet shall be installed to the room side of the light switches at 48" above finish floor to the top of the telephone controls (no part of the telephone controls shall be higher than 48" above finish floor. Coordinate phone requirements with the owner prior to any rough-in). Do not locate phone outlet above the switches – locate 8" from the end of the light switches to allow clearance of the phone.
  6. Where wall-mounted volume controls, A/V controls, and/or screen switches are shown on the drawings in the same location as light switches, these controls shall be installed on the room side of light switches at 48" to the top of the box.
- FF. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- GG. Locate boxes so that cover or plate will not span different building finishes.

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- HH. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- II. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- JJ. Set metal floor boxes level and flush with finished floor surface.
- KK. Provide code gauge galvanized steel raised covers on outlet boxes installed in plaster finish. Set to plaster grounds with outside edge of cover flush with plaster finish.
- LL. Provide 0.375-inch or larger fixture stud in each outlet box scheduled to receive lighting fixture. Select covers with proper opening for device installed in outlet box.
- MM. Use of utility or “Handy” boxes acceptable only where single gang flush outlet box in masonry is “dead-end” with only one conduit entering box from end or back.
- NN. Use no sectional outlet boxes.
- OO. Install boxes to maintain all fire ratings, as required by the building code and NEC. At all boxes installed in fire walls throughout the project, provide fire-rated sealing assembly (refer to the other specification sections for additional locations – refer to the architectural specifications for specification of all fire-rated penetration sealing materials and/or assemblies). Putty pads and/or other fire-rated sealing assemblies, where provided, shall fully seal all boxes and conduit entries (including at the penetration into the top of the wall) and shall be installed per the manufacturer’s instructions (including minimum/maximum ambient temperatures at time of install and after installation). Submit fire penetration materials and information with the shop drawings to the architect. Refer to the other specification sections for additional requirements. Putty pads and/or fire-rated sealing assemblies shall have a minimum STC rating per the architectural specifications.
- PP. Locate outlet boxes generally from column centers and finished wall lines. Install ceiling outlet boxes at suspended ceiling elevations.
- QQ. Accurately locate lighting fixtures and appliance outlet boxes mounted in concrete or in plaster finish on concrete. Install outlet boxes in forms to dimensions taken from bench marks, columns, walls, or floors. Rough-in lighting fixtures and appliance outlet boxes to general locations before installation of walls and furring, and reset to exact dimensions as walls and furring are constructed. Set outlet boxes true to horizontal and vertical finish lines of building.
- RR. Install outlet boxes accessible. Provide outlet boxes above piping or ductwork with extension stems or offsets as required to clear piping and ductwork.
- SS. If a wiring device (including, but not limited to, switches, fire alarm devices, temperature controls, lighting controls, receptacles, television outlets, telephone/data outlets, volume controls, A/V controls, screen switches, etc.) is shown to be installed in or on a column, it shall be centered on the column unless noted otherwise.



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- TT. Contractor shall be responsible for coordination of all box locations with millwork, wall treatments (mats, chair rails, paneling, special systems, etc.), finishes and architectural elements to maintain full accessibility per NEC and to facilitate installation and operation of all systems. Where conflicts occur with other building components, notify A/E of conflict and get approval to modify box location or rotation prior to any rough-in. It shall be the contractor's responsibility to relocate any boxes, conduits, wiring, etc. installed prior to coordination with any other building system.

END OF SECTION 26 0533

SECTION 26 0553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Section 260000 "General Electrical Requirements".
- B. 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. Color and legend requirements for raceways, conductors, and warning labels and signs.
  - 2. Labels.
  - 3. Bands and tubes.
  - 4. Tapes and stencils.
  - 5. Tags.
  - 6. Signs.
  - 7. Cable ties.
  - 8. Paint for identification.
  - 9. Fasteners for labels and signs.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.
- C. Delegated-Design Submittal: For arc-flash hazard study.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with ASME A13.1 and IEEE C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

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- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Comply with NFPA 70E and Section 260573.19 "Arc-Flash Hazard Analysis" requirements for arc-flash warning labels.
- F. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.
- G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
  - 1. Temperature Change: 120 deg F ambient; 180 deg F, material surfaces.

### 2.2 COLOR AND LEGEND REQUIREMENTS

- A. Raceways and Cables Carrying Circuits at 600 V or Less:
  - 1. Black letters on an orange field.
  - 2. Legend: Indicate voltage and system or service type.
- B. Color-Coding for Phase-and Voltage-Level Identification, 600 V or Less: Use colors to match existing in the building.
  - 1. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.
- C. Warning Label Colors:
  - 1. Identify system voltage with white letters on a red background.
- D. Warning labels and signs shall include, but are not limited to, the following legends:
  - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
  - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."
  - 3. Arc Flash Warning: Nominal system voltage, available fault current, service overcurrent protective device clearing time, and the label date must be included in the arc-flash warning label per requirements of NEC 110.16.
- E. Equipment Identification Labels:
  - 1. Black letters on a white field.

## 2.3 LABELS

- A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.
  - 1. Equivalent to Brady or approved equal.
- B. Snap-around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameter and that stay in place by gripping action.
  - 1. Equivalent to Brady or approved equal.
- C. Self-Adhesive Wraparound Labels: Preprinted or written, 3-mil thick vinyl flexible label with acrylic pressure-sensitive adhesive.
  - 1. Equivalent to Brady or approved equal.
  - 2. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
  - 3. Marker for Labels: Permanent, waterproof, black ink marker recommended by tag manufacturer.
  - 4. Marker for Labels: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.
- D. Self-Adhesive Labels: Vinyl, thermal, transfer-printed, 3-mil thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.
  - 1. Equivalent to Brady or approved equal.
  - 2. Minimum Nominal Size:
    - a. 1-1/2 by 6 inches for raceway and conductors.
    - b. 3-1/2 by 5 inches for equipment.
    - c. As required by authorities having jurisdiction.

## 2.4 BANDS AND TUBES

- A. Snap-around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameters sized to suit diameter and that stay in place by gripping action.
- B. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameters of and shrunk to fit firmly around item being identified. Full shrink recovery occurs at a maximum of 200 deg F. Comply with UL 224.

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### 2.5 TAPES AND STENCILS

- A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mil thick by 1 to 2 inches wide; compounded for outdoor use.
- C. Tape and Stencil: 4-inch-wide black stripes on 10-inch centers placed diagonally over orange background and is 12 inches wide. Stop stripes at legends.
- D. Floor Marking Tape: 2-inchwide, 5-mil pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.
- E. Underground-Line Warning Tape:
  - 1. Tape:
    - a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
    - b. Printing on tape shall be permanent and shall not be damaged by burial operations.
    - c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.
  - 2. Color and Printing:
    - a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
    - b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE"
    - c. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE".
  - 3. Tag: Standard
    - a. Pigmented polyolefin, bright colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
    - b. Width: 3 inches.
    - c. Thickness: 4 mils.
    - d. Weight: 18.5 lb/1000 sq. ft.
    - e. Tensile according to ASTM D882: 30 lbf and 2500 psi.
  - 4. Tag: Detectable
    - a. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core; bright colored, compounded for direct-burial service.

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- b. Width: 3 inches.
- c. Overall Thickness: 5 mils.
- d. Foil Core Thickness: 0.35 mil.
- e. Weight: 28 lb/1000 sq. ft..
- f. Tensile according to ASTM D882: 70 lbf and 4600 psi.

- F. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

## 2.6 TAGS

### A. Write-on Tags:

- 1. Polyester Tags: 0.010 inch thick, with corrosion-resistant grommet and cable tie for attachment.
- 2. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
- 3. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

## 2.7 SIGNS

### A. Baked-Enamel Signs:

- 1. Preprinted aluminum signs punched or drilled for fasteners, with colors, legend, and size required for application.
- 2. 1/4-inch grommets in corners for mounting.
- 3. Nominal Size: 7 by 10 inches.

### B. Laminated Acrylic or Melamine Plastic Signs:

- 1. Engraved legend.
- 2. Thickness (3 layer):
  - a. For signs up to 20 sq. in., minimum 1/16 inch thick.
  - b. For signs larger than 20 sq. in., 1/8 inch thick.
  - c. Engraved legend with black letters on white face. Warning labels shall be white letters on red face.
  - d. Self-adhesive.
  - e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.
  - f. Lettering shall be ¼" for grouped equipment and loads and 1/8" for individual equipment and loads.

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### 2.8 CABLE TIES

- A. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
  - 1. Minimum Width: 3/16 inch.
  - 2. Tensile Strength at 73 Deg F according to ASTM D638: 12,000 psi.
  - 3. Temperature Range: Minus 40 to plus 185 deg F.
  - 4. Color: Black, except where used for color-coding.
  
- B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
  - 1. Minimum Width: 3/16 inch.
  - 2. Tensile Strength at 73 Deg F according to ASTM D638: 12,000 psi.
  - 3. Temperature Range: Minus 40 to plus 185 deg F.
  - 4. Color: Black.
  
- C. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.
  - 1. Minimum Width: 3/16 inch.
  - 2. Tensile Strength at 73 Deg F according to ASTM D638: 7000 psi.
  - 3. UL 94 Flame Rating: 94V-0.
  - 4. Temperature Range: Minus 50 to plus 284 deg F.
  - 5. Color: Black.

### 2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).
  
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
  
- B. Install identifying devices before installing acoustical ceilings and similar concealment.
  
- C. Verify identity of each item before installing identification products.

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- D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.
- G. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.
- H. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.
  - 1. Secure tight to surface of conductor, cable, or raceway.
- I. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
- J. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.
- K. Vinyl Wraparound Labels:
  - 1. Secure tight to surface at a location with high visibility and accessibility.
  - 2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.
- L. Snap-around Labels: Secure tight to surface at a location with high visibility and accessibility.
- M. Self-Adhesive Wraparound Labels: Secure tight to surface of raceway or cable at a location with high visibility and accessibility.
- N. Self-Adhesive Labels:
  - 1. On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
  - 2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch high label; where two lines of text are required, use labels 2 inches high.
- O. Snap-around Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.
- P. Heat-Shrink, Preprinted Tubes: Secure tight to surface at a location with high visibility and accessibility.
- Q. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.



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- R. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.
  - 1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.
- S. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.
- T. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's written instructions.
- U. Underground Line Warning Tape:
  - 1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall.
  - 2. Limit use of underground-line warning tape to direct-buried cables.
  - 3. Install underground-line warning tape for direct-buried cables and cables in raceways.
- V. Write-on Tags:
  - 1. Place in a location with high visibility and accessibility.
  - 2. Secure using general-purpose, UV-stabilized, or plenum-rated cable ties as required.
- W. Baked-Enamel Signs:
  - 1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
  - 2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on minimum 1-1/2-inch high sign; where two lines of text are required, use signs minimum 2 inches high.
- X. Laminated Acrylic or Melamine Plastic Signs:
  - 1. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
  - 2. Unless otherwise indicated, provide a single line of text with 1/4-inch-high letters for equipment.
- Y. Cable Ties: General purpose, for attaching tags, except as listed below:
  - 1. Outdoors: UV-stabilized nylon.
  - 2. In Spaces Handling Environmental Air: Plenum rated.

### 3.2 IDENTIFICATION SCHEDULE

- A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.
- C. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than 30A and 120V to Ground: Identify with self-adhesive raceway labels or vinyl tape applied in bands.
  - 1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- D. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use] self-adhesive wraparound labels with the conductor or cable designation, origin, and destination.
- E. Control-Circuit Conductor Termination Identification: For identification at terminations, provide self-adhesive wraparound labels with the conductor designation.
- F. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.
- G. Workspace Indication: Apply floor marking tape or tape and stencil to finished surfaces. Show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- H. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.
- I. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive equipment labels.
  - 1. Apply to exterior of door, cover, or other access.
  - 2. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:
    - a. Power-transfer switches.
    - b. Controls with external control power connections.
- J. Arc Flash Warning Labeling: Self-adhesive labels.
- K. Operating Instruction Signs: Self-adhesive labels.

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- L. Equipment Identification Labels:
  - 1. Indoor Equipment: Self Adhesive, Engraved plastic label (name, voltage, source)
  - 2. Outdoor Equipment: Laminated acrylic or melamine sign 4 inches high.
  
- M. All electrical equipment shall be identified with permanent engraved plastic labels or nameplates. Engraving stock shall be melamine plastic laminate punched or drilled for mechanical fasteners 1/16-inch (1.6-mm) minimum thickness for signs up to 20 sq. in. or less than 8" long and 1/8-inch minimum thickness for larger sizes. Labels shall be engraved in black letters on white background. Fasteners for labels shall be self-tapping, stainless-steel screws, or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers. Labels may be factory installed as long as they meet these standards.
  
- N. Signs shall include the equipment designation as described below and shall indicate where the equipment is fed from.
  
- O. Contractor shall be responsible for modified typed circuit directory for any modified circuits affected by this construction contract. The index card shall include as-built information and shall be permanently attached to the panel door.
  
- P. All overcurrent protective devices in panels shall have individual engraved nameplate indicating the load the feed for distribution panel. Lighting and power panels shall have new typed circuit directory for all renovation/existing panel projects and new directories for new panels.
  
- Q. All fire alarm conduit shall be colored red. Covers for wiring boxes for fire alarm system shall be colored red and labeled "fire alarm".

END OF SECTION 26 0553

SECTION 26 0923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Indoor occupancy sensors.
  - a. The objective of this section is to ensure the proper installation of the occupancy sensor based lighting control system so that lighting is turned off automatically after reasonable time delay when a room or area is vacated by the last person to occupy said room or area.
  - b. The occupancy sensor based lighting control shall accommodate all conditions of space utilization and all irregular work hours and habits.
2. Contractor's work to include all labor, materials, tools, appliances, control hardware, sensor, wire, junction boxes and equipment necessary for and incidental to the delivery, installation and furnishing of a completely operational occupancy sensor lighting control system, as described herein.

B. Related Requirements:

1. Section 260000 "General Electrical Requirements".
2. Section 262726 "Wiring Devices" for wall-box dimmers, non-networkable wall-switch occupancy sensors, and manual light switches.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Show installation details for the following:
  - a. Occupancy sensors.
  - b. Vacancy sensors.
2. Interconnection diagrams showing field-installed wiring.
3. Include diagrams for power, signal, and control wiring.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.4 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace lighting control devices that fail(s) in materials or workmanship within specified warranty period.

1. Warranty Period: one year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 INDOOR OCCUPANCY SENSORS

A. Equivalent switches by Cooper Wiring, Hubbell, Wattstopper, Lutron or Leviton.

1. Wall switch sensors: Wall switch sensors shall be dual technology unless otherwise as indicated.
2. Ceiling mount sensors: Ceiling mount sensors shall be dual technology with dual contacts for motion detection as indicated. Sensors shall be located to minimize coverage in unwanted areas. Provide circuit control hardware to interface sensors between lighting circuits and low voltage ceiling occupancy sensor. Where (2) sensors are shown in one room sensors shall be wired so that motion detected by any sensor in that room energizes all light fixtures in the room.
3. All sensors shall be capable of operating normally with electronic ballasts, PL lamp systems and rated motor loads.
4. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction shall occur in coverage due to the cycling of air conditioner or heating fans.
5. Sensors shall be equipped with adjustable time delay and sensitivity sensors. Contractor shall adjust setting per owner requirements after installation and before occupancy.
6. In the event of failure, a bypass manual override shall be provided on each sensor. When bypass is utilized, lighting shall remain on constantly or control shall divert to a wall switch until sensor is replaced. This control shall be recessed to prevent tampering.
7. All sensors shall have UL rated, 94V-0 plastic enclosures
8. Provide wall override switch for all ceiling sensor systems whether indicated on plans or not.

2.2 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "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 260519 "Low-Voltage Electrical Power Conductors and Cables."

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- C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No.14 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Comply with NECA 1.
- B. Examine lighting control devices before installation. Reject lighting control devices that are wet, moisture damaged, or mold damaged.
- C. 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.
- D. It shall be the contractor's responsibility to locate and aim sensors in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas per the manufacturer's recommendations. Rooms shall completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room(s). The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only the rooms which are to be provided with sensors. The contractor shall provide additional sensors if required to properly and completely cover the respective room.
- E. Proper judgment must be exercised in executing the installation so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components. The contractor shall also provide, at the owner's facility, the training necessary to familiarize the owner's personnel with the operation, use, adjustment, and problem solving diagnosis of the occupancy sensing devices and systems. Locations shown on plans are schematic and shall be modified as required in field to accommodate obstructions and undesired exposures.

#### 3.2 WIRING INSTALLATION

- A. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 0.75".
- B. Wiring within Enclosures: Separate power-limited and nonpower-limited conductors in accordance with conductor manufacturer's written instructions.
- C. Size conductors in accordance with lighting control device manufacturer's written instructions unless otherwise indicated.

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- 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 in accordance with Section 260553 "Identification for Electrical Systems."

### 3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 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.
- B. Lighting control devices will be considered defective if they do not pass tests and inspections.

END OF SECTION 26 0923

## SECTION 26 2726 - WIRING DEVICES

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Specification-grade receptacles
2. USB receptacles.
3. GFCI receptacles
4. Toggle switches
5. Occupancy sensors.
6. Digital timer light switches.
7. Wall-box dimmers.
8. Wall plates.

B. Related Requirements:

1. Section 260000 "General Electrical Requirements".

#### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

#### 1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

### PART 2 - PRODUCTS

#### 2.1 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Comply with NFPA 70.



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- C. Comply with NEMA WD 1.
- D. Device Color:
  - 1. Wiring Devices Connected to Normal Power System: Match existing unless otherwise indicated or required by NFPA 70 or device listing.
  - 2. SPD Devices: Blue.
  - 3. Isolated-Ground Receptacles: Orange.
- E. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

### 2.2 SPECIFICATION-GRADE RECEPTACLES, 125 V, 20 A:

- A. Duplex Receptacles, 125 V, 20 A:
  - 1. Equivalent receptacles by Cooper Wiring, Hubbell, Bryant, Leviton, or Pass & Seymour.
  - 2. Description: Two pole, three wire, and self-grounding.
  - 3. Configuration: NEMA WD 6, Configuration 5-20R.
  - 4. Standards: Comply with UL 498 and FS W-C-596.
  - 5. Commercial Specification grade
- B. Tamper-Resistant Duplex Receptacles, 125 V, 20 A:
  - 1. Equivalent receptacles by Cooper Wiring, Hubbell, Bryant, Leviton, or Pass & Seymour.
  - 2. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle.
  - 3. Configuration: NEMA WD 6, Configuration 5-20R.
  - 4. Standards: Comply with UL 498 and FS W-C-596.
  - 5. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.
  - 6. Commercial Specification grade

### 2.3 USB RECEPTACLES

- A. USB Charging Receptacles:
  - 1. Equivalent receptacles by Cooper Wiring, Hubbell, Bryant, Leviton, or Pass & Seymour.
  - 2. Description: Single piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap.
  - 3. USB Receptacles: USB Type A, 5 V dc, and 3.6 A per receptacle (minimum).
  - 4. Standards: Comply with UL 1310 and USB 3.0 devices.
  - 5. Commercial specification grade
- B. Tamper-Resistant Duplex and USB Charging Receptacles:
  - 1. Equivalent receptacles by Cooper Wiring, Hubbell, Bryant, Leviton, or Pass & Seymour.

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2. Description: Single piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap. Integral shutters that operate only when a plug is inserted in the line voltage receptacle.
3. Line Voltage Receptacles: Two pole, three wire, and self-grounding; NEMA WD 6, Configuration 5-20R.
4. USB Receptacles: Dual USB Type A, 5 V dc, and 3.6 A per receptacle (minimum).
5. Standards: Comply with UL 498, UL 1310, USB 3.0 devices, and FS W-C-596.
6. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.
7. Commercial specification grade

### 2.4 GFCI RECEPTACLES, 125 V, 20 A

#### A. Duplex GFCI Receptacles, 125 V, 20 A:

1. Equivalent receptacles by Cooper Wiring, Hubbell, Bryant, Leviton, or Pass & Seymour.
2. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding.
3. Configuration: NEMA WD 6, Configuration 5-20R.
4. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.
5. Commercial specification grade

#### B. Tamper-Resistant Duplex GFCI Receptacles, 125 V, 20 A:

1. Equivalent receptacles by Cooper Wiring, Hubbell, Bryant, Leviton, or Pass & Seymour.
2. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle.
3. Configuration: NEMA WD 6, Configuration 5-20R.
4. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.
5. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.
6. Commercial specification grade

### 2.5 TOGGLE SWITCHES

#### A. Commercial Grade Switches, 120/277 V, 20 A:

1. Equivalent switches by Cooper Wiring, Hubbell, Bryant, Leviton, or Pass & Seymour.
2. Standards: Comply with UL 20 and FS W-S-896.
3. Provide number of poles and configuration as shown on drawings.
4. Pilot Light: Illuminated when switch is on.
5. Commercial specification grade

### 2.6 OCCUPANCY SENSORS

#### A. Wall Switch Sensor Light Switch, Dual Technology:

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- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Hubbell Lighting.
  - 2. Leviton Mfg. Company Inc.
  - 3. Lithonia Lighting; Acuity Lighting Group, Inc.
  - 4. Watt Stopper.
  
- C. Description: Switchbox-mounted, combination lighting-control sensor and conventional switch lighting-control unit using dual (ultrasonic and passive infrared) technology.
  - 1. Standards: Comply with UL 20.
  - 2. Adjustable time delay.
  - 3. Able to be locked to Automatic-On mode.
  - 4. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc.
  - 5. Connections: Provisions for connection to BAS.
  - 6. Connections: RJ-45 communications outlet.
  - 7. Connections: Integral wireless networking.
  - 8. Set for vacancy mode: manual on and automatic off

### 2.7 DIMMERS

- A. Wall-Box Dimmers:
  - 1. Description: Modular, full-wave, solid-state dimmer switch with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
  - 2. Control: Continuously adjustable slider with single-pole or three-way switching.
  - 3. Standards: Comply with UL 1472.
  - 4. Incandescent/LED Lamp Dimmers: 120 V; control shall follow square-law dimming curve. On-off switch positions shall bypass dimmer module.
    - a. 600 W minimum or as otherwise required; dimmers shall require no derating when ganged with other devices.
  - 5. LED Lamp Dimmer Switches: Modular; compatible with LED lamps; trim potentiometer to adjust low-end dimming; capable of consistent dimming with low end not greater than 10 percent of full brightness.
  - 6. Dimmers shall be Lutron Caseta style PD dimmer with on, off, and up/down dimmer button in middle of switch.

### 2.8 WALL PLATES

- A. Provide Leviton high-impact nylon wallplates conforming to UL, NEMA and Federal Specification WP-455A. Color shall be standard selection as directed by architect.
  
- B. Provide wallplates for all switches, receptacles, blanks, telephone, computer, and special purpose outlets.

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- C. Plates shall be modern design, having rounded edges and corners complete with finish-matching mounting screws.
- D. Provide flush wallplates on wiremold switch and receptacle boxes.
- E. Provide factory engraved wallplates where indicated. Where engraved text is not outlined, submit two (2) copies of proposed text to A/E for review and approval prior to engraving.
- F. Wallplates shall not support wiring devices. Provide wiring device accessories as required to properly install devices and wallplates.
- G. Provide wallplates to match existing
- H. Provide designs and finishes equivalent to above specification where wallplates for special devices are available only from manufacturer of device.
- I. Verify with A/E finish of any plate where is may be apparent a special finish or color should have been specified.
- J. Provide narrow wallplates as indicated.
- K. Ganged wiring devices shall have a single wallplate.
- L. Provide wallplates manufactured by same company as wiring devices.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. All new receptacles installed below 5.5' AFF shall be tamper resistant type.
- B. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- C. Coordination with Other Trades:
  - 1. 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.
  - 2. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
  - 3. Install wiring devices after all wall preparation, including painting, is complete.
  - 4. Reference 260533 for device location requirements.
- D. Device Installation:
  - 1. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.

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2. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.
- E. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.
  2. Install hospital-grade receptacles in patient-care areas with the ground pin or neutral blade at the top.
- F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- G. Dimmers:
1. Install dimmers within terms of their listing.
  2. 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. Install light switch or lighting control junction boxes at 48 inches above floor to the top of the box unless otherwise called for or required by Wainscot, counter, moulding, etc – coordinate with millwork contractor and G/C prior to any rough-in. All electrical light switches shall be located as close to door frame as possible. Under no circumstances should switches be located more than 12 inches from the edge of door frames.
- J. Install centerline of receptacle outlet boxes 18 inches above floor unless otherwise called for on drawings.
- K. If a wiring device (including, but not limited to, switches, fire alarm devices, temperature controls, lighting controls, receptacles, television outlets, telephone/data outlets, volume controls, A/V controls, screen switches, etc.) is shown to be installed in or on a column, it shall be centered on the column unless noted otherwise.
- L. Locate associated data, telephone and television outlets at the same height as adjacent, associated receptacles, within 6 inches of the associated receptacles, where shown side-by-side on the plans and not noted otherwise.
- M. Where wall-mounted telephone outlets are shown on the drawings in the same location as light switches, the telephone outlet shall be installed to the room side of the light switches at 48" above finish floor to the top of the telephone controls (no part of the telephone controls shall be higher than 48" above finish floor. Coordinate phone requirements with the owner prior to any rough-in). Do not locate phone outlet above the switches – locate 8" from the end of the light switches to allow clearance of the phone.

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- N. Where wall-mounted volume controls, A/V controls, and/or screen switches are shown on the drawings in the same location as light switches, these controls shall be installed on the room side of light switches at 48" to the top of the box.
- O. Contractor shall be responsible for coordination of all box locations with millwork, wall treatments (mats, chair rails, paneling, special systems, etc.), finishes and architectural elements to maintain full accessibility per NEC and to facilitate installation and operation of all systems. Where conflicts occur with other building components, notify A/E of conflict and get approval to modify box location or rotation prior to any rough-in. It shall be the contractor's responsibility to relocate any boxes, conduits, wiring, etc. installed prior to coordination with any other building system. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

### 3.2 FIELD QUALITY CONTROL

- A. Tests for Receptacles:
  - 1. Line Voltage: Acceptable range is 105 to 132 V.
  - 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
  - 3. Ground Impedance: Values of up to 2 ohms are acceptable.
  - 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
  - 5. Using the test plug, verify that the device and its outlet box are securely mounted.
- B. Wiring device will be considered defective if it does not pass tests and inspections.

END OF SECTION 26 2726

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SECTION 26 5119 - LED INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes the following types of LED luminaires:
  - 1. Interior LED luminaires.
- B. Related Requirements:
  - 1. Section 260000 "General Electrical Requirements".
  - 2. Section 260923 "Lighting Control Devices" for automatic control of lighting, occupancy sensors, and multipole lighting relays and contactors.
  - 3. Luminaire Schedule on Drawings.

1.2 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. LED: Light-emitting diode.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting unit, including driver, reflector, and housing.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
  - 1. Arrange in order of luminaire designation.
  - 2. Include data on features, accessories, and finishes.
  - 3. Include physical description and dimensions of luminaires.
  - 4. Include emergency lighting units, including batteries and chargers.
  - 5. Include life, output (lumens, CCT, and CRI), and energy-efficiency data.
  - 6. Photometric data and adjustment factors based on laboratory tests, complying with IES "Lighting Measurements Testing and Calculation Guides" for each luminaire type.
    - a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.



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- b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
    - B. Shop Drawings: For nonstandard or custom luminaires.
      - 1. Include mounting and attachment details.
      - 2. Include details of luminaire assemblies. Indicate dimensions, power loads, required clearances, components, and location and size of each field connection.
    - C. Product Schedule: Use designations indicated on drawings for luminaires and lamps.
- 1.4 CLOSEOUT SUBMITTALS
- A. Operation and maintenance data.
  - B. Warranty information.
- 1.5 QUALITY ASSURANCE
- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.
  - B. Provide luminaires from a single manufacturer for each luminaire type.
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.
- 1.7 WARRANTY
- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
  - B. Warranty Period: One year from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Basis-of-Design Product: The design for each lighting fixture is based on the product named in the luminaire schedule on the drawings and is restricted to that model due to maintenance needs of the facility.

### 2.2 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Recessed luminaires shall comply with NEMA LE 4.
- C. Refer to Luminaire Schedule.

### 2.3 LUMINAIRES

- A. Refer to Luminaire Schedule on drawing for requirements.
- B. Provide luminaires with integral mounting provisions.
- C. Luminaires shall have integral junction box with conduit fittings.
- D. LED fixtures shall be provided with plug-in type disconnect and have minimum 5 year warranty.
- E. Surface and suspended luminaires shall have mounting bracket.
- F. Where aircraft cable is utilized, luminaire shall be suspend using two 5/32-inch diameter aircraft cable supports. Length shall be adjust as required to achieve mounting height shown on drawing.
- G. Metal Parts:
  - 1. Free of burrs and sharp corners and edges.
  - 2. Sheet metal components shall be steel unless otherwise indicated.
  - 3. Form and support to prevent warping and sagging.
- H. Steel:
  - 1. ASTM A36/A36M for carbon structural steel.
  - 2. ASTM A568/A568M for sheet steel.
- I. Stainless Steel:

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1. Manufacturer's standard grade.
2. Manufacturer's standard type, ASTM A240/240M.

J. Galvanized Steel: ASTM A653/A653M.

K. Aluminum: ASTM B209.

### 2.4 METAL FINISHES

- A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

### 2.5 LUMINAIRE SUPPORT

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish shall match luminaire.
- C. Wires: ASTM A641/A641M, Class 3, soft temper, zinc-coated steel.
- D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
- E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.
- F. All fixtures shall have two (2), #12 gage (minimum) hangar wires connected from the fixture housing (opposite corners) to the structure above.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Supports:
1. Sized and rated for luminaire weight.
  2. Able to maintain luminaire position after cleaning and relamping.
  3. Provide support for luminaire without causing deflection of ceiling or wall.
  4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

D. Ceiling-Grid-Mounted Luminaire Supports:

1. Install ceiling support system rods or wires for each luminaire to structural steel above. Locate not more than 6 inches from luminaire corners. Provide a minimum of two (2) #12 gage (min) hanger wires from the fixture housing (opposite corners) to the structure above.
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.

E. Flush-Mounted Luminaire Support:

1. Secured to outlet box.
2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
3. Trim ring flush with finished surface.

F. Wall-Mounted Luminaire Support:

1. Attach fixture wall per manufacturer recommendations.
2. Do not attach luminaires directly to gypsum board.

G. 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. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
3. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.
4. Provide a minimum of two (2) #12 gage (min) hanger wires from the fixture housing (opposite corners) to the structure above for each 4' fixture section.

H. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and Section 260533 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

3.2 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:

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1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
  2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 26 5119

SECTION 26 5213 - EMERGENCY AND EXIT LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Emergency lighting units.
2. Exit signs.
3. Luminaire supports.

B. Related Requirements:

1. Section 260000 "General Electrical Requirements".
2. Luminaire Schedule on Drawings.

1.2 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Emergency Lighting Unit: A lighting unit with integral or remote emergency battery powered supply and the means for controlling and charging the battery and unit operation.

D. Fixture: See "Luminaire" Paragraph.

E. Lumen: Measured output of lamp and luminaire, or both.

F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of emergency lighting unit, exit sign, and emergency lighting support, arranged by designation.

B. Product Schedule: Use designations indicated on drawings for luminaires and lamps.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

B. Warranty information.

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### 1.5 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.
- B. Provide luminaires from a single manufacturer for each luminaire type.

### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

### 1.7 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: One year from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Basis-of-Design Product: The design for each lighting fixture is based on the product named in the luminaire schedule on the drawings and shall be provided per owner's maintenance requirements.

### 2.2 GENERAL REQUIREMENTS FOR EMERGENCY LIGHTING

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. NRTL Compliance: Fabricate and label emergency lighting units, exit signs, and batteries to comply with UL 924.
- C. Comply with NFPA 70 and NFPA 101.
- D. Comply with NEMA LE 4 for recessed luminaires.
- E. Comply with UL 1598 for recessed luminaires.
- F. Internal Type Emergency Power Unit: Self-contained, LED, modular, battery-inverter unit, factory mounted within luminaire body.

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1. Emergency Connection: Operate lamp(s) continuously upon loss of normal power. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast/driver.
2. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
3. Test Push-Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
  - a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
  - b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
4. Battery: Sealed and maintenance-free type.
5. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.

### 2.3 EMERGENCY LIGHTING

- A. General Requirements for Emergency Lighting Units: Self-contained units.
- B. Emergency Luminaires:
  1. Emergency Luminaires: Provide luminaires as indicated on Luminaire Schedule, with the following features:
    - a. Operation at nominal voltage.
    - b. Emergency power unit.
    - c. UL 94 flame rating.
- C. Emergency Lighting Unit:
  1. Emergency Lighting Unit: Provide unit as indicated on Luminaire Schedule with the following features:
    - a. Operation at nominal voltage.
    - b. Universal junction box adaptor.
    - c. UV stable thermoplastic housing.
    - d. Emergency power unit.

### 2.4 EXIT SIGNS

- A. Internally Lighted LED Signs:
  1. Provide unit as indicated on Luminaire Schedule with the following features:



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- a. Operation at nominal voltage.
- b. Lamps for AC Operation.
- c. Self-Powered Exit Signs (Battery Type): Internal emergency power unit.

### 2.5 MATERIALS

#### A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

### 2.6 METAL FINISHES

- A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

### 2.7 LUMINAIRE SUPPORT COMPONENTS

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

### 3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  1. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.

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END OF SECTION 26 5213

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## SECTION 27 0000 – COMMUNICATION SYSTEMS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
1. Category 6 twisted pair cable.
  2. Twisted pair cable hardware, including plugs and jacks.
  3. Grounding provisions for twisted pair cable.
  4. Termination Hardware

#### 1.2 COPPER HORIZONTAL CABLING DESCRIPTION

- A. Cabling system consists of horizontal cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for horizontal-to-horizontal cross-connection.
1. TIA-568-C.1 requires that a minimum of two equipment outlets be installed for each work area.
  2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications equipment outlet.
  3. Bridged taps and splices shall not be installed in the horizontal cabling.
  4. Contractor shall replace any cabling that does not pass testing.
- B. The maximum allowable horizontal cable length is 275'. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment or in the horizontal cross-connect.
- C. Provide systems indicated on drawings, specified or reasonably implied. Provide every device and accessory for proper operation and completion of all systems. In no case will claims for "Extra Work" be allowed for work about which contractor could have informed himself before bids were taken. Contractor shall familiarize himself with equipment provided by other contractors, which require electrical connections and controls. All work shall comply with Division 26.
- D. All components and wiring shall be installed in accordance with BICSI installation guidelines and per all owner requirements.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:

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1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
2. Wiring diagrams and installation details of telecommunications equipment, to show location and layout of telecommunications equipment.

### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For installer installation supervisor, and field inspector.

### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff. All contractor work shall be performed and supervised by managers and technicians qualified and certified by the manufacturer to install and test the specified system AND shall have a minimum of 2 years' experience installing products specified.

### 1.6 COORDINATION

- A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA-568-C.1, when tested according to test procedures of this standard.
- B. Telecommunications Pathways and Spaces: Comply with TIA-569-D.
- C. Grounding: Comply with TIA-607-B.

### 2.2 GENERAL CABLE CHARACTERISTICS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with the applicable standard and NFPA 70 for the following types:
  1. Communications, Plenum Rated: Type CMP complying with UL 1685.
- B. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  1. Flame-Spread Index: **25** or less.
  2. Smoke-Developed Index: **50** or less.

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- C. RoHS compliant.

### 2.3 CATEGORY 6 TWISTED PAIR CABLE

- A. Description: Four-pair, non bonded pair cable, certified to meet transmission characteristics of Category 6 cable at frequencies up to 250MHz.
- B. Belden Cat 6 cable Catalog number 3613, Datatwist 3600, 4 pair plenum rated.
- C. Standard: Comply with NEMA WC 66/ICEA S-116-732 and TIA-568-C.2 for Category 6 cables.
- D. Conductors: 100-ohm, 23 AWG solid copper.
- E. Jacket: White or Blue thermoplastic jacket to match application.

### 2.4 TWISTED PAIR CABLE HARDWARE

- A. Description: Hardware designed to connect, splice, and terminate twisted pair copper communications cable.
- B. General Requirements for Twisted Pair Cable Hardware:
  - 1. Comply with the performance requirements of Category 6.
  - 2. Comply with TIA-568-C.2, IDC type, with modules designed for punch-down caps or tools.
  - 3. Cables shall be terminated with connecting hardware of same category or higher.
- C. Plugs and Plug Assemblies:
  - 1. Male; eight position; un-keyed, color-coded modular telecommunications connector designed for termination of a single four-pair, 100-ohm, unshielded or shielded twisted pair cable.
  - 2. Standard: Comply with TIA-568-C.2.
  - 3. Marked to indicate transmission performance.
- D. Jacks and Jack Assemblies:
  - 1. Female; eight position; modular; fixed telecommunications connector designed for termination of a single four-pair, 100-ohm, twisted pair cable.
  - 2. Designed to snap-in to a patch panel or faceplate.
  - 3. Standard: Comply with TIA-568-C.2.
  - 4. Marked to indicate transmission performance.
  - 5. Belden AX10132 or RV6MJKEUW-S1 in white, CAT6 modular jack
- E. Faceplate:
  - 1. Two, Four, or Six port, vertical single gang faceplates designed to mount to single gang wall boxes. Color shall match wiring devices.

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2. Plastic Faceplate: High-impact plastic. Coordinate color with Section 262726 "Wiring Devices."
3. Model
  - a. Belden AX102655 – 2 port white
  - b. Belden AX102249 – 4 port white
  - c. Belden AX102251 – 6-port white

F. Legend:

1. Machine printed, in the field, using adhesive-tape label.
2. Snap-in, clear-label covers and machine-printed paper inserts.

### 2.5 GROUNDING

- A. Comply with requirements in Section 26 "Grounding and Bonding" for grounding conductors and connectors for communications.
- B. Comply with TIA-607-B.

## PART 3 - EXECUTION

### 3.1 INSTALLATION OF TWISTED-PAIR HORIZONTAL CABLES

- A. Comply with NECA 1 and NECA/BICSI 568.
- B. Wiring Method: Install cables in raceways and cable trays, except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces, attics, and gypsum board partitions where unenclosed wiring method may be used by use of j-hooks. Conceal raceway and cables, except in unfinished spaces.
  1. Install plenum cable in environmental air spaces, including plenum ceilings.
- C. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools. Install conductors parallel with or at right angles to sides and back of enclosure.
- D. General Requirements for Cabling:
  1. Comply with TIA-568-C.1.
  2. Comply with BICSI's Information Transport Systems Installation Methods Manual, Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section.
  3. Install 110-style IDC termination hardware unless otherwise indicated.
  4. Do not untwist twisted pair cables more than 1/2 inch from the point of termination to maintain cable geometry.

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5. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
6. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
7. Install lacing bars to restrain cables, prevent straining connections, and prevent bending cables to smaller radii than minimums recommended by manufacturer.
8. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI Information Transport Systems Installation Methods Manual, Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section. Use lacing bars and distribution spools.
9. 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.
10. In the communications equipment room, install a 10-foot long service loop on each end of cable. Provide 12" of slack at the outlet.
11. Cables must not lie on or be suspended from suspended ceiling wires or frames.
12. Cables must exhibit some sag in hanging between supports. Hanging supports such as j-hooks shall be provided as needed and shall be located within 5' of each other.
13. All cables shall be supported by cable tray or contractor supplied j-hooks. Wiring installed through structural elements will NOT be approved without written owner or A/E approval prior to installation.
14. Pulling Cable: Comply with BICSI Information Transport Systems Installation Methods Manual, Ch. 5, "Copper Structured Cabling Systems," "Pulling and Installing Cable" Section. Monitor cable pull tensions.

E. Group connecting hardware for cables into separate logical fields.

F. Separation from EMI Sources:

1. Comply with recommendations from BICSI's "Telecommunications Distribution Methods Manual" and TIA-569-D for separating unshielded copper communication cable from potential EMI sources, including electrical power lines and equipment.

### 3.2 FIRESTOPPING

- A. Comply with requirements in Section 078413 "Penetration Firestopping."
- B. Comply with TIA-569-D, Annex A, "Firestopping."
- C. Comply with "Firestopping Systems" Article in BICSI's "Telecommunications Distribution Methods Manual."



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### 3.3 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA-606-B. Comply with requirements for identification specified in Section 270553 "Identification for Communications Systems."
- B. Paint and label colors for equipment identification shall comply with university standards.
- C. Cable and Wire Identification:
  - 1. Label each cable within 5-10 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
  - 2. Label each terminal strip, and screw terminal in each cabinet, rack, or panel.
    - a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group, extended from a panel or cabinet to a building-mounted device, with the name and number of a particular device.
    - b. Label each unit and field within distribution racks and frames.
  - 3. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and -connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
- D. Labels shall be preprinted or computer-printed type, with a printing area and font color that contrast with cable jacket color but still comply with TIA-606-B requirements.

### 3.4 FIELD QUALITY CONTROL

- A. Tests and Inspections:
  - 1. Visually inspect jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA-568-C.1.
  - 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
  - 3. Test twisted pair cabling for Length, DC continuity, NEXT, PSNEXT, attenuation, return loss, ELFEXT, PSELFEXT, and polarity between conductors with level III tester. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
  - 4. Test jack and part of the channel for Length, DC continuity, NEXT, PSNEXT, attenuation, return loss, ELFEXT and PSELFEXT using the specified hardware manufacturer's test heads and industry standard level III tester.
  - 5. A PASS indication shall be obtained for all link or channel test when tested using the appropriate level tester for all cables and jacks.
- B. Remove and replace cabling where test results indicate that they do not comply with specified requirements.

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- C. End-to-end cabling will be considered defective if it does not pass tests and inspections.

END OF SECTION 27 0000

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SECTION 284621.11 - ADDRESSABLE FIRE-ALARM SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Manual fire-alarm boxes.
2. System smoke detectors.
3. Duct smoke detectors.
4. Heat detectors.
5. Fire-alarm notification appliances.
6. Fire-alarm addressable interface devices.

B. Related Requirements:

1. Section 260000 "General Electrical Requirements".
2. Section 260519 "Low-Voltage Electrical Power Conductors and Cables" or Section 260523 "Control Voltage Electrical Power Cables" for cables and conductors for fire-alarm systems.

1.2 DEFINITIONS

A. Voltage Class: For specified circuits and equipment, voltage classes are defined as follows:

1. Control Voltage: Listed and labeled for use in remote-control, signaling, and power-limited circuits supplied by a Class 2 or Class 3 power supply having rated output not greater than 150 V and 5 A, allowing use of alternate wiring methods complying with NFPA 70, Article 725.
2. Low Voltage: Listed and labeled for use in circuits supplied by a Class 1 or other power supply having rated output not greater than 1000 V, requiring use of wiring methods complying with NFPA 70, Article 300, Part I.

1.3 ACTION SUBMITTALS

A. Approved Permit Submittal: Submittals must be approved by authorities having jurisdiction prior to submitting them to Architect.

B. Product Data: For each type of product, including furnished options and accessories.

1. Include construction details, material descriptions, dimensions, profiles, and finishes.
2. Include rated capacities, operating characteristics, and electrical characteristics.

C. Shop Drawings: For fire-alarm system.

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1. Comply with recommendations and requirements in "Documentation" section of "Fundamentals" chapter in NFPA 72.
2. Include plans and details, including details of attachments to other Work.
3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
4. Include voltage drop calculations for notification-appliance circuits.
5. Include battery-size calculations.
6. Include written statement from manufacturer that equipment and components have been tested as a system and comply with requirements in this Section and in NFPA 72.
7. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
8. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.

### 1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.
  1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following.
    - a. Comply with "Records" section of "Inspection, Testing and Maintenance" chapter in NFPA 72.
    - b. Complete wiring diagrams showing connections between devices and equipment. Each conductor must be numbered at every junction point with indication of origination and termination points.
    - c. Device addresses.
    - d. Manufacturer's required maintenance related to system warranty requirements.

### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications:
  1. Personnel must be trained and certified by manufacturer for installation of units required for this Project.
  2. Delegated design must be by personnel certified by NICET as fire-alarm **Level IV** technician. Contractor shall have NICET certified personnel on site during installation.
  3. All work shall be in compliance with applicable sections of NFPA.

1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail because of defects in materials or workmanship within specified warranty period.

1. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 EXISTING FIRE-ALARM SYSTEM

- A. Provide all work for new devices including power extender panels, equipment devices, wiring, etc for new devices wiring to the existing Notifier NFS-320 system. The main panel is located in the basement beside the main electrical switchgear.
- B. Source Limitations for Fire-Alarm System and Components: Components must be compatible with, and operate as extension of, existing system. Provide system manufacturer's certification that components provided have been tested as, and will operate as, a system.

2.2 SYSTEM SMOKE DETECTORS

- A. Photoelectric Smoke Detectors:

1. Performance Criteria:

- a. General Characteristics:

- 1) Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to FACU.
- 2) Base Mounting: Detector and associated electronic components must be mounted in twist-lock module that connects to fixed base. Provide terminals in fixed base for connection to building wiring.
- 3) Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
- 4) Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
- 5) Detector address must be accessible from FACU and must be able to identify detector's location within system and its sensitivity setting.
- 6) Operator at FACU, having designated access level, must be able to manually access the following for each detector:
  - a) Primary status.
  - b) Device type.
  - c) Present average value.
  - d) Present sensitivity selected.
  - e) Sensor range (normal, dirty, etc.).

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- 7) Detector must have functional humidity range within 10 to 90 percent relative humidity.
- 8) Color: White.
- 9) Remote Control: Unless otherwise indicated, detectors must be digital-addressable type, individually monitored at FACU for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by FACU.
- 10) Rate-of-rise temperature characteristic of combination smoke- and heat-detection units must be selectable at FACU for 15 or 20 deg F (8 or 11 deg C) per minute.
- 11) Fixed-temperature sensing characteristic of combination smoke- and heat-detection units must be independent of rate-of-rise sensing and must be settable at FACU to operate at 135 or 155 deg F (57 or 68 deg C).
- 12) Multiple levels of detection sensitivity for each sensor.
- 13) Sensitivity levels based on time of day.

### B. Ionization Smoke Detectors:

#### 1. Performance Criteria:

##### a. General Characteristics:

- 1) Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to FACU.
- 2) Base Mounting: Detector and associated electronic components must be mounted in twist-lock module that connects to fixed base. Provide terminals in fixed base for connection to building wiring.
- 3) Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
- 4) Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
- 5) Detector address must be accessible from FACU and must be able to identify detector's location within system and its sensitivity setting.
- 6) Operator at FACU, having designated access level, must be able to manually access the following for each detector:
  - a) Primary status.
  - b) Device type.
  - c) Present average value.
  - d) Present sensitivity selected.
  - e) Sensor range (normal, dirty, etc.).
- 7) Detector must have functional humidity range within 10 to 90 percent relative humidity.
- 8) Color: White.
- 9) Remote Control: Unless otherwise indicated, detectors must be digital-addressable type, individually monitored at FACU for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by FACU.

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- 10) Rate-of-rise temperature characteristic of combination smoke- and heat-detection units must be selectable at FACU for 15 or 20 deg F (8 or 11 deg C) per minute.
- 11) Fixed-temperature sensing characteristic of combination smoke- and heat-detection units must be independent of rate-of-rise sensing and must be settable at FACU to operate at 135 or 155 deg F (57 or 68 deg C).
- 12) Multiple levels of detection sensitivity for each sensor.
- 13) Sensitivity levels based on time of day.

### 2.3 DUCT SMOKE DETECTORS

A. Description: Photoelectric-type, duct-mounted smoke detector.

B. Performance Criteria:

1. General Characteristics:

- a. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to FACU.
- b. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
- c. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
- d. Detector address must be accessible from FACU and must be able to identify detector's location within system and its sensitivity setting.
- e. Operator at FACU, having designated access level, must be able to manually access the following for each detector:
  - 1) Primary status.
  - 2) Device type.
  - 3) Present average value.
  - 4) Present sensitivity selected.
  - 5) Sensor range (normal, dirty, etc.).
- f. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with supplied detector for smoke detection in HVAC system ducts.
- g. Each sensor must have multiple levels of detection sensitivity.
- h. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
- i. Relay Fan Shutdown: Fully programmable relay rated to interrupt fan motor-control circuit.

### 2.4 HEAT DETECTORS

A. Combination-Type Heat Detectors:

1. Performance Criteria:

a. General Characteristics:



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- 1) Temperature sensors must test for and communicate sensitivity range of device.
- b. Actuated by fixed temperature of 135 deg F (57 deg C) or rate of rise that exceeds 15 deg F (8 deg C) per minute unless otherwise indicated.
- c. Mounting: Twist-lock base interchangeable with smoke-detector bases.
- d. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to FACU.
- e. Detector must have functional humidity range of 10 to 90 percent relative humidity.
- f. Color: White.

### 2.5 FIRE-ALARM NOTIFICATION APPLIANCES

#### A. Fire-Alarm Audible Notification Appliances:

1. Description: Horns, bells, or other notification devices that cannot output voice messages.
2. Performance Criteria:
  - a. General Characteristics:
    - 1) Individually addressed, connected to signaling-line circuit, equipped for mounting as indicated, and with screw terminals for system connections.
    - 2) Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.
    - 3) Chimes, Low-Level Output: Vibrating type, 75 dB(A-weighted) minimum rated output.
    - 4) Chimes, High-Level Output: Vibrating type, 81 dB(A-weighted) minimum rated output.
    - 5) Sounders, High Volume 24 V(dc): Less than 6 mA of alarm current.
    - 6) Sounders, Low Volume 24 V(dc): Less than 4 mA of alarm current.
    - 7) Audible notification appliances must have functional humidity range of 10 to 95 percent relative humidity.
    - 8) ISO Temporal 3 Evacuation Tone: 90 plus or minus 4 dB(A-weighted) at 24 V.
    - 9) ISO Temporal 3 Alert Tone: 95 plus or minus 5 dB(A-weighted) at 24 V.
    - 10) AS2220 Evacuation Tone: 93 plus or minus 4 dB(A-weighted) at 24 V.
    - 11) AS2220 Alert Tone: 93 plus or minus 5 dB(A-weighted) at 24 V.
    - 12) Horns: Electric-vibrating-polarized type, 24 V(dc); with provision for housing operating mechanism behind grille. Comply with UL 464. Horns must produce sound-pressure level of 90 dB(A-weighted), measured 10 ft. (3 m) from horn, using coded signal prescribed in UL 464 test protocol.
    - 13) Combination Devices: Factory-integrated audible and visible devices in single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.

#### B. Fire-Alarm Voice/Tone Notification Appliances:

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1. Description: Notification appliances capable of outputting voice evacuation messages.
2. Performance Criteria:

- a. General Characteristics:

- 1) Speakers for Voice Notification: Locate speakers for voice notification to provide intelligibility requirements of "Notification Appliances" and "Emergency Communications Systems" chapters in NFPA 72.
- 2) High-Range Units: Rated 2 to 15 W.
- 3) Low-Range Units: Rated 1 to 2 W.
- 4) Mounting: semi-recessed.
- 5) Matching Transformers: Tap range matched to acoustical environment of speaker location.
- 6) Combination Devices: Factory-integrated audible and visible devices in single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.

- C. Fire-Alarm Visible Notification Appliances:

1. Performance Criteria:

- a. Regulatory Requirements:

- 1) NFPA 72.
- 2) UL 1971.

- b. General Characteristics:

- 1) Rated Light Output:
  - a) 15/30/75/110 cd, selectable in field.
- 2) Clear or nominal white polycarbonate lens mounted on aluminum faceplate.
- 3) Mounting: Wall mounted unless otherwise indicated.
- 4) For units with guards to prevent physical damage, light output ratings must be determined with guards in place.
- 5) Flashing must be in temporal pattern, synchronized with other units.
- 6) Strobe Leads: Factory connected to screw terminals.
- 7) Mounting Faceplate: Factory finished, red.

### 2.6 FIRE-ALARM ADDRESSABLE INTERFACE DEVICES

- A. Performance Criteria:

1. General Characteristics:

- a. Include address-setting means on module.
- b. Store internal identifying code for control panel use to identify module type.

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- c. Monitor Module: Microelectronic module providing system address for alarm-initiating devices for wired applications with normally open contacts.
- d. Integral Relay: Capable of providing direct signal to elevator controller to initiate elevator recall and to circuit-breaker shunt trip for power shutdown.
  - 1) Allow control panel to switch relay contacts on command.
  - 2) Have minimum of two normally open and two normally closed contacts available for field wiring.
- e. Control Module:
  - 1) Operate notification devices.
  - 2) Operate solenoids for use in sprinkler service.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.
  - 1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.
- B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Preinstallation Testing: Perform verification of functionality of installed components of existing system prior to starting work. Document equipment or components not functioning as designed.
- B. 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 in accordance with requirements indicated:
  - 1. Notify Owner no fewer than seven days in advance of proposed interruption of fire-alarm service.
  - 2. Do not proceed with interruption of fire-alarm service without Owner's permission.
- C. Protection of In-Place Conditions: Protect devices during construction unless devices are placed in service to protect facility during construction.

### 3.3 INSTALLATION OF EQUIPMENT

- A. Comply with NECA 305, NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."
  - 1. Devices placed in service before other trades have completed cleanup must be replaced.
  - 2. Devices installed, but not yet placed, in service must be protected from construction dust, debris, dirt, moisture, and damage in accordance with manufacturer's written storage instructions.
  
- B. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.
  - 1. Connect new equipment to existing control panel in existing part of building.
  - 2. Connect new equipment to existing monitoring equipment at supervising station.
  - 3. Expand, modify, and supplement existing equipment as necessary to extend existing functions to new points. New components must be capable of merging with existing configuration without degrading performance of either system.
  
- C. Install wall-mounted equipment, with tops of cabinets not more than 78 inch (1980 mm) above finished floor.
  
- D. Smoke- and Heat-Detector Spacing:
  - 1. Comply with "Smoke-Sensing Fire Detectors" section in "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
  - 2. Comply with "Heat-Sensing Fire Detectors" section in "Initiating Devices" chapter in NFPA 72, for heat-detector spacing.
  - 3. Smooth ceiling spacing must not exceed 30 ft. (9 m). Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas must be determined in accordance with NFPA 72.
  - 4. HVAC: Locate detectors not closer than 36 inch (910 mm) from air-supply diffuser or return-air opening.
  - 5. Lighting Fixtures: Locate detectors not closer than 12 inch (300 mm) from lighting fixture and not directly above pendant mounted or indirect lighting.
  
- E. Install cover on each smoke detector that is not placed in service during construction. Cover must remain in place except during system testing. Remove cover prior to system turnover.
  
- F. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend full width of duct. Tubes more than 36 inch (9100 mm) long must be supported at both ends.
  - 1. Do not install smoke detector in duct smoke-detector housing during construction. Install detector only during system testing and prior to system turnover.

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- G. Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location. Do not install smoke detectors in sprinklered elevator shafts.
- H. Remote Status and Alarm Indicators: Install in visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.
- I. Audible Alarm-Indicating Devices: Install not less than 6 inch (150 mm) below ceiling. Install bells and horns on flush-mounted back boxes with device-operating mechanism concealed behind grille. Install devices at same height unless otherwise indicated.
- J. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inch (150 mm) below ceiling. Install devices at same height unless otherwise indicated.
- K. Device Location-Indicating Lights: Locate in public space near device they monitor.

### 3.4 ELECTRICAL CONNECTIONS

- A. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."
- C. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.

### 3.5 CONTROL CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.
- B. Connect control wiring in accordance with Section 260523 "Control-Voltage Electrical Power Cables."

### 3.6 PATHWAYS

- A. Pathways must be installed in EMT or wiremold to match existing conditions.

### 3.7 CONNECTIONS

- A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Section 087100 "Door Hardware." Connect hardware and devices to fire-alarm system.
  - 1. Verify that hardware and devices are listed for use with installed fire-alarm system before making connections.

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- B. Make addressable connections with supervised interface device to the following devices and systems. Install interface device less than 36 inch (910 mm) from device controlled. Make addressable confirmation connection when such feedback is available at device or system being controlled.
  - 1. Alarm-initiating connection to smoke-control system (smoke management) at firefighters' smoke-control system panel.
  - 2. Alarm-initiating connection to stairwell and elevator-shaft pressurization systems.
  - 3. Smoke dampers in air ducts of designated HVAC duct systems.
  - 4. Magnetically held-open doors.
  - 5. Electronically locked doors and access gates.
  - 6. Alarm-initiating connection to elevator recall system and components.
  - 7. Supervisory connections at valve supervisory switches.
  - 8. Supervisory connections at elevator shunt-trip breaker or power module equipment

### 3.8 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 270553 "Identification for Communications Systems."

### 3.9 FIELD QUALITY CONTROL

- A. Administrant for Tests and Inspections:
  - 1. Administer and perform tests and inspections.
- B. Tests and Inspections:
  - 1. Visual Inspection: Conduct visual inspection prior to testing.
    - a. Inspection must be based on completed record Drawings and system documentation that is required by "Completion Documents, Preparation" table in "Documentation" section of "Fundamentals" chapter in NFPA 72.
    - b. Comply with "Visual Inspection Frequencies" table in "Inspection" section of "Inspection, Testing and Maintenance" chapter in NFPA 72; retain "Initial/Reacceptance" column and list only installed components.
  - 2. System Testing: Comply with "Test Methods" table in "Testing" section of "Inspection, Testing and Maintenance" chapter in NFPA 72.
- C. Reacceptance Testing: Perform reacceptance testing to verify proper operation of added or replaced devices and appliances.
- D. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

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### **3.10 CLEANING AND ADJUSTING**

- A. Cleaning: Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Clean unit internally using methods and materials recommended by manufacturer.
  
- B. Occupancy Adjustments: When requested within one-year of date of substantial completion, provide on-site assistance in adjusting sound levels and adjusting controls and sensitivities to suit actual occupied conditions.

**SECTION 313116 - TERMITE CONTROL**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Chemical soil treatment.

**1.2 REFERENCE STANDARDS**

- A. Title 7, United States Code, 136 through 136y - Federal Insecticide, Fungicide and Rodenticide Act 2019.

**1.3 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate toxicants to be used, composition by percentage, dilution schedule, intended application rate.
- C. Include the EPA Registered Label for termiticide products.
- D. Warranty: Submit warranty and ensure that forms have been completed in Owner's name.

**1.4 WARRANTY**

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Provide three year installer's warranty against damage to building caused by termites.

**PART 2 PRODUCTS**

**2.1 MANUFACTURERS**

- A. Source Limitations: Obtain termite control products from single source from single manufacturer.

**2.2 CHEMICAL SOIL TREATMENT**

- A. Toxicant Chemical: EPA Title 7, United States Code, 136 through 136y approved; synthetically color dyed to permit visual identification of treated soil.
- B. Manufacturers:
  - 1. Bayer Environmental Science Corp; \_\_\_\_: [www.backedbybayer.com/pest-management/#sle](http://www.backedbybayer.com/pest-management/#sle).
  - 2. BASF Corporation
  - 3. Ensystem, Inc.
- C. Mixes: Mix toxicant to manufacturer's instructions.
- D. Service Life of Treatment: Soil treatment termiticide that is effective for not less than three years against infestation of subterranean termites.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

- A. Verify that soil surfaces are unfrozen, sufficiently dry to absorb toxicant, and ready to receive treatment.
- B. Verify final grading is complete.

**3.2 PREPARATION**

- A. General: Prepare work areas according to the requirements of authorities having jurisdiction and according to manufacturer's written instructions before beginning application and installation of termite control treatment(s). Remove extraneous sources of wood cellulose and other edible materials, such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.
- B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.

**3.3 APPLICATION - CHEMICAL TREATMENT**

- A. Comply with requirements of U.S. EPA and applicable state and local codes.



- B. Application: Mix soil treatment termiticide solution to a uniform consistency. Distribute treatment uniformly. Apply treatment at the product's EPA-Registered Label volume and rate for maximum specified concentration of termiticide to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction.
  - C. Apply toxicant at following locations:
    - 1. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
    - 2. Foundations: Soil adjacent to and along the entire inside perimeter of foundation walls; along both sides of interior partition walls; around plumbing pipes and electric conduit penetrating the slab; around interior column footers, piers, and chimney bases; and along the entire outside perimeter, from grade to bottom of footing.
  - D. Apply extra treatment to structure penetration surfaces such as pipe or ducts, and soil penetrations such as grounding rods or posts.
  - E. Re-treat disturbed treated soil with same toxicant as original treatment.
  - F. If inspection or testing identifies the presence of termites, re-treat soil and re-test.
  - G. Post warning signs in areas of application
- 3.4 PROTECTION**
- A. Do not permit soil grading over treated work.
  - B. Protect termiticide solution dispersed in treated soils and fills from being diluted by exposure to water spillage or weather until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

**END OF SECTION 313116**

## SECTION 32 13 00 - SITE CONCRETE

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Cast-in-place concrete outside of the building for site improvements including, but not limited to, the following:
  - a. Curbing, gutters, walks and pavement.
  - b. Equipment pads, light pole bases, utility trench protection and bollard anchorage.
  - c. Retaining walls, vaults, utility structures.

#### 1.2 QUALITY ASSURANCE

A. Any work in public right-of-way or other areas subject to the jurisdiction of any body shall be performed either to the requirements of that jurisdiction or to the requirements of this Specification, whichever is more stringent.

##### B. Qualifications of Workers:

1. Provide at least one person who shall be present at all times during execution of this portion of the work.
2. This person shall be thoroughly familiar with the type of materials being installed and the best methods for their installation.
3. This person shall direct all work performed under this Section.

C. Manufacturer: manufacturer of ready-mixed concrete products complying with ASTM C94 requirements for production facilities and equipment.

##### D. Codes and Standards:

1. In addition to complying with all pertinent codes and regulations, comply with all pertinent requirements of the following American Concrete Institute Publications:
  - a. "Building Code Requirements for Reinforced Concrete" ACI 318-11.
  - b. "Recommended Practice for Cold Weather Concreting" ACI 306 R-10.
  - c. "Recommended Practice for Hot Weather Concreting" ACI 305 R-10.
2. Where provisions of pertinent codes and standards conflict with this Section, the more stringent provisions shall govern.

##### E. Testing and Inspection:

1. All testing and inspection shall be performed by an independent Geotechnical Engineering Consultant ("Geotechnical Engineer")
2. The Geotechnical Engineer is responsible for all testing, sampling and inspection.
3. The Geotechnical Engineer is responsible for approving all materials, installation and procedures.
4. The Contractor is responsible for providing these services.
5. The Contractor is responsible for all coordination and scheduling with the Geotechnical Engineer.

### 1.3 SUBMITTALS

- A. Mix Designs.
- B. Testing and inspection reports.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

#### A. Concrete:

1. Cement: ASTM C150, Type I or III.
2. Fine aggregate: ASTM C33.
3. Coarse aggregate: ASTM C33.
  - a. Crushed stone shall be used for exterior concrete, unless otherwise noted.
  - b. Maximum aggregate size is 3/4 of the minimum clear spacing (per code) between reinforcing bars or between bars and forms.
4. Water: Clean, fresh, potable.
5. Air-entraining admixture: ASTM C260.
6. Fly ash: ASTM C618.
7. Sealer/curing compound:
  - a. ASTM C309, Type I, clear.
  - b. Compatible with texture of surfaces.

#### B. Mix Design:

1. Strength: 4000 psi, 28-day, ready mixed in accordance with ASTM C94.
2. Slump: 3" +/- 1".
3. Cement Content: Each cubic yard of concrete shall contain not less than the quantity of cement stated below:

<b>ASTM C33</b>		<b>M</b> □ □ □ □ □ □	
<b>C</b> □ □ □ □ □ □	<b>A</b> □ □ □ □ □ □ □ □	<b>C</b> □ □ □ □ □ □	<b>P</b> □ □
<b>S</b> □ □ □ □	<b>N</b> □ □ □ □ □ □	<b>C</b> □ □ □ □ □ □ □ □	

#57 (1" to #4)	540 Lbs.
#67 (3/4" to #4)	560 Lbs.
#7 (1/2" to #4)	600 Lbs.

4. Fly ash shall not replace more than 20% of the cement.
5. The water content of the concrete mix shall be calculated by the ratio (by weight) of water to cement ("W/C Ratio"). The weight of water shall be the total water in the mix, including free moisture in the aggregate. The W/C ratio shall not exceed 0.38 for concrete in all portions of any structure which contains or conveys water or sewage. The W/C ratio shall not exceed 0.45 for all other concrete.
6. Air entrainment: 5-7%. Percentage of air content shall be determined in accordance with the admixture manufacturer's recommendations based on aggregate size and a moderate level of exposure. Air content may be reduced to 1-3% for smooth troweled surfaces not subject to environmental and freeze-thaw cycles.

C. Other Requirements:

1. Proportions of materials for concrete shall be established in accordance with Section 5.2 of ACI 318 (Latest edition).
2. Follow ACI 211 and ACI 301 to determine the water-cement ratios.
3. Concrete shall not exceed maximum chloride ion content for corrosion protection as defined in ACI 318 Table 4.4.1.
4. Do not use calcium chloride or admixtures containing soluble chlorides.
5. Do not use re-tempered concrete or concrete that has been contaminated by foreign materials.
6. All exterior concrete shall be air entrained.
7. Unless otherwise indicated, all reinforcing for concrete pavement shall be epoxy coated.

D. Isolation Joints: Unless specified otherwise on Drawings, use the following:

1. Cork isolation joints with sealant:
  - a. Joint material: AASHTO M213; 1/2 inch thick.
  - b. Joint sealer: AASHTO M173; polyurethane with color matching adjacent concrete
  - c. Application: Use cork isolation joint with sealant for isolation joints adjacent to buildings, structures, columns, etc.
2. Asphalt saturated cellulosic fiber:
  - a. Joint material: AASHTO M213; 1/2 inch thick.
  - b. Do not place sealant on asphalt saturated cellulosic fiber isolation joints.
  - c. Application: Use this type of isolation joint for items such as curbs and walks, which are in areas not adjacent to buildings, structures and columns, etc. Do not use in areas of colored concrete.

3. Contact Architect/Engineer if further direction is needed for proper application in specific areas.

E. Detectable Warning Surface:

1. Concrete Pavers:

- a. Size: 12" x 12" x 2" thick excluding the dome height.
- b. Pavers shall be resistant to road salts and common road pollutants.
- c. Paver unit shall be suitable for traffic loads.
- d. Truncated dome elements shall comply with current ADA requirements

2. Cast Iron Plates: Detectable Warning Surface Paver:

- a. Shall be manufactured from gray iron in accordance with AASHTO M105, Class 30A.
- b. The tops of the domes and the space between domes shall have a non-slip textured surface.
- c. The minimum thickness of the casting shall be 0.30 inches excluding the dome height.
- d. Plates shall be resistant to road salts and common road pollutants.
- e. Plates shall be suitable for traffic loads.

## 2.2 Steel Reinforcing

A. Reinforcing Bars:

1. Reinforcing bars and dowels: ASTM A615, Grade 60.
2. Reinforcing to be welded: ASTM A615, Grade 40.
3. Epoxy coated bars and dowels: ASTM A884, Grade 60.

B. Welded Wire Fabric:

1. ASTM A185 6"x6"xW1.4xW1.4, unless otherwise indicated.
2. Provide in flat sheets, not rolled form.

C. Other Embedded Items: Provide standard manufactured products as approved by the Architect/Engineer.

D. Bar Supports:

1. Conform to the requirements of the "Manual of Standard Practice", published by the Concrete Reinforcing Steel Institute.
2. Accessories shall be plastic protected Class "C" for all concrete exposed in the finished structure, except as specified below.
3. Accessories shall be Class "A", bright basic, for unexposed concrete.
4. Utilize Call "E," stainless steel bar supports, for exterior concrete to be finished by sand blasting.

5. Do not use continuous high chairs. Use individual high chairs laced with bottom cross bars plus #5 support bars. (Minimum of 2 rows of support for all reinforcing).
6. Supports must be capable of supporting construction loads without failing. Contractor to furnish additional supports at no cost to the Owner if in the Architect/Engineer estimation the supports are not adequate.

## 2.3 Formwork

### A. Form Lumber:

1. All form lumber in contact with exposed concrete shall be new or of sufficient quality to insure an unblemished texture.
2. All form lumber shall be plywood, board lumber, hardwood or other material of grade or quality to best suit each particular usage.

### B. Fiber Forms:

1. Fiber forms may be utilized to construct round columns/piers.
2. Seamless forms must be used for concrete exposed in the finished structure.
3. Standard seamed tubes are permissible for non-exposed concrete.

### C. Form Release Agent:

1. Standards:
  - a. Release agent shall be similar to Symons Manufacturing Company Magic Kote.
  - b. Grace Construction Products Formshield Chemical Release Agent.

### D. Bracing/Shoring/Studs:

1. Such supports shall be selected for economy consistent with safety requirements and the quality required in the finished work. The Contractor is responsible for the design, illustration, safety and serviceability of all formwork.

### E. Other Materials: All other materials, not specifically described, but required for proper completion of concrete formwork, shall be as selected by the Contractor subject to advance acceptance by the Architect/Engineer.

## PART 3 - EXECUTION

### 3.1 GENERAL

#### A. Job Conditions:

1. Extreme temperature conditions:

- a. When extreme hot or cold weather conditions occur, or are expected to occur, which might detrimentally affect concrete, employ handling and placing techniques to guard against such effects.
      - b. Comply with the recommendations of American Concrete Institute for hot and cold weather concreting. ACI Publications ACI 306 and ACI 305.
    2. Inclement weather: Unless adequate protection is provided, do not place exterior concrete during rain, sleet or snow.
  - B. Preparation and Verification:
    1. Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly begin.
    2. Verify all items to be embedded in concrete are in place.
    3. Verify concrete may be placed to the lines and elevations indicated on the Drawings, with all required clearances for reinforcement.
    4. Verify forms may be constructed in accordance with all pertinent codes and regulations, the referenced standards and the original design.
    5. Remove all dirt, oil, paint, loose rust and other foreign materials from the concrete reinforcement prior to placement.
    6. In the event of discrepancy, contact Architect/Engineer immediately and do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.
    7. Verify approval of mock-ups by Owner and Architect/Engineer before beginning work.
  - C. Other: Unless otherwise indicated, all exterior concrete shall be placed on a compacted aggregate fill per the following:
    1. Minimum depth equal to the concrete thickness for pavement, walks and other slabs on grade.
    2. Minimum 6" depth of fill for curbing and other support bases.
- ### 3.2 Formwork
- A. Protection:
    1. Use all necessary and appropriate means to protect formwork materials before, during and after installation.
    2. Protect the installed work and materials of all others trades.
    3. In the event of damage, immediately make all repairs and replacements necessary at no additional cost to Owner or other trades.
  - B. General:
    1. Forms shall have sufficient strength and be sufficiently tight to prevent leakage of mortar.

2. The design and engineering of the formwork shall be the responsibility of the Contractor.
3. Refer to this Section for construction joint requirements.
4. Tolerances: Construct all forms straight, true, plumb and square within the tolerances recommended by ACI 347.
5. Embedded items: Set all required steel frames, angles, grilles, bolts, reglets, inserts, pipe, conduit and other such items required to be anchored in the concrete before the concrete is placed.
6. Wetting: Keep forms sufficiently wetted to prevent joints opening up before concrete is placed, except as recommended in ACI 306 R-78, "Recommended Practice for Cold Weather Concreting."

C. Layout:

1. Form all required cast-in-place concrete to the shapes, sizes, lines and dimensions indicated on the Drawings.
2. Exercise particular care in the layout of forms to ensure the proper finish structure size and shape.
3. Make proper provision for all openings, offsets, recesses, anchorage, blocking and other features of the Work as shown or required.
4. Carefully examine the Contract Documents and consult with other trades as required to ensure proper provisions for openings, reglets, chases, and other items in the forms.

D. Bracing and Shoring:

1. Properly brace and tie the forms together so as to maintain position and shape and to ensure safety to personnel.
2. Construct all bracing, supporting members, and centering of ample size and strength to safely carry, without excessive deflection, all dead and live loads to which they may be subjected.
3. Properly space the forms apart and securely tie them together, using metal spreader ties that give positive tying and accurate spreading.
4. All shoring shall extend to adequate foundations.
5. The Contractor is responsible for both the proper design and installation of all bracing and shoring, to properly insure the safety and serviceability of the structure.

E. Plywood Forms:

1. Assembly: Nail the plywood panels directly to studs and apply in a manner to minimize the number of joints.
2. Joints: Make all panel joints tight butt joints with all edges true and square.

F. Reuse of forms:

1. Reuse of forms shall in no way delay or change the schedule for placement of concrete from the schedule obtainable if all forms were new.
2. Reuse of forms shall in no way impart less structural stability to the forms, nor less acceptable appearance to finished concrete.



G. Cleaning:

1. Before concrete is placed the forms shall be cleaned of all debris, ice, snow, frost, and standing water.
2. Remove all loose earth materials from the surfaces of earth forms.

H. Removal of Forms:

1. Forms shall be removed in such a manner to ensure complete safety of the structure.
2. Formwork for columns, walls, and other parts not supporting the weight of the concrete may be removed as soon as the concrete has hardened sufficiently to resist damage from removal operations with the following minimums:
  - a. Formwork for walls and columns shall remain in place a minimum of two (2) days during which the temperature of the air surrounding the concrete must be above 50° F.
  - b. This minimum time period represents a cumulative number of days or fractions thereof.
  - c. Such formwork for concrete placed during cold weather with surrounding air temperatures 50° F shall remain in place one day after the artificial heating and/or freeze protection is discontinued/removed.
3. Forms and false-work:
  - a. Any supporting vertical loads shall remain in place until the members have acquired sufficient strength to safely support their weight and any superimposed loads.
  - b. Such forming shall remain in place until the concrete has attained its specified 28 day strength as indicated by the test cylinders unless reshores are installed in sufficient quantities to transmit the loads to adequate foundations without over stressing the particularly cured structure.
  - c. The requirements of ACI 305 and 306 must also be met before forms may be removed.
  - d. Removal of forms and falsework is the responsibility of the Contractor, and the Contractor shall bear the full responsibility for this operation.
  - e. Concrete damaged by too early removal of forms or falsework shall be repaired or replaced as directed by the Architect/Engineer.
4. Concrete exposed by form removal during the curing period shall be cured by one of the methods specified in this Section.
5. Curing compound is not permitted in certain locations. In these cases, curing is to be by an alternate method. Refer alternate methods in this Section.
6. In no case shall the superimposed load or relatively new concrete exceed 50 pounds per square foot unless proper shoring to suitable foundations is installed as required by the Architect/Engineer.
7. Use all necessary and appropriate means to protect workman, public, the installed work and materials of other trades, and the complete safety of the structure.
8. Cut nails and similar fasteners off flush and leave all surfaces smooth and clean.

### 3.3 Reinforcement

#### A. Protection:

1. Use all necessary and appropriate means necessary to protect concrete reinforcement before, during and after installation and to protect the installed work and materials of all other trades.
2. Store in a manner to prevent excessive rusting and fouling with dirt, grease, and other bond-breaking coatings.
3. In the event of damage, immediately make all repairs and replacements necessary at no additional cost to the Owner.

#### B. Placing:

##### 1. Reinforcing bars:

- a. Positively secure reinforcing to bar supports and tie or otherwise anchor bars to prevent displacement by construction loads or by the placing of concrete.
- b. Splice bars with a minimum lap of 40 bar diameters, unless otherwise indicated.
- c. Use mechanical splicers/couplers where quantity of reinforcement restricts placement of concrete if lapped splices are utilized.
- d. Splice bars only at locations indicated on the Contract Documents and shop drawings.
- e. Both shop and field bending shall be accomplished without heating the bars.
- f. Minor placing adjustments can be made to avoid interference with other reinforcement and/or embedded devices. The final arrangement, however, is subject to review and acceptance of the Architect/Engineer.
- g. Immediately notify the Architect/Engineer if reinforcing cannot be installed as shown on drawings. No cutting of reinforcing shall occur unless the Architect/Engineer has reviewed and approved such cuts.

##### 2. Embedded devices:

- a. Set hangers, anchor bolts, inserts, and other embedded devices accurately in place.
- b. Make sure all such devices are installed so that work to be attached thereto will be properly received.
- c. Keep devices straight and true-to-line.

##### 3. Welded wire fabric:

- a. Splice by lapping each section at least two meshes wide plus one wire with the adjacent section, but not less than 8".
- b. Extend fabric into all openings, doorways, and the like, unless otherwise indicated.

C. Final Cleaning:

1. Prior to placing concrete, remove all loose mill and rust scale, oil, mud, ice, and other foreign coatings which destroy and/or reduce bond between the reinforcement and concrete.
2. Use wire brushing and/or other suitable methods to complete cleaning operations.

### 3.4 CONCRETE PLACEMENT

A. Preparation:

1. Remove all wood scraps, ice, snow, frost, standing water and debris from the area in which concrete will be placed.
2. Thoroughly wet the surface of excavations (except in freezing weather), coat forms with release agent and remove all standing water.

B. Method:

1. Convey concrete from mixer to place of final deposit by methods that will prevent separation and loss of materials.
2. For chuting, pumping and pneumatically conveying concrete, use only equipment of such size and design as to ensure a practically continuous flow of concrete at the delivery end without loss or separation of materials.
3. Deposit concrete as nearly as possible in its final position to avoid segregation due to rehandling and flowing.
4. Use screed poles or similar devices to ensure that all slabs are cast at the proper elevations and that specified tolerances are maintained.

C. Rate of Placement:

1. Place concrete at such a rate that concrete is at all times plastic and flows readily between reinforcement.
2. Once placing is started, carry it on as a continuous operation until placement of the panel or section is complete.
3. Do not pour a greater area at one time than can be properly finished. This is particularly important during hot or dry weather.

D. Consolidation:

1. Thoroughly consolidate all concrete by mechanical vibration, hand, and other suitable means during placement, working it around all embedded fixtures and into corners of forms.
2. Do not over-consolidate with when using mechanical vibration as to cause separation of the aggregate.

### 3.5 JOINTS

A. Unless otherwise shown on Drawings, joints shall meet the following minimum requirements. If questions or concerns exist, contact Architect/Engineer for direction.

B. Isolation Joints:

1. General:

- a. Tool concrete on both sides of joint (1/4" radius).
- b. Install joint material to full depth of concrete.
- c. See Part 2 Products for type of joint material to be used.
- d. Install sufficient smooth doweling reinforcing to prevent differential movement in curbing, walks and pavement.
- e. Do not dowel into such items as columns and exterior building walls/foundations, unless specified on Drawings. Refer to Structural drawings also.
- f. Unless otherwise indicated, install isolation joints per the following minimum requirements.

2. Curbing:

- a. Provide each side of inlet castings.
- b. Provide at all tangent points and changes in direction.

3. Walks:

- a. For walks 6 feet in width and less, provide at intervals not exceeding 25 feet.
- b. For larger walks and plaza areas, provide at intervals not exceeding 20 feet in any direction.

4. Pavement:

- a. Provide at intervals not exceeding 20 feet in any direction.

5. Retaining walls:

- a. Provide at intervals not exceeding 40 feet per linear length of wall.

6. Other:

- a. Provide at accessible ramps, buildings, columns, bollards, castings, drains and other locations as necessary to prevent excess cracking or displacement.
- b. Contact Architect/Engineer if any areas of question or concern are encountered.

C. Control Joints:

1. General:

- a. Control joint depth shall be minimum  $\frac{1}{4}$  of the slab thickness.
  - b. Continue one half of reinforcing through joint.
  - c. Install joints by tooling or sawcutting as described below, unless otherwise indicated.
  - d. Construction joints may be used where appropriate.
- 2. Curbing: Sawcut at intervals not exceeding 10 feet.
  - 3. Walks: Tool joints at intervals not-to-exceed 6 feet in any direction.
  - 4. Pavement: Sawcut at intervals not exceeding 18x pavement thickness feet in any direction.
  - 5. Retaining walls: Provide at intervals not exceeding 20 feet per linear length of wall.
  - 6. Other:
    - a. Provide at accessible ramps, columns, bollards, castings, drains and other locations as necessary to prevent excess cracking.
    - b. Contact Architect/Engineer if any areas of question or concern are encountered.

D. Construction Joints:

- 1. Joints shall be made with properly constructed bulkheads and formed keyways.
- 2. Extend reinforcing through construction joints, unless otherwise indicated.
- 3. The Contractor shall consult with the Architect/Engineer before starting concrete work to establish a satisfactory placing schedule and to confirm joint locations.
- 4. Retaining walls: Provide at intervals not exceeding 80 feet per linear length of wall.

E. Tooled Joints and Scoring:

- 1. Make straight, clean and unragged.
- 2. Tool or score concrete on both sides of joint (1/4" radius).
- 3. Provide window pane joint finish unless otherwise indicated.

F. Bond Break: 15# per 100 square foot building paper.

### 3.6 FINISHING

- A. Unless otherwise indicated, provide a light-broom finish on all exterior slabs, walks and stairs.
- B. Provide a dry-rub finish for all exposed concrete walls, curbs or edge surfaces.

### 3.7 CURING

A. Formed Surfaces:

- 1. Cure formed surfaces by either of the following methods:

- a. Leave forms in place until the cumulative number of days or fractions thereof, not necessarily consecutive, has totaled seven days during which the temperature of the air in contact with the concrete is 50°F or above.
  - b. Remove forms at an earlier time, but apply curing compound to concrete surfaces.
  - c. Apply compound in accordance with manufacturer's recommendations.
2. If curing compound is not used and the forms are stripped prior to 7 days curing, the following methods are approved:
- a. Ponding or continuous sprinkling.
  - b. Continuously wet mats.
  - c. Sand kept continuously wet.

### 3.8 PATCHING

- A. Patch existing concrete to receive new finish in a manner so that existing and patched surfaces are smooth and continuous and have a uniform appearance.

### 3.9 QUALITY ASSURANCE

A. Coordination:

1. A representative from the Geotechnical Engineer shall be present to observe and perform tests at all times site concrete work is in progress.
2. Contractor shall provide minimum 72 hour notice to Geotechnical Engineer before each operation requiring testing or inspection.

B. Inspection:

1. Immediately after forms and curing membranes have been removed, inspect all concrete surfaces and patch all pour joints, voids, rock pockets, form tie holds and other imperfections before the concrete is thoroughly dry.
2. If the defects are serious or affect the strength of the structure, or if patching does not satisfactorily restore the quality and appearance of the surface, the concrete shall be removed and replaced complete, at no additional cost to the Owner.

C. Testing: The Geotechnical Engineer shall perform the following:

1. Compression tests:

- a. Secure three standard cylinders from each pour of concrete, in accordance with ASTM C31, and cure under standard moisture and temperature conditions.
- b. Test in accordance with ASTM C39.
- c. Test one cylinder at 7 days and two cylinders at 28 days.
- d. Submit duplicate test reports of results from testing to Architect/Engineer.
- e. Take steps immediately to evaluate unsatisfactory test results.

- f. In the event of unsatisfactory test results, an investigation as outlined in Section 5.6.5 of ACI 318-99 shall be employed.
2. Slump and air entrainment:
  - a. Perform slump tests in accordance with ASTM C143.
  - b. Determine the air content of concrete in accordance with ASTM standards.
  - c. Submit results of slump tests and air content on each compression test report.
3. Should additional testing be required because of unsatisfactory test results, the Contractor is responsible for the costs incurred for correcting any deficiencies and the cost of additional testing.

END OF SECTION 32 13 00

## SECTION 329113 - SOIL PREPARATION

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Preparation of subsoil.
  - 2. Soil testing.
  - 3. Placing topsoil.

#### 1.2 COORDINATION

- A. Coordinate with installation of underground sprinkler system piping and watering heads.

### PART 2 - PRODUCTS

#### 2.1 SUSTAINABILITY CHARACTERISTICS

- A. Materials and Resources Characteristics:
  - 1. Not applicable.

#### 2.2 SOIL MATERIALS

- A. Topsoil: Fertile, agricultural soil, typical for locality, capable of sustaining vigorous plant growth, taken from drained Site; free of subsoil, clay or impurities, plants, weeds and roots; pH value of minimum 5.4 and maximum 7.0.

#### 2.3 SOURCE QUALITY CONTROL

- A. Analyze to ascertain percentage of nitrogen, phosphorus, potash, soluble salt content, organic matter content, and pH value.
- B. Provide recommendation for fertilizer and lime application rates for specified seed mix as result of testing.
- C. Testing not required when recent tests and certificates are available for imported topsoil. Submit these test results to testing laboratory. Indicate, by test results, information necessary to determine suitability.



## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify prepared soil base is ready to receive Work of this Section.

### 3.2 PREPARATION OF SUBSOIL

- A. Prepare sub-soil to eliminate uneven areas and low spots. Maintain lines, levels, profiles and contours. Make changes in grade gradual. Blend slopes into level areas.
- B. Remove foreign materials, weeds and undesirable plants and their roots. Remove contaminated sub-soil.
- C. Scarify subsoil to depth of 2 inches where topsoil is to be placed. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted sub-soil.

### 3.3 PLACING TOPSOIL

- A. Spread topsoil to minimum depth of 6 inches over area to be seeded. Rake until smooth.
- B. Place topsoil during dry weather and on dry unfrozen subgrade.
- C. Remove vegetable matter and foreign non-organic material from topsoil while spreading.
- D. Grade topsoil to eliminate rough, low or soft areas, and to ensure positive drainage.
- E. Install edging at periphery of seeded areas in straight lines to consistent depth.

END OF SECTION 329113

## SECTION 329219 - SEEDING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Fertilizing.
  - 2. Seeding.
  - 3. Hydroseeding.
  - 4. Mulching.
  - 5. Maintenance.

#### 1.2 DEFINITIONS

- A. Weeds: Vegetative species other than specified species to be established in given area.

#### 1.3 SUBMITTALS

- A. Product Data: Seed mix, fertilizer, mulch and other accessories.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Include maintenance instructions, cutting method and maximum grass height.

#### 1.5 QUALITY ASSURANCE

- A. Provide seed mixture in containers showing percentage of seed mix, germination percentage, inert matter percentage, weed percentage, year of production, net weight, date of packaging, and location of packaging.
- B. Seed Supplier: Company specializing in manufacturing products specified in this Section with three years' experience.
- C. Installer: Company specializing in performing Work of this Section with minimum 3 years' experience.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable.

- B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

#### 1.7 MAINTENANCE SERVICE

- A. Maintain seeded areas for three months from date of Substantial Completion. Areas should have greater than 85% coverage. Areas with less than 85% coverage shall be reseeded.

### PART 2 - PRODUCTS

#### 2.1 SEED MIXTURE

- A. Manufacturers:
  - 1. "Super EZIV" manufactured by Missouri Southern Seed.
- B. Substitutions: Not permitted.

#### 2.2 ACCESSORIES

- A. Mulching Material: Oat or wheat straw, free from weeds, foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are not acceptable.
- B. Fertilizer: Commercial grade; recommended for grass; of proportion necessary to eliminate deficiencies of topsoil, as indicated in.
- C. Lime: Agricultural limestone containing a minimum 80 percent calcium carbonate equivalent.
- D. Water: Clean, fresh and free of substances or matter capable of inhibiting vigorous growth of grass.

#### 2.3 SOURCE QUALITY CONTROL

- A. Analyze to ascertain percentage of nitrogen, phosphorus, potash, soluble salt content, organic matter content, and pH value.
- B. Provide recommendation for fertilizer and lime application rates for specified seed mix as result of testing.
- C. Testing is not required when recent tests and certificates are available for imported topsoil. Submit these test results to testing laboratory. Indicate, by test results, information necessary to determine suitability.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify prepared soil base is ready to receive Work of this Section.

### 3.2 FERTILIZING

- A. Apply lime at application rate recommended by soil analysis. Work lime into top inches of soil.
- B. Apply fertilizer at application rate recommended by soil analysis.
- C. Apply after smooth raking of topsoil.
- D. Do not apply fertilizer at same time or with same machine used to apply seed.
- E. Mix fertilizer thoroughly into upper 2 inches of topsoil.
- F. Lightly water soil to aid dissipation of fertilizer. Irrigate top level of soil uniformly.

### 3.3 SEEDING

- A. Apply seed at rate of 350 lbs per Ac evenly in two intersecting directions. Rake in lightly.
- B. Do not seed areas in excess of that which can be mulched on same day.
- C. Planting Season: March to September.
- D. Do not sow immediately following rain, when ground is too dry, or when winds are over 12 mph.
- E. Immediately following seeding, apply mulch to thickness of 1/8 inch. Maintain clear of shrubs and trees.
- F. Apply water with fine spray immediately after each area has been mulched. Saturate to 4 inches of soil.

### 3.4 HYDROSEEDING

- A. Apply fertilizer, mulch and seeded slurry with hydraulic seeder at rate of 2,850 lbs per Ac evenly in one pass in proportions as indicated in section 3.4.E.
- B. Mulch shall be composed of cellulose or wood fiber products with no growth or germination inhibiting substances and shall be manufactured in such a manner that when thoroughly mixed with seed, fertilizer, organic stabilizer, and water, in the proportions specified, will form homogeneous slurry which is capable of being sprayed

to form a porous mat. The fibrous mulch in its air-dry state shall contain no more than 15% by weight of water. The fiber shall have a temporary green dye and shall be accompanied by a certificate of compliance stating that the fiber conforms to these specifications.

- C. Equipment used for application of slurry shall be a commercial-type Hydro-Seeder and have a built-in agitation system with an operation capacity sufficient to agitate, suspend and homogeneously mix slurry. Tank capacity shall be a minimum of 1,500 gallons and shall be mounted on a truck to allow access to the site. Distribution Lines: Large enough to prevent stoppage and allow for even distribution of slurry over the site. Pump: Shall be able to generate 150 psi at the nozzle.
- D. *Hydroseeding Preparation*: Do all slurry preparation at the job site:
  1. Water, mulch, fertilizer, binder and other ingredients shall be added to the tank simultaneously so that the finished load is a homogenous mix of the specified ingredients.
  2. Seed shall be added last and shall be discharged within 2 hours. Loads held over 2 hours will be recharged with  the seed rate before application.
  3. Once fully loaded, the complete slurry shall be agitated for 3-5 minutes to allow for uniform mixing.
- E. HydroSeeding Application: *One Step Hydroseed*

<u>Lbs/Ac</u>	<u>Material</u>
2,000 lbs	100% Cellulose or Wood Fiber
500 lbs	Fertilizer (Fertilizer 13-13-13)
350 lbs	Seed (Super EZIV from Missouri Sothern Seed)
- F. All hydroseed applications are to be applied in a sweeping motion to form a uniform application and form a mat at the specified rates.
- G. Unused Loads: If mixture remains in tank for more than 8 hours it shall be removed from the job site at contractor's expense.
- H. After application, apply water with fine spray immediately after each area has been hydroseeded. Saturate to 4 inches of soil and maintain moisture levels 2 to 4 inches.

### 3.5 SEED PROTECTION

- A. It shall be the contractor's responsibility to protect seed. Any disturbed seed or seed that does not germinate shall be re-sown at the contractor's expense.

### 3.6 MAINTENANCE

- A. Mow grass at regular intervals to maintain at maximum height of 2-1/2 inches. Do not cut more than 1/3 of grass blade at each mowing. Perform first mowing when seedlings are 40 percent higher than desired height.
- B. Neatly trim edges and hand clip where necessary.

- C. Immediately remove clippings after mowing and trimming. Do not let clippings lay in clumps.
- D. Water to prevent grass and soil from drying out.
- E. Control growth of weeds. Apply herbicides. Remedy damage resulting from improper use of herbicides.
- F. Immediately reseed areas showing bare spots.
- G. Repair washouts or gullies.
- H. Protect seeded areas with warning signs during maintenance period.

END OF SECTION 329219

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## SECTION 331416 - SITE WATER DISTRIBUTION PIPING

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Water and fire services outside of building.

#### 1.2 ACTION SUBMITTALS

##### A. Product Data for the following:

1. Pipe, fittings and joining materials.
2. Transition fittings.
3. Valves, hydrants and tapping sleeves.
4. Other water specialties and accessories required for Work.

##### B. Shop drawings for the following, where applicable:

1. Precast vaults.
2. Draindown pits.

##### C. Water line bacterial and pressure test reports.

##### D. Operation and Maintenance Data: In addition to items specified in Division 01 Section "Closeout Procedures", include the following:

1. Valves.

#### 1.3 QUALITY ASSURANCE

##### A. Product Options: Drawings indicate size, profiles and dimensional requirements of piping and specialties and are based on the specific system indicated. Refer to Division 01 Section "Quality Requirements."

##### B. Regulatory Requirements:

1. Comply with requirements of utility company supplying the water ("Water Company").
2. Comply with requirements of local fire department ("Fire Department").
3. Comply with standards of authorities having jurisdiction for potable water services, including materials, installation, testing and disinfections.
4. Comply with standards of authorities having jurisdiction for fire suppression systems, including materials, hose threads, installation and testing.



C. Other:

1. Piping material shall bear label, stamp, or other markings of specified testing agency.
2. Comply with ASTM F 645 for selection, design, and installation of thermoplastic water piping.
3. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.
4. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.
5. NSF Compliance:
  - a. NSF 14 for plastic potable water-service piping.
  - b. NSF 61 for material for water-service piping and specialties for domestic water.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport:

1. Ensure all materials are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.
3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. Delivery:

1. Deliver piping with factory-applied end caps.
2. Maintain end caps through shipping, storage and handling to prevent pipe-end damage and to prevent entrance of dirt, debris and moisture.

C. Storage:

1. Do not remove valve or hydrant protectors unless necessary for inspection, then reinstall for storage.
2. Protect valves and hydrants from weather. Store indoors and maintain temperature higher than ambient dewpoint temperature.
3. Support valves and hydrants off the ground or pavement in watertight enclosures when outdoor storage is necessary.
4. Protect stored piping from moisture and dirt. Elevate above grade.
5. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

D. Handling:

1. Use sling to handle valves if size requires handling by crane or lift.
2. Rig valves to avoid damage to exposed parts.
3. Do not use handwheels or stems as lifting or rigging points.

## 1.5 PROJECT CONDITIONS

- A. Do not interrupt existing utility services unless approved and coordinated with Owner.
- B. Maintain 18" vertical and 10' horizontal separation between all water lines and storm and sanitary sewers.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. All products and materials must meet requirements and specifications of the Water Company and Fire Department.
- B. Unless otherwise indicated, pipe sizes refer to the nominal inside diameter.
- C. Unless otherwise indicated or required by Water Company, Fire Department or Owner, the following materials shall be used as described below.

### 2.2 PIPING MATERIALS

- A. Ductile Iron Pipe and Fittings (4" through 16"):
  - 1. Piping: AWWA C151, pressure class 350, bell and plain spigot end.
  - 2. Fittings: Ductile iron AWWA C110 standard pattern or AWWA C153 compact pattern.
  - 3. Joints: Every joint shall be restrained:
    - a. Rubber Field Lok 350 Gasket (U.S. Pipe) or approved equal.
    - b. Restrained mechanical joint (EBAA Megalug) or approved equal, with rubber gasket per AWWA C111.
    - c. Unrestrained mechanical joints are not acceptable.
    - d. Concrete thrust blocking is not acceptable.
  - 4. Interior lining: cement-mortar lining with seal coat per AWWA C104.
  - 5. Exterior coating: standard asphaltic coating per AWWA C151.
  - 6. Polyethylene encasement: AWWA C105 tube or sheet, Linear Low Density (LLD, minimum 8 mil) or High Density Cross Laminated (HDCL, minimum 4 mil) with 2" wide polyethylene tape (minimum 12 mil).
- B. PVC Pipe and Fittings (4" through 12"):
  - 1. Piping: AWWA C900, DR 18, pressure class 235 psi, bell and plain-spigot end. Piping shall be same outside diameter as ductile iron and of a blue tint.
  - 2. Fittings:
    - a. Ductile iron AWWA C110 standard pattern or AWWA C153 compact pattern.
    - b. Interior cement lining and seal coat per AWWA C104.
    - c. Exterior asphaltic coating per AWWA C151.

- d. Polyethylene encasement: AWWA C105 tube or sheet, Linear Low Density (LLD, minimum 8 mil) or High Density Cross Laminated (HDCL, minimum 4 mil) with 2" wide polyethylene tape (minimum 12 mil).
3. Joints: Every joint shall be restrained.
    - a. Restrained mechanical joint (2000PV or 1600 Series by EBAA, or approved equal) with elastomeric gasket per AWWA C111.
    - b. Unrestrained mechanical joints are not acceptable.
    - c. Concrete thrust blocking is not acceptable.
- C. HDPE Pipe and Fittings (4" through 12"):
1. Piping:
    - a. Polyethylene Pipe shall conform to ANSI/AWWA C901 and ANSI/AWWA C906
    - b. Pipe material used shall conform to the PE Standard PE 3408 high density polyethylene pipe meeting ASTM D3350, SDR9 pressure class 250 psi, bell and plain spigot end.
    - c. Piping shall be same outside diameter as ductile iron and of a blue tint or have a co-extruded blue striping for identification.
  2. Fittings:
    - a. Molded fittings shall be manufactured and tested in accordance with ASTM D3261 and ASTM D2682 and shall be so marked.
    - b. Fitting shall also be tested in accordance with AWWA C906.
    - c. Electrofusion Fittings - Fittings shall be made of HDPE material with a minimum material designation code of PE 4710 and with a minimum Cell Classification as noted in 2.01.A. Electrofusion Fittings shall have a manufacturing standard of ASTM F1055. Fittings shall have a minimum pressure rating equal to or greater than the pipe to which they are joined unless otherwise specified on the plans. For potable water systems, all electrofusion fittings shall have AWWA approval
    - d. Bolted Connections – Flanged and Mechanical Joint Adapters can be made to ASTM D 3261 or if machined, must meet the requirements of ASTM F 2206. Flanges and MJ Adapters shall be fused onto the pipe and have a minimum pressure rating equal to or greater than the pipe unless otherwise specified on the plans.
  3. Joints:
    - a. Butt fusion joints shall be PE4308 HDPE and approved for AWWA use.
    - b. Shall meet the requirements of the pipe to which they are to be fused.
    - c. Shall be manufactured in accordance with AWWA C906 with a minimum pressure class of 200 psi
  4. Fusion Unit Requirement
    - a. All Fusion Equipment, whether new or used, rented or owned, shall comply with the requirements of ISO 12176-1 "Equipment for Fusion Jointing Polyethylene Systems

D. Copper Tube and Fittings (3" and smaller):

1. Piping: ASTM B88, Type K, soft annealed piping and fittings.
2. Fittings: ASME B16.22 wrought-copper.
3. Joints: soldered, ASTM B828. Use flushable flux and lead-free solder.
4. Polyethylene encasement: AWWA C105 tube or sheet, Linear Low Density (LLD, minimum 8 mil) or High Density Cross Laminated (HDCL, minimum 4 mil) with 2" wide polyethylene tape (minimum 12 mil).

E. Transition Fittings (joining dissimilar materials):

1. Manufactured couplings or fittings compatible with piping materials, outside diameter and system working pressure.

## 2.3 VALVES

A. Gate Valves (4" and greater):

1. AWWA C509, UL 262, FM approved, ductile iron body, minimum 200 psi working pressure rating
2. Interior 6 mils fusion epoxy coating per AWWA C550, bronze stem and nut, non-rising stem.
3. End connections: restrained mechanical joint.
4. Seat: resilient molded rubber seat per ASTM D2000.
5. Application: water lines 4" and greater.

B. Gate Valves (3" and smaller):

1. Bronze, AWWA C509, MSS SP-80, Class 125 or Class 150.
2. ASTM B 62 cast-bronze body and bonnet, solid-bronze wedge, copper-silicon-alloy rising stem, and PTFE-impregnated packing with bronze packing nut.
3. If valve is accessible by hand, provide with aluminum or malleable-iron handwheel otherwise provide with connection compatible with operating wrench.
4. End connections: threaded or soldered.
5. Application: copper lines 1" – 3".

## 2.4 OTHER

A. Tapping Sleeve Assemblies:

1. Stainless steel, two-piece bolted sleeve with flanged outlet for new branch connection.
2. Comply with MSS SP-60.
3. Include sleeve and valve compatible with drilling machine.
4. Include sleeve matching size and type of pipe material being tapped and with recesses flange for branch valve.
5. Approved manufacturers:
  - a. American Cast Iron Pipe Company: Waterous Company Subsidiary.

- b. Grinnell Corporation; Mueller Company; Water Products Division.
- c. International Piping Services Company.
- d. United States Pipe and Foundry Company.

B. Valve Boxes:

- 1. AWWA M44 cast-iron.
- 2. Adjustable top section extension of length required for depth of burial of valve.
- 3. Bottom section with base of size to fit over valve.
- 4. Approximate 5" diameter barrel and plug with lettering "WATER".
- 5. Operating wrenches: steel, tee-handle with one pointed end, stem of length to operate deepest buried valve and socket matching valve operating nut.

C. Indicator Posts:

- 1. UL 789, FMG-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.
- 2. Valve: non-rising stem gate valve.
- 3. Include supervisory switches.

D. Fire Department Connections:

- 1. Fire department connections shall meet requirements and standards of the Water Company and Fire Department.
- 2. Contact Water Company and Fire Department and verify all requirements.

E. Freestanding Fire Hydrants:

- 1. Dry barrel, AWWA C502. UL listed and FM approved.
- 2. Minimum working pressure 200 psi and minimum test pressure 400 psi.
- 3. Hydrants shall meet requirements and standards of the Water Company and Fire Department.
- 4. Contact Water Company and Fire Department and verify all requirements.

F. Corporation Valves:

- 1. Service-saddle assemblies shall meet AWWA C800.
- 2. Include saddle and valve compatible with tapping machine.
- 3. Service-saddle: Copper alloy with seal and AWWA C800, threaded outlet for corporation valve.
- 4. Corporation Valve: Bronze body and ground-key plug, with AWWA C800, threaded inlet and outlet matching service piping material.

G. Curb Valves:

- 1. Comply with AWWA C800.
- 2. Include bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material.
- 3. Service boxes: Similar to AWWA M44 requirements for cast-iron valves boxes.

4. Include cast-iron telescoping top section of length required for depth of burial of valve, plug with lettering "WATER," bottom section with base of size to fit over curb valve, and approximately 3-inch diameter barrel.
  5. Shutoff Rods: Steel, tee-handle with one pointed end, stem length to operate deepest buried valve, and slotted end matching curb valve.
- H. Tracer Wire- pipe shall be installed with an extra high-strength, copper clad steel tracer wire including 45 mil HDPE jacket that has a minimum average break load of at least 1150 lbs. The jacket shall be colored based on pipe service, with blue for potable water or green for sewer. Tracer wire gauge shall be 12 AWG, 10 AWG, or 8 AWG depending upon application and installation procedure. This wire shall be continuous and brought up in the valve boxes at the ends of each line segment with splices made only by methods per the equipment manufacturer's recommendation. All miscellaneous splicing components shall be furnished and installed by the Contractor

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Identification: Install continuous underground detectable warning tape over all water lines during backfilling.

### 3.2 CONNECTIONS

A. Water Company Mains:

1. Contact the Water Company and verify size, location, materials and all other requirements for connection.
2. Connect to Water Company main in accordance with the Water Company's requirements and specifications.
3. Connections to Water Company mains shall be hot-tapped, unless otherwise specified on Drawings or agreed to in writing by Water Company.
4. The Contractor is responsible for all costs and fees associated with connecting to Water Company mains.

B. Owner Lines:

1. Connections to existing Owner lines shall be hot-tapped, unless specified otherwise on Drawings or agreed to in writing by Owner.
2. Contact Owner and coordinate connections.
3. Existing water service shall be maintained at all times.

### 3.3 PIPING INSTALLATION

A. General:

1. Comply with NFPA 24 for fire-service-main piping material and installation.

2. Install ductile iron water service piping according to AWWA C600 and AWWA M41.
3. Install PVC pipe according to AWWA M23 and ASTM F645.
4. Install copper tube and fittings according to CDA's "Copper Tube Handbook."
5. Install fittings for all changes in direction and for branch connections.
6. Unless otherwise indicated, install two 45 degree fittings at all horizontal and vertical 90 degree changes in direction.
7. Unless otherwise indicated, install all water piping with a minimum 60" burial depth, from top of pipe to top of finished grade, for frost protection. If local conditions or regulations warrant, increase burial depth such that the top of the pipe is at least 12" below the maximum frost penetration depth.

### 3.4 FUSION AND JOINING

#### A. Fusion Joining Requirements:

- B. All HDPE pipes shall be joined to itself by the heat fusion process which produces homogeneous, seal, leak tight joints. Tie-ins between sections of HDPE pipe shall be made by butt fusion whenever possible.

- C. Butt Fusion: The pipe shall be joined by the butt fusion procedure outlined in ASTM F 2620 or PPI TR-33. All fusion joints shall be made in compliance with the pipe or fitting manufacturer's recommendations. Fusion joints shall be made by qualified fusion technicians per PPI TN-42. A record or certificate of training for the fusion operator must be provided that documents training to the fundamentals of ASTM F 2620. Considerations should be given to and provisions made for adverse weather conditions, such as temperatures below freezing, precipitation, or wind, which is accepted by the owner/engineer.

- D. Electrofusion: Electrofusion joining shall be done in accordance with the manufacturers recommended procedure. Other sources of electrofusion joining information are ASTM F 1290, PPI TN 34, and PPI Municipal Advisory Board (MAB) Generic Electrofusion Procedure for Field Joining of 12 Inch and Smaller Polyethylene (PE) Pipe. The process of electrofusion requires an electric source, commonly called an electrofusion processor that has wire leads and a method to read electronically (by laser) or otherwise input the barcode of the fitting. The electrofusion processor must be capable of reading and storing the input parameters and the fusion results for later download to a record file. Qualification of the fusion technician shall be demonstrated by evidence electrofusion training within the past year on the equipment to be utilized for this project.

#### E. Fusion Operators:

1. The employer of the fusion machine operator is responsible for the fusion joint quality of the fusion weld made by that individual. The employer is responsible for documenting all training and qualification records for that individual, including compliance to any code requirements for fusion/bonder operators.
2. All HDPE fusion equipment operators shall be qualified to the procedure used to perform pipe joining. Fusion equipment operators shall have current, formal training on all fusion equipment employed on the project. Training received more

than two years prior to operation with no evidence of activity within the past 6 months shall not be considered current.

3. When the fusion machine operator is employed by the HDPE pipe and fusion machine supplier, the supplier shall maintain an ISO 9001 Certified Quality Management System.

F. Butt Fusion Equipment:

1. For 6" and larger pipe sizes, the pipe butt fusion machine shall be a self-contained hydraulic fusion machine capable of butt fusing HDPE pipe. The carriage must be removable from the chassis for in-ditch use. The machine must be compatible with an electronic data recording device. Accessories will include all butt fusion inserts for the specified range of pipe sizes, a pyrometer kit for checking the surface temperature of the heater, extension cord of appropriate gauge (25' minimum), and hydraulic extension hoses (minimum of four).

### 3.5 JOINT RESTRAINT

A. General:

1. Every joint shall be restrained. Un-restrained push-on joints or plain mechanical joints are not acceptable. Refer to Part 2 for each type of pipe.
2. Fire hydrants shall utilize anchor couplings or other appropriate restraining methods.
3. Apply a full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

### 3.6 VALVE INSTALLATION

A. Gate Valves:

1. Comply with AWWA C600, AWWA M44 and NFPA 24.
2. Install each underground valve with stem pointing up and with valve box.

B. Indicator Posts:

1. Comply with NFPA 24.
2. All post indicator valves shall be supervised with tamper switches as specified in Division 28 Section "Fire Alarm."

- C. Corporation stops: unless otherwise required by the Water Company or Owner, do not install service saddles on ductile iron pipe. Use saddles on plastic pipe as specified in Part 2.



### 3.7 FLUSHING, CLEANING, AND DISINFECTING

- A. All mains shall be cleaned and flushed to remove all dirt, sand, debris and other foreign matter
- B. Disinfection:
  - 1. Cleaning and disinfecting of potable water systems shall be in accordance with AWWA C651 and AWWA M55 Chapter 10, and PPI Handbook of Polyethylene Pipe Chapter 2 (2<sup>nd</sup> Edition).
  - 2. The liquid disinfection chemical solution should be limited to less than 12% active chlorine. The time-duration of the disinfection should not exceed 24 hours. Chlorine tablets or powders are not permitted.
  - 3. Upon completion, the system should be thoroughly flushed with fresh water, and retested to verify the disinfectant chlorine level has been reduced to potable drinking water concentrations in all service water tubing and branch lateral pipes

### 3.8 TESTING AND LEAKAGE HDPE

- A. The contractor shall restrain pipe, components, and test equipment as required. All pumps, valves, temporary connections, meters, gauges and other measuring devices shall be furnished, installed and operated by the Contractor.
- B. The pressure gauges or data recorders should be calibrated and sufficiently sized to provide mid-range data (pressure tested will not be below 10% or greater than 90% of gauge capacity) that result in easy reading, interpretation. Gauges shall be accurate to within 2% of full scale with increments no greater than 2 psi.
- C. The test pressure may be up to 1.5 times the FM pressure class, based on the lowest point in elevation in the test section.
- D. Pressure Pipelines-Pressure testing shall be conducted in accordance with requirements and recommendations of ASTM F 2164 (Field Leak Testing of Polyethylene Pressure Piping Systems Using Hydrostatic Pressure), AWWA M55 Chapter 9, and PPI Handbook of Polyethylene Pipe Chapter 2 (2<sup>nd</sup> Edition). Pneumatic (compressed air) leakage testing of HDPE pressure piping is prohibited for safety reasons.
  - 1. The section of pipe to be tested shall be filled with potable or generally clean water (uncontaminated river/lake water) approved by the Owner/Engineer. While the system is being filled with water, air shall be carefully and completely exhausted.
  - 2. If the Contractor elects to perform hydrostatic testing against valves in an existing system, it does so at his own risk and will bear the cost of any damages to the existing valve, piping system, private or public property, or the new pipeline under test.

3. The test procedure for HDPE pipe consists of two steps: 1) the initial phase or expansion phase and 2) the test phase. During the initial/expansion phase, sufficient make-up water shall be added hourly for 3 hours to return to the test pressure. During the test phase, the expansion phase pressure is reduced by 10 psi to test phase pressure and monitored for at least one hour (3 hours maximum).
  4. Under no circumstances shall the total time under test exceed eight (8) hours. If the test is not completed due to leakage, equipment failure or any other reason, depressurize the test section and permit the system to "relax" for eight (8) hours prior to the next testing sequence.
  5. In accordance with section 9.8 of ASTM F 2164, the pipe shall pass if the final pressure is within 5% of the test phase pressure for the testing period (3 hours maximum). If the test section fails this test, the Contractor shall repair or replace all defective materials and/or workmanship at no additional cost to the Owner.
- E. All pressure and leakage testing shall be done in the presence of a representative of the Owner and Engineer.

### 3.9 TESTING AND LEAKAGE – OTHER THAN HDPE

- A. If testing requirements are not specified by the Water Company, the following shall be used:
1. Conduct piping tests before joints are covered (and after thrust blocks have hardened sufficiently, if applicable).
  2. Fill pipeline 24 hours before testing and apply test pressure to stabilize system.
  3. Ensure all air has been expelled from lines.
  4. Hydrostatic test: Test at not less than 1-1/2 times the working pressure (but not more than the rated pressure) for 2 hours.
  5. Increase pressure in 50-psig increments and inspect each joint between increments.
  6. Hold at pressure for 1 hour; decrease to 0 psig. Slowly increase again to test pressure and hold for 1 more hour.
  7. Maximum allowable leakage is 2 quarts per hour per 100 joints.
- B. Prepare reports of cleaning and testing and submit to Water Company and Architect/Engineer.

END OF SECTION 331000

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